DOCTOR OF PHILOSOPHY

Community-based knowledge sharing in a changing energy sector

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Award date:
2022

Awarding institution:
Coventry University

Community-based knowledge sharing in a changing energy sector

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PhD

November 2021

Certificate of Ethical Approval

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Project Title:

Community-based knowledge sharing within a changing energy sector

This is to certify that the above named applicant has completed the Coventry University Ethical Approval process and their project has been confirmed and approved as Medium Risk

Date of approval:

15 November 2019

Project Reference Number:

P94896

Abstract

Growing concerns about climate change and increasing carbon emissions have prompted world leaders, governments, and organisations to consider the transition to a low carbon economy. Rising populations and energy demands are also presenting new challenges for energy grids, with countries facing increasing energy demands. In the UK the ambition is to become carbon neutral by 2050, but many questions remain about how the country will transition from using fossil fuels to low carbon sources of energy, whilst also reducing energy demand and peak-time pressure on the energy grid.

The private and public sectors are contributing towards the ongoing transition within the UK through initiatives such as SMART metering, the development of electric vehicles and ISO14001 environmental management frameworks. Over the past decade, policy supporting communities to produce their own energy and therefore decentralise energy production has resulted in many community-based energy groups being formed across the UK. These groups engage in sustainable methods of producing energy for use in their own communities, such as using solar PV and wind turbines. The potential for community-based approaches to developing low carbon sources of energy supply, gives considerable opportunities to increase the scale and size of this effort across the UK.

The effective operation of energy communities relies on them being able to access a range of technical, financial and business knowledge. There is evidence that many communities struggle to gain the knowledge they need. A knowledge-based view has been used to explore how knowledge is shared within these communities, and how this supports the scalability of community-based approaches to carbon reduction. Although knowledge sharing and knowledge management have been extensively considered within commercial organisations, the use of knowledge within community groups is much less well understood, including in energy focused settings. An exploratory approach has explored the types and uses of knowledge within these communities and how it is shared. Qualitative semi-structured interviews were undertaken with members of three energy communities located in the Midlands.

The findings reveal the significant role of knowledge in helping these communities leverage the skills of members, increase the impact of their activities, and ultimately reduce carbon. Several contributions to theory and practice are made. A theoretical framework is developed that describes the process of knowledge sharing within energy communities. Practically, the research contributes to understanding the nature of knowledge shared within energy communities and the context specific influences on those who share knowledge and how that takes place. These contributions also provide deeper insights into the role of knowledge and knowledge sharing within community settings.

Acknowledgements

I would like to take this opportunity to thank several people who supported me during the last three years.

Firstly, I would like to thank my two supervisors, Dr Helen Roby and Professor Sally Dibb. It feels like yesterday I arrived at the Coventry University campus for an interview, where I knew straight away that Helen and Sally were the perfect supervisors to guide and support me through this process. Not once did I have to pretend to be somebody I am not during the three years. I would not describe myself as the usual PhD student, as I have always been a doer rather than a thinker. However, they made me feel comfortable and welcome in a space where I felt totally out of my depth at times. They gave me a great deal of confidence throughout the process, reassuring me that my ability to get things done would carry me to the end, regardless of how intellectually challenged I felt. I would also like to send my best wishes to Helen on her recovery and thank Sally for becoming my Director of Studies during the final six months and pushing me over the line. I look forward to keeping in contact with you both and perhaps working together in the future.

I would also like to thank Professor Alexeis Garcia-Perez and Professor David Jarvis as my progress review panel team for examining me throughout the three years. They provided me with encouragement and valuable feedback on my progress.

Last, but certainly not least, I would like to thank my family for their endless support, encouragement, and love. I have no doubt that they have experienced the ups and the downs of the last three years as much as I have.

CONTENTS

List of abbreviations

BEIS – Department for Business, Energy and Industrial Strategy

CE – Community Energy

CEE – Community Energy England

CKM – Customer Knowledge Management

CoP – Community of Practice

CRM – Customer Relationship Management

FiT – Feed in Tariff

KM – Knowledge Management

KS – Knowledge Sharing

KBV – Knowledge-based View

TRA – Theory of Reasoned Action

UK – United Kingdom

UN – United Nations

USA – United States of America

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1 INTRODUCTION: THE IMPORTANCE OF COMMUNITY ENERGY

1.1 RESEARCH CONTEXT AND RATIONALE

1.1.1 Energy, carbon, and the global population

The increasing awareness of climate change and global warming is prompting world leaders and governments to consider the impact of carbon footprint. Climate change is considered by the IPCC[1] as "any change in climate over time, whether due to natural variability or as a result of human activity" (Parry et al., 2007, p.27). As awareness of climate change rises, an increasing number of people are being forced to change and adapt their lifestyles, irrespective of whether they have the economic, social or personal resources to do so (Popovski et al., 2012). Carbon emissions are recognised globally as the key contributor to climate change, predominantly via the usage of electricity and heat, agriculture, industry, transportation, other energy, and buildings (Edenhofer et al., 2014). Despite global carbon emissions declining by 5.8% in 2020, given this reduction is considered a result of the decrease in demand for oil and coal due to the COVID 19 pandemic, a rebound is predicted, with estimates that these will increase by nearly 5% in 2021 (IEA, 2021).

In addition to the expected rise in global carbon emissions, the United Nations (UN) predicts that the global life expectancy age and the total global population will both continue to increase. The average median age is expected to reach 80 by 2080, with the total population expected to reach 11 billion by 2100 (UN, 2019). These increasing rates indicate that the global usage of energy and creation of carbon emissions will continue to steadily increase over the next six decades. If the global approach to managing carbon emissions remains the same, global temperatures are predicted to rise by two to five degrees this century (Osborne et al., 2016). Consequently, the Secretary of State for Business, Energy and Industrial Strategy predicts that rising temperatures could negatively influence the climate, ecosystems, people, water scarcity and the economy and infrastructure (Sharma, 2020).

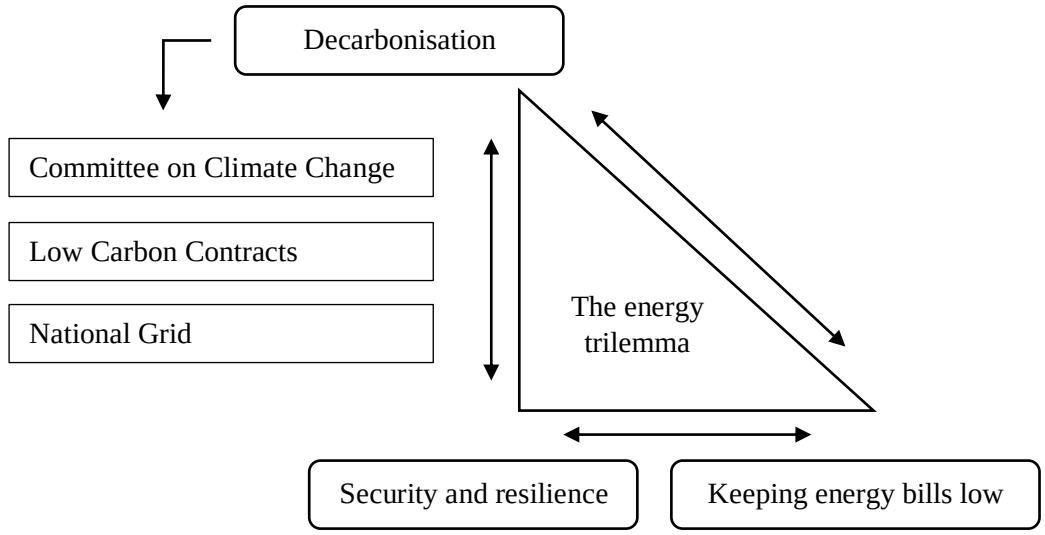
The culmination of factors such as population growth and increasing carbon emissions will inevitably have a large and long-lasting influence upon total energy demand across the globe. Rising energy demands on the energy grid in the UK and elsewhere are forcing governments, organisations and communities to think differently about approaches to the demand side management of energy (Noor et al., 2018).

[1] IPCC - Intergovernmental Panel on Climate Change.

1.1.2 The role of the United Kingdom (UK)

In response to these likely increases in global carbon emissions, the UK government recently set out a plan to reduce emissions by up to 78% by 2035 and to become carbon neutral by 2050 (BEIS, 2021). These targets align with the UN's seventh sustainable development goal of ensuring "access to affordable, reliable, sustainable and modern energy" (UN, 2021, p.1). More specifically, the UK government considers decarbonisation as a vital part of the "energy trilemma", where decarbonisation, energy security and resilience and cost must all be managed (Hinson, 2020). The Committee on Climate Change, Low Carbon Contracts Company and The National Grid are all examples of organisations that are key to achieving decarbonisation in the UK (ibid).

Figure 1: UK energy trilemma



Source: Adapted from (Osborne et al., 2016)

The Committee on Climate Change is a public body that advises the government on carbon reduction levels and monitors the UK's performance. The Low Carbon Contracts Company is also publicly owned but manages payments to electricity generators with low carbon contracts. Finally, the National Grid is private company with statutory responsibilities for ensuring energy supplies across the UK (Hinson, 2020). Although the UK government predicts that greenhouse gas emissions in the UK have fallen by around 45.2% from 1990 to 2019, predictions show that countries across the globe will fall short of becoming net zero in carbon contribution by 2050 (IEA, 2021). This prediction has been publicized despite the UK's contribution and the Prime Minister's Ten-Point Sustainability Plan being released in 2020 (see Appendix 1). Based on this, the Ten-Point Sustainability Plan may not be influential enough to support the UK's transition to becoming net zero.

1.1.3 Community-based approaches to carbon reduction and national policy

National energy policies in the UK over the past decade have created a space for community energy (CE) groups to be established in both rural and urban communities. In 2014, the Department of Energy and Climate Change (DECC), (now the Department for Business, Energy and Industrial Strategy (BEIS)), developed the 'Community Energy Strategy: People Powering Change'. This report created a space for community energy in the energy sector. Since 2014, community-based approaches to carbon reduction have gained in popularity and become viewed as a method for decentralising energy production and engaging energy consumers at a community and local level. Subsequent energy policies have failed to offer direct support to community energy, with the focus shifting more widely to the role of community energy in the 'Net Zero Carbon' agenda. Within the 2014 DECC report, the policies are formed under four main themes (ibid, p.4). These are:

- Generating energy (electricity or heat)
- Reducing energy use (saving energy through energy efficiency and behaviour change)
- Managing energy (balancing supply and demand)
- Purchasing energy (collective purchasing or switching to save money on energy)

The management of all four areas within different CE groups has predominantly been supported by initiatives such as the Feed in Tariff (FiT) which was launched in 2012. The FiT ensured that CE groups were paid for energy that was generated and exported to the National Grid (Acharya & Cave, 2020; Gov.uk, 2021). The FiT scheme ended in 2019 (Acharya & Cave, 2020), leaving many unsolved questions about how CE could be sustained and transition into a more mainstream solution to the various energy challenges that face the UK (Nolden, 2013).

Throughout this period, the academic and grey literatures that link community approaches to sustainability issues such as energy and resource scarcity have become more and more prevalent (Mohtar & Lawford, 2016). At a regional level, the creation and development of umbrella organisations in the UK such as Community Energy England (CEE) have supported the mobilization and sharing of knowledge between various communities. These organisations have also helped to provide a tangible link between the carbon reduction efforts of communities, stakeholders, corporate organisations and the government (Hargreaves et al., 2013). This is emphasized by CEE's statement that their work is "intended to help clear obstacles, create connections between practitioners and stakeholders, and facilitate the work of community energy organisations" (C. E. England, 2021, p.1). Considering the work of CEEs thus far, community approaches to sharing knowledge and providing links between organisations could provide the UK with a unique, effective and alternative method of influencing the reduction of carbon.

Despite the work of organisations such as CEE, national UK energy policy continues to be questioned by local councils, as they face challenges obtaining the tools and expertise they need to make informed decisions about local energy projects (Sharman, 2021). These increasing concerns further emphasize the lack of synergy between national energy policy and the stakeholders that use this policy to support community-based carbon reduction solutions. Local authorities have attempted to address these synergy issues by creating local guiding frameworks such as the "sub-national co-ordination framework" and by calling upon the Cabinet Office to make Net Zero Carbon targets a priority in all departmental decisions (Evans, 2020).

At a community level, consumers continue to face rising energy prices that have recently been inflated by Russia's invasion of Ukraine. It is predicted that UK households will see their electricity and gas bills double, resulting in a £38 billion hit to the overall UK household energy budget (Pickard & Giles, 2022). These price increases are largely due to Europe's reliance on Russia for oil and gas, leading to serious threats to energy security and supply. The ongoing war in Ukraine and rise of energy prices is likely to result in increased fuel poverty across the UK, as consumers struggle to pay their bills and maintain their disposable income (Wallis, 2022). Fuel poverty and energy security issues are contributing to raising the relevance of community energy in the UK transition to becoming self-sufficient and to producing energy that is both renewable and affordable for consumers. This is because community energy provides local communities with the opportunity to decentralise energy production and reduce community reliance on imported energy.

1.1.4 Critiques of the community-based approach to carbon reduction

The following Section will clearly identify the problems that exist with a community-based approach to carbon reduction. Each issue will be presented using existing literature that shows the need for further research into each area.

The overarching notion within the existing CE and wider sustainability literature seems to commend the transition that the UK has made over the past decade, yet criticize the scale of the impact that has been achieved. Chatzikadis & Shaw (2018) suggest that policy promoting sustainability may be misplaced, mainly because people's consumption and decisions are influenced by varying contexts. In other words, policy encourages people to consume sustainably, but individual circumstances and contexts encourage them to place other priorities ahead of sustainability and such policy. Bomberg & McEwen (2012) highlight the challenge around mobilizing CE and the importance of structural and symbolic resources in allowing energy communities to thrive. In line with these views, new opportunities for mainstreaming CE have been identified, reframing the role that communities could play in decentralising the energy system (Roby & Dibb, 2019). These developments suggest that the scalability of CE is the overarching challenge within this space.

Considering the discussed scalability challenge that energy communities face, knowledge could be considered as a fundamental contributor to solving this problem. Research has previously identified the importance of understanding knowledge and how it can contribute to supporting responses to energy specific issues (Catney et al., 2013; Edwards, 2008; Fadel et al., 2013). Catney et al., (2013, p. 516) highlighted the community knowledge network approach as one that has been used to tackle similar energy specific topics, where the research has aimed to gain a deeper understanding of social interaction, dynamics and learning (Catney et al., 2013). In addition, Edwards (2008, p. 18) provided a review of knowledge management and the future directions for the use of this theory within the energy sector, stating that "there is much to be gained from looking at what has been tried in other sectors: studying the wider theory on knowledge sharing and organisational learning, for example". These acknowledgements show that understanding more about knowledge could play a crucial role in supporting issues such as scalability within energy communities. Figure 2 displays the scalability issue and shows how knowledge-based opportunities are linked to scalability.

Figure 2: The relevance of knowledge-based issues to the mobilization of community energy

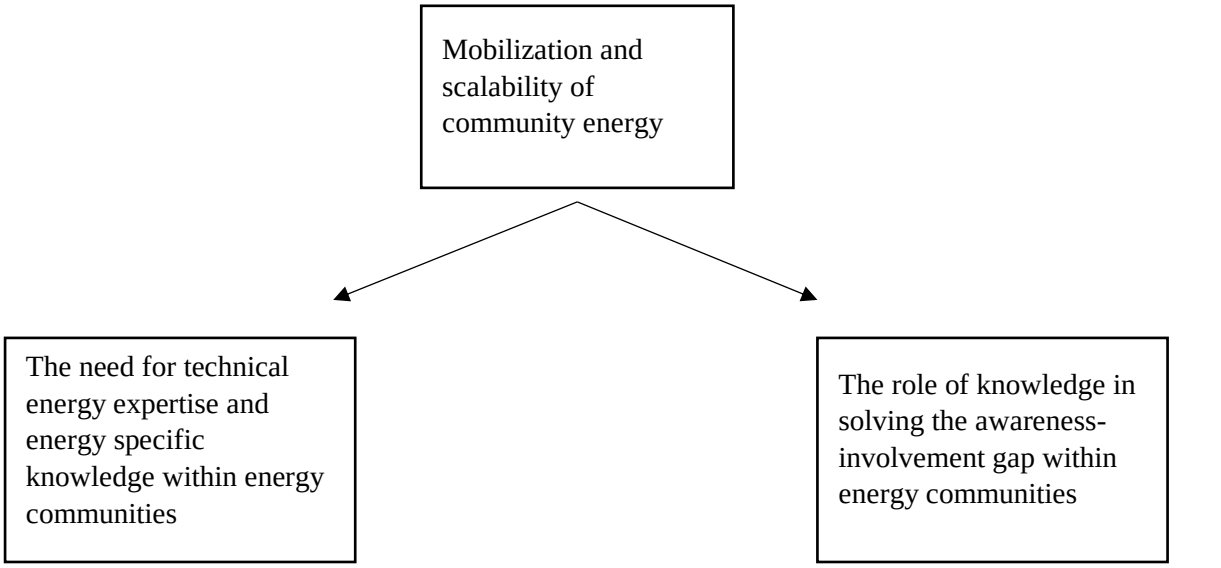


Figure 2 highlights the mobilization and scalability of CE as the overarching issue that this project aims to address. Considering this overarching challenge, two knowledge-based gaps have been identified as key areas that could contribute to the improvement of scalability. These areas, which are discussed in more detail in the following Sections, are:

1. The need for technical energy expertise and energy specific knowledge within energy communities.
2. The role of knowledge in solving the awareness-involvement gap within CE.

The ensuing Sections will introduce each problem and show how they are linked to the scalability issue within energy communities.

1.1.4.1 The need for technical energy expertise and energy specific knowledge within energy communities

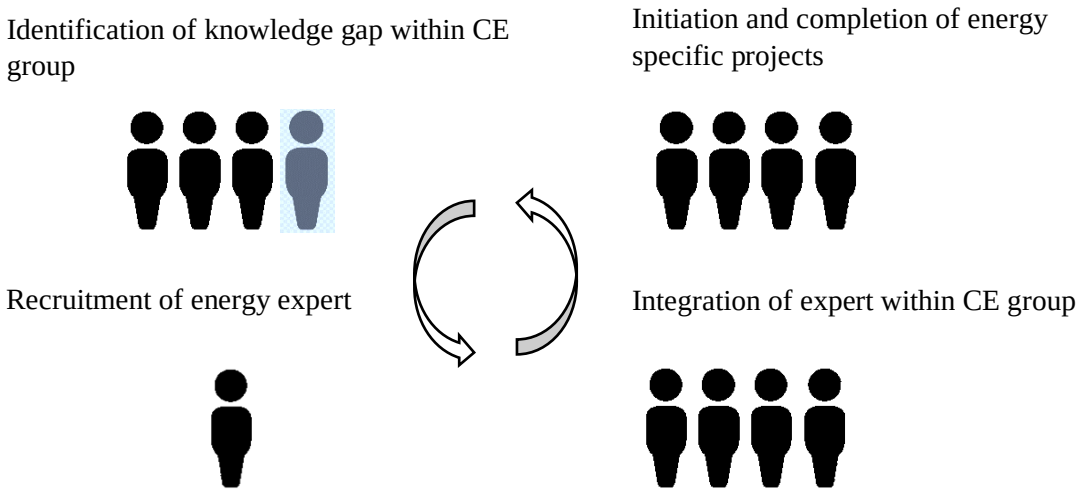
The notion that many CE groups lack specific energy expertise and knowledge is widely espoused. Brummer's (2018) review of CE groups showed a lack of resources, expertise, and resilience as the key barriers to the mobilization of such communities. More specifically, financing and the intensity of communication and networking were identified as particular challenges for UK CE groups. Similarly, Seyfang et al. (2013) considered technical expertise, advice and skills as weaknesses within UK CE groups, stating that knowledge gaps exist within these communities. The stance taken in this thesis is that filling these knowledge gaps within communities is important because it could improve the effectiveness and performance of these groups in multiple ways. The knowledge management literature suggests that improving the collective knowledge of a group can help influence the decision making processes in which the group engages (Nicolas, 2004). For CE groups, Seyfang & Haxeltine (2012) identified that the recruitment of more members and financing as key challenges that influence the scaling of sustainable energy initiatives. Improved knowledge about these issues, could therefore lead to higher quality decisions that might improve the performance of CE groups across areas such as recruitment, financing, and project completion. The organizational literature also links improved knowledge management practices with significant competitive advantages for a firm (Goh, 2005; Gupta & McDaniel, 2002). When knowledge is managed and shared effectively, this literature argues that organizations are able to:

1. Make better decisions (Nicolas, 2004).
2. Attract and recruit competent and knowledgeable people (Vaiman & Vance, 2010).

Relating these views to this specific research and reframing them for a community context, might, for example, provide insights to enable CE groups to make better decisions or attract and retain members with energy expertise. For example, the sharing of knowledge within an energy community may help members understand the knowledge gaps that exist within the group, prompting them to search for members with specific energy expertise.

The need for knowledge within energy communities is ongoing. This is predominantly because of the nature of the field and the notion that the needs of an energy community are continually changing. For example, recent policy changes to the UK FiT meant that CE groups had to re-think their long-term survival strategies (Acharya & Cave, 2020). It has been well documented that CE groups need to be flexible and responsive to factors that impact upon their existence and survival (Bomberg & McEwen, 2012). The persistent nature of this need for knowledge within energy communities is shown in Figure 3 below.

Figure 3: The continual need for energy knowledge and expertise within CE groups



The ongoing need for knowledge is illustrated by the requirement for up to date energy expertise. In the first instance, members need to be aware of the expertise that the group requires. The CE group then needs to fill this gap in knowledge via recruitment processes that attract new group members. Once the recruitment process has been completed, the expert's new knowledge needs to be shared with the wider group. The group needs to be receptive to this knowledge, so that it can be received and integrated into their working practices. This might include documenting or otherwise recording the knowledge so that it is available for future use. For example, after joining the community, a new member who is an expert in solar PV installations may be asked to provide a beginner's guide to understanding installations. The remainder of the members within the group would have to be willing to read this guide and trust that it is written accurately and with precision. Once the knowledge has been received and understood, external influences require energy communities to seek newer and more up to date expertise. From this perspective, the need for knowledge and technical energy expertise is cyclical and continuous, making the problem pertinent in the pursuit of CE scalability. Indeed, the acquired knowledge by the shared group can then be used to enable the group to successfully implement new projects. For example, the recruitment of a new member with expertise in solar installations may enable a CE group to successfully install solar panels on a local community building, such as a school or church. Once that knowledge is embedded within the group, the opportunity for future projects is created.

1.1.4.2 The role of knowledge in solving the awareness-involvement gap within energy communities

The second area of opportunity within the scalability issue in CE groups is often referred to as the "awareness-involvement gap". The discussion of this gap within the sustainability literature alludes to the idea that although an individual may be aware of what it means to behave "sustainably", this does not always result in active participation in pro-environmental initiatives or behaviours.

Although gaps in awareness, attitudes and behaviour have been extensively discussed in the consumer behaviour literature (e.g. Valkila & Saari, 2013; Zainudin et al., 2017), the role of knowledge within communities and the resulting impacts on behaviour have received relatively little attention within an energy context. However, Hines et al., (1987) used the much cited "Theory of Reasoned Action" (TRA) (Ajzen & Fishbein, 1980) to explore pro-environmental behaviour across 128 research studies, finding that knowledge does indeed play a key role in influencing the environmental behaviours of individuals. Figure 4 displays the predictors of pro-environmental behaviour (Hines et al., 1987).

Figure 4: Predictors of pro-environmental behaviour

Source: Hines et al. (1987, p.7)

As shown in Figure 4, the influence of factors such as control and personal responsibility on behavioural intention show that the relationship between intention and behaviour is extremely complex. Critiques of linear models of pro-environmental behaviour recognize that increased knowledge alone does not result in increased pro-environmental behaviour (Brummer, 2018). However, two knowledge specific variables that have been associated with pro-environmental behaviour are: (1) knowledge of issues and (2) knowledge of action strategies. Knowledge of issues relates to an individual's familiarity with environmental problems and causes. Within energy communities, this knowledge could be specific to understanding renewable energy production or energy saving methods. Knowledge of action strategies refers to the "know how" that the individual has and how they react to solve a particular problem, based on their knowledge. For example, someone who has a high level of knowledge about the carbon impact

of their daily travel routine would be in a good position to act decisively and lower that impact by using other methods of transport.

In acknowledging that knowledge does play a role in influencing behaviour, the knowledge level of energy community members becomes crucial in contributing to the mobilization of such groups. As Brummer (2018, p.193) states:

> Missing experience can lead to a lack of confidence in communities, making them hesitant to start their initiative. After the initial phase, long-term maintenance has to be secured. If knowledge and skills dissipate after the initial phase, this may be an issue for CE as it involves liabilities over time.

Brummer (2018) makes the connection between knowledge and confidence, suggesting that a lack of confidence could result in lower participation levels. In addition, he (2018) insinuates that knowledge should be maintained throughout the lifecycle of a CE group to enable the group to remain sustainable over the long-term. It is for this reason that knowledge should be viewed as crucial to the development and mobilization of CE groups over time, indicating that more needs to be known about knowledge and how it is shared in this context. Table 1 summarizes the key research problems and the lens used to view these problems within this research.

Table 1: Summary of research problems

Global level issue	**UK policy response**	**Approach**	**Knowledge specific problems**	**Overarching community problem**	**Lens of exploration**
Carbon reduction	Carbon neutral by 2050	Community-based approaches such as community energy	Awareness-involvement gap	The scalability of energy communities and increasing carbon reduction activity	Community Knowledge Networks/ Knowledge-based View (KBV)
			The need for energy related knowledge and expertise within these communities		

As shown in Table 1, this Chapter has refined the research problem into two knowledge specific problems, both of which can be addressed using the knowledge-based view (KBV) as the lens. The KBV will be used to explore the carbon reduction problem in a way that helps us to understand the knowledge that is being shared within this space. Catney et al., (2013) used a community knowledge network approach to explore how individuals and communities use energy. This approach concerns the "constellation of people, organisations, material objects, information, practices and relations through which knowledge is shared and articulated within communities and between their members" (ibid, p. 510). Like the community knowledge network approach (Catney et al., 2013), this research will explore

communities using qualitative techniques that will allow the research to capture the depth of knowledge and understanding needed. The research will use an exploratory qualitative approach to explore communities use of sharing of knowledge.

1.2 CHOSEN COMMUNITIES

Several similar communities were chosen for this research to allow the researcher to identify themes that are common across more than one case. Each community is considered to be a Community of Practice (CoP) that comprises several participants who all have decision making influence upon the day-to-day operation of the chosen community groups.

The first element of similarity among each community is in the number of members involved. All three communities have a maximum of twelve group directors, who have all invested funds in their respective groups. The similarity in the number of members within each community allows a comparison of themes, knowing that the scale and impact of each group is likely to be similar. The roles of members within each community are also very similar, with each community directed by one community leader and having a minute taker who documents the activities. The remaining members attend community meetings at local venues or via online video meetings, such that all have opportunities to influence the decisions that are made. The similar roles enacted by participants in each community allows the researcher to explore the knowledge sharing activity taking place by individual in similar roles, within several communities.

In each community, the agenda pursued by the leader is broadly similar. All three communities focus on solar solutions to energy generation and carbon reduction, aiming to install these solutions into community buildings such as churches, libraries, and schools. Having similar agendas within each community enables distinct comparisons to be made between communities. Finally, the participants in each community are volunteers and receive no financial payments for their involvement. The legal structure of each community means that each member has an equal shareholding and any small investments they make in projects are only used for the purchase of community assets. Although members are not paid financially for their involvement, they may be re-paid their investment after an initial payback period has passed.

1.3 RESEARCH AIMS AND PROBLEMS

As Table 1 shows, two specific research problems will be addressed. Specifically, this research will aim to explore the knowledge shared and managed within energy communities. This overarching research aim is particularly important both theoretically and practically.

The UK government's 2050 carbon neutral target suggests that there is a need for different sectors and communities to increase the scale of their carbon reduction activity, whereas this research views the

sharing of knowledge within energy communities as the prevalent solution. However, this poses the theoretical problem of understanding how knowledge should be shared within energy communities. In addition, the aim of achieving scalability within energy communities is also important practically. This research will provide insights into how energy communities can work more effectively and increase their scale and impact. In providing these insights, this research will also explore the potential for tackling carbon reduction at both a community level and a national level. The consideration of these explorations may result in several policy recommendations and an agenda for future research in this space.

1.4 STRUCTURE OF THE THESIS

The structure of this thesis is as follows. Chapter 2 presents a critical overview of the relevant literature and a conceptual framework containing the key concepts that are reviewed. This conceptual framework will then inform and contribute to the development of three key research questions that arise in the literature. Chapter 3 develops a research methodology to answer the outlined research questions. Chapter 4 presents and discusses the findings of the collected data. Chapter 5 compares the discussed findings against the reviewed literature, outlining possible contributions to the literature. Chapter 6 discusses the conclusions of this research and lays out the contributions to the outlined research questions in Chapter 2.

2 LITERATURE REVIEW: KNOWLEDGE SHARING AND COMMUNITIES

2.1 INTRODUCTION

This Chapter aims to present a critical discussion of the literature on knowledge management (KM), communities and the various factors that influence knowledge sharing (KS). In doing so, this Chapter will explore three different issues that arise within the literature. Firstly, the nature of knowledge that exists within organisations and could therefore exist within energy communities. Secondly, the factors that influence KS within various contexts and could therefore influence sharing within energy communities. Thirdly, the process of how knowledge is shared within Communities of Practice (CoPs) and could therefore be shared within energy communities. Based on these explorations, three research questions are presented at the end of the Chapter that show the gaps in the literature that this research seeks to fill.

This Chapter is structured as follows. Section 2.2 defines the key concepts of data, information, and knowledge. Section 2.3 provides an overview of the relationship between these three concepts. Section 2.4 comprises of a review of knowledge literature. This review initially explores the development of knowledge as a field of expertise (Section 2.4.1). Following this, Sections 2.4.2 to 2.4.10 consider the nature and typologies of knowledge, whilst also discussing what it means to "know". The Section on knowledge concludes by reviewing KS frameworks for organisations (Section 2.4.11 to 2.4.13) and by discussing how the organisational discussion is relevant to this research (Section 2.4.14).

Following the Section on knowledge, a range of community literature is discussed in Section 2.5. Section 2.5.1 introduces the Section by providing a historical background of community theory. Section 2.5.2 defines and explores the term "community". Succeeding this, Section 2.5.3 explores KS in communities. Section 2.5.4 to 2.5.9 introduces and subsequently explores the concept of CoPs and how they can be analysed. To conclude the Section, the interests and characteristics of energy specific communities are discussed.

Finally, Section 2.6 discussed a range of literature that is focused upon the factors that influence KS. These factors are divided by member level factors (Section 2.7), community level factors (Section 2.8) and organisational level factors (Section 2.9). The literature review concludes with the identification of a conceptual framework (Section 2.10), the identification of the research gap (Section 2.11) and the proposed research questions (Section 2.12). Section 2.13 summarises the chapter.

2.2 DEFINITIONS OF KEY CONCEPTS

This Chapter begins by defining and explaining some of the key concepts used in this thesis. This explanation will help to clarify and distinguish between key KM concepts such as data, information and

knowledge. The perception of data as information, or information as knowledge shows that these terms can often be confused (Melkas & Harmaakorpi, 2008). It is therefore necessary to clearly define and outline the three key concepts.

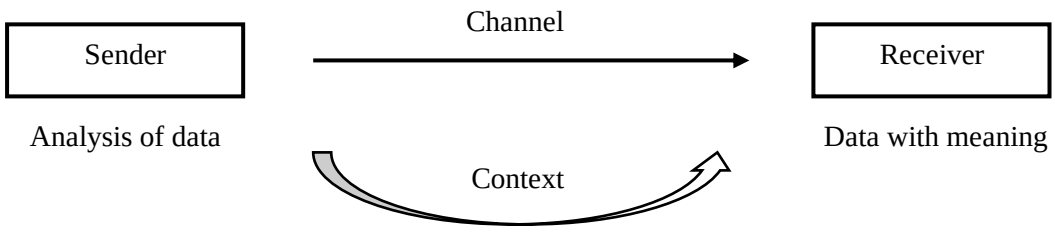
2.2.1 **Data**

Davenport and Prusak (1998) define data as discrete, objective and a set of facts about a particular event. Despite the objective nature of data, Davenport and Prusak (1998) argue that data informs both information and knowledge. This is because the prior experiences of an individual who handles a set of data are particularly important, as data is converted into information as soon as it has been understood by someone who receives it (Kock et al., 1997). In this respect, the literature suggests that data is meaningless without context (Hislop, 2009).

2.2.2 Information

Dalkir (2013) makes a clear distinction between data and information, referring to data as a form of content that is observable and factual, in comparison to information, which arises from the successful analysis of data. Zins (2007, p.480) attempts to make the divergence particularly clear, by viewing information as a concept that encompasses a communication process between a sender and a receiver. This process is shown in Figure 5.

Figure 5: Information diagram



2.2.3 **Knowledge**

The concept of "knowledge" has been widely addressed, with numerous attempts to define the term. Thus knowledge has been defined as an individual's true belief (Nonaka & Takeuchi, 1996) and one that can only exist in an individual's mind (Alavi & Leidner, 2007; Gorman, 2002). However, in their Harvard Business School Press book *How organizations manage what they know*, Davenport and Prusak (1998, p.5) present knowledge as a:

> Flux mix of framed experiences, values, contextual information, and expert insight that provides a framework for evaluating and incorporating new experiences and information.

Other scholars also make the connection between knowledge and the attainment of a context (Tsoukas and Vladimirou, 2003). Indeed, early works on KM by Michael Polanyi (1966, p.4) are underpinned by his statement that *"we can know more than we can tell"*, implying that the format and the understanding of knowledge changes once it is applied to a context.

Polanyi (2009) divides the concept of knowledge into two clear segments: explicit and tacit knowledge. Explicit knowledge is positioned as knowledge that can be coded or presented in a more tangible and material format (Jasimuddin et al., 2005). Barley, Treem and Kuhn (2018, p.5) posit that this type of knowledge can be "externalized" using symbols, objects and language. This term has provided the theoretical underpinning for many KM models that build upon Polanyi's ideas (Nonaka, 2007). In comparison, tacit knowledge is widely acknowledged as intangible and correlated with a specific context (Barley et al., 2018; Dalkir, 2013; Nonaka & Takeuchi, 1996; Tsoukas & Vladimirou, 2003). Polanyi (1966) explains that it is this type of knowledge that people know and can apply but may struggle to explain and share with others. Both types highlight the differences in understanding of what knowledge is. These varying viewpoints on the concept of knowledge have recently been summarised by Barley, Treem and Kuhn (2018) who identify three key questions:

1) Whether or not knowledge is explicit.
2) Where knowledge exists.
3) How knowledge is applied.

These three positions are well articulated by Edwards (2008), who notes that tacit and explicit knowledge are not alternatives, but elements of knowledge such that both elements are present when knowledge exists. This may be where: 1) tacit could not be made explicit 2) tacit could be made explicit and 3) explicit. For example, Edwards (2008, p.4) uses the example of riding a bike as tacit knowledge, learning to fix two objects together as explicit, and learning how to release a stuck drill as "something in between". In the context of this project, tacit knowledge could involve knowing how to configure heating controls to cut household consumption without reducing the comfort for residents. Explicit knowledge could involve documenting this knowledge, so that it is clearly laid out for others, whilst configuring the SMART meter to a specific household's needs would be "something in between".

2.3 OVERVIEW OF THE DATA, INFORMATION AND KNOWLEDGE RELATIONSHIP

Underpinned by these distinctions between data, information and knowledge; the relationship between the three concepts is illustrated by Figure 6.

Source: Adapted from Pearlson and Saunders (2004)

The figure distinguishes between information and knowledge, suggesting that knowledge is valuable because it has been shaped by the individual who is in receipt of the information. Knowledge is therefore richer, contextual and actionable in comparison to information, which is often positioned as data in context (Galup, 2007; Pearlson & Saunders, 2004). Figure 6 adds to this view by acknowledging the two elements of knowledge: tacit, which is intangible and often resides within the individual (Barley et al., 2018; Dalkir, 2013; Nonaka & Takeuchi, 1996; Tsoukas & Vladimirou, 2003); and explicit, which can be presented in a tangible manner (Jasimuddin et al., 2005). It is important to recognise the elements of knowledge within this relationship, as it adds to the positioning of knowledge and its clear distinction from information. Knowledge resides within the individual and can be used implicitly or explicitly, whereas information is a set of contextual and actionable data.

Faucher, Everett and Lawson (2008) highlight that the KM literature provides many different definitions of the data, information, and knowledge concepts, as presented in Table 2.

Table 2: Data, information, and knowledge definitions

	Data	Information	Knowledge
Galup, 2007		Data in context	Integrated information that is given a context
Awad and Ghaziri, 2004	Unprocessed and static facts	Facts based on reformatted or processed data	Abstraction that exists in people's minds
Applehans, Globe and Laugero, 1999	Measurements	A statement of facts about the measurement	Ability to turn data and information in actions
Davenport and Prusak, 1998	An objective fact about events	Data that makes a difference	A mix of framed experiences, values contextual information and insight that provides a framework for analysing information

To conclude this Section, the differences between data, information and knowledge has been discussed in many different research papers. The most cited definitions allude to action and experience as the main differentiator between information and knowledge.

2.4 KNOWLEDGE LITERATURE

Having defined data, information and knowledge, this Section will now explore the key areas of the knowledge literature. In the first instance, the development of knowledge as a field of expertise will be explored, followed by an exploration of the nature and types of knowledge that exist. Following this, KM and KS models will be explored and critiqued. Finally, the importance and need for knowledge will be explored within the organisational context.

2.4.1 The development of knowledge as a field of expertise

Much of the research on knowledge was published in the 1960s, where it was highlighted that it was only by chance that a justified true belief (JTB) is actually true (Gettier, 1963). Based on this idea, Goldman (1967) explored the causal connections between knowing and not knowing. This philosophical lens to understanding knowledge underpinned the later work by KM practitioners, particularly when knowledge became a practiced and researched area in the 1990s. Nonaka &

Takeuchi's (1996) development of Polanyi's (1966) work displayed how knowledge was being considered as a more fluid concept that would be difficult to measure and understand. Barney & Hesterly (2008) noted that turbulent times in the external environment have contributed to knowledge being considered as a strategic resource for organisations. Such thinking has led to the conception of "KM" as an area of literature and competitive advantage for organisations (Bolisani & Bratianu, 2018a).

2.4.2 **The nature of knowledge**

Extending Edwards' (2011) notion that the community view of knowledge is concerned with "knowing", the nature of knowledge and its consideration within the knowledge literature will now be explored.

Bolisani & Bratianu (2018b) acknowledged the development of the work on the nature of knowledge, explaining that knowledge has moved on from being considered as an "object" or a "stock" metaphorically, to now being considered as a "flow" or "life cycle". Such observations are consistent with Nissen's (2011) knowledge dynamics model, which shows that both life cycle and flow time should be considered as an adaptation of the SECI model of knowledge creation (Nonaka & Takeuchi, 1996). Much of the published work on the nature of knowledge has viewed knowledge as a Newtonian concept, in which time and activities have been considered by models that illustrate a cyclical process (Bratianu, 2019). For example, the SECI model of knowledge creation (which will be discussed in Section 2.4.10) shows knowledge being created after it has been shared, acknowledging no form of knowledge loss within the model. Bratianu (2019) argued that these Newtonian models do not represent real processes within organisations and that this type of thinking is too linear. Bratianu's (2019) consideration of (1) knowledge loss in sharing and creation and (2) knowledge as "energy", poses questions around what it means to be able to "know".

Similarly, in previous literature, Polanyi (1966) explained that people often struggle to explain and share their knowledge with others. As Harvey & McMeekin (2009, p.8) state, "tacit knowledge is private to the individual or group by virtue of experience, codes and representations not shared by others, hence incommunicable or at least untranslated for a wider constituency". Although this is partly because knowledge lies somewhere between the tacit and explicit spectrum in nature, it also raises the same question concerning how people know what they know. For example, if the extent to which someone knows about a topic varies, how do we distinguish between "knowing" and "not knowing"?

As a response to these questions, Bolisani & Bratianu (2018a) proposed a framework – the known/unknown matrix - for considering the four stages of knowing (see Figure 7 below).

Figure 7: Known/unknown matrix

Source: Bratianu & Bolisani (2015, p.4)

The four areas of knowing correspond with an individual's level of awareness of their knowledge and the external world. The first domain (1) is a static domain of knowledge that is created via education and learning (Bratianu, 2019). For example, a CE member could educate themselves on the need for a SMART meter at home and learn how to use it. In other words, this is knowledge that an individual knows and is already aware of. In comparison, the second domain (2) involves searching for knowledge that is needed in the future. In this state, the awareness level of the need for knowledge is high, but the actual knowledge on the topic is low. For example, an individual may be aware of a growing interest and need in society for solar powered homes, but not know the requirements for installation. Bratianu (2019) describes the third domain (3) as knowledge that an individual has but is unaware of due to it being possessed by the "unconscious zone" of the brain. This form of knowledge is cognitive and gained from direct experience. For example, an individual may obtain management experiences from a previous project in a community group, but not be aware of the competence or transferrable skill that can be used in a new project. Finally, the fourth domain (4) concerns knowledge that an individual is totally unaware of and has no prior relatable knowledge. This type of knowing is often related to organisations, as turbulent environments may require organisations to implement knowledge exploration strategies. Bolisani & Bratianu (2018a, p.167) state that "although people enjoy living and working in a comfortable zone of known-knowns, the new turbulent business landscape increasingly imposes to search for the unknown-unknowns zone, which features a high level of uncertainty and risks".

The clear categorisation of the four domains of "knowing" has made the known/unknown matrix particularly relevant to organisations, which have used it to explore the adoption of various knowledge strategies. For example, "I know what I don't know" has been resolved by the adoption of a knowledge acquisition strategy within organisations (Bolisani, 2015). Although these domains provide an underpinning and understanding of "What it means to know", the literature has also identified various types and modes of knowledge.

2.4.3 **Typologies of knowledge**

Before considering the different types of knowledge discussed in the literature, it is important to acknowledge the intangible nature of knowledge. Bratianu and Andriessen (2008) performed a metaphorical analysis of knowledge as energy, showing how a source domain is often energy, whilst a target domain is knowledge. The area that lies between the source domain and the target domain is regarded as tacit and explicit energy, which is cognitive and emotional (ibid). Bratianu (2016, p.328) referred to rational, emotional and spiritual knowledge as "fields of knowledge", where knowledge is considered as an intangible physical object. The recognised intangibility of knowledge, regardless of its identified typology, seems to be derived from the acceptance that thinking is a metaphorical process (Lakoff & Johnson, 1998). In addition to the previously explored knowledge matrix, De Jong & Ferguson-Hessler (1996) outlined various ways in which knowledge could be considered, focusing on the type of knowledge that exists. Referring to situational, conceptual, procedural, and strategic knowledge, De Jong & Ferguson-Hessler (1996) discuss each type in relation to knowledge level, structure, automation, modality, and generality. Table 3 provides an overview of each type of knowledge and its relevant description.

Table 3: Types of knowledge

Source: Adapted from De Jong & Ferguson-Hessler (1996).

Situational knowledge is described as knowledge that relates to a specific domain. For example, De Jong & Ferguson-Hessler (1996, p. 106) provide the example of knowing that a rough surface means that there must be a frictional force. In comparison, conceptual knowledge is considered as static knowledge, that is factual and relevant to a specific topic. For example, it is well known that the sky is seen as the colour blue. This type of knowledge can be used by problem solvers to add to existing knowledge to solve a particular problem (De Jong & Ferguson-Hessler, 1996). Procedural knowledge allows a problem solver to move from one problem scenario to another, whilst strategic knowledge contributes to the ordering of the problem-solving process.

Despite the work of De Jong & Ferguson-Hessler (1996) being widely cited, other descriptions and categorizations of knowledge have emerged (Olaisen & Revang, 2018). De Jong & Ferguson-Hessler (1996) recognise that their view of knowledge types comes from an epistemological perspective, where the types of knowledge relate to a specific task and context. This is a pragmatic stance that considers where the knowledge needs to be used. In comparison, a broader and more holistic view of knowledge would focus on the psychological construction of knowledge (Dole & Sinatra, 1998). Alexander & Judy (1988) constructed their discussion on different knowledge types by outlining the declarative, procedural and conditional types of knowledge. This is important because it provides a distinction between the general view of knowledge, and how context specific knowledge is viewed.

As shown in Figure 8, Lam & Holloway (2000) also acknowledge epistemological and more holistic views of knowledge.

Figure 8: Epistemological vs ontological dimensions of knowledge

Source: Lam & Holloway (2000, p.491)

Within the epistemological view of knowledge, both embrained and embodied knowledge are acknowledged as types that show tacit and explicit qualities. Embodied knowledge alludes to a form of

individual and tacit knowledge that is hard to share and often context specific. In comparison, embrained knowledge refers to a more explicit knowledge type that is more scientific and shows both "understanding" and "knowing" on behalf of the individual (Lam & Holloway, 2000, p.492). Both of these knowledge types are shown by the individual and align with Polanyi's (1966) initial tacit and explicit knowledge conceptualisation. However, Lam & Holloway (2000) also identify an ontological perspective, where knowledge exists at a collective or group level. Within this level, encoded and embedded knowledge are identified as types of knowledge that are also explicit and tacit. Encoded knowledge is explicit in nature, as it is well documented and easy to share with those in a group. Lam & Holloway (2000, p. 492) note that this type of knowledge enables centralisation and control within organisations. Finally, embedded knowledge describes a more tacit and deep-rooted form of knowledge that is engrained within group understanding and shared norms (ibid).

2.4.4 **Levels of knowledge**

The level of knowledge that an individual obtains can be described as being either deep or surface level (De Jong & Ferguson-Hessler, 1996). Deep level pertains to a more permanent form of knowledge that an individual has processed, structured, and stored within their memory (De Jong & Ferguson-Hessler, 1996, p.107). Glaser (1991) noted that this type of knowledge is useful for application when attempting to exceed in specific task performance. In comparison, surface level knowledge exists when an individual has a lack of critical judgement and adopts a trial and error approach to developing their knowledge (Glaser, 1991). Within an energy community, deep level knowledge would be shown if the group leader was to discuss the benefits and drawbacks of holding an annual general meeting, providing a clear evaluation and critical judgement of whether the group should engage in this activity. In contrast, surface level knowledge would exist if the group leader was to recommend a trial of the annual general meeting and fail to present a critical evaluation of the activity.

2.4.5 **Structure of knowledge**

The structure of knowledge was first considered in the 1970s, when Larkin and Reif (1979) conducted a study among experts and novices, showing that an expert was able to retain large amounts of deep level knowledge by chunking information into meaningful units. These results were consistent with the work of Chase & Simon (1973), who conducted a similar exploration amongst chess masters. Literature has stressed the importance of the structure of knowledge, primarily by showing that a hierarchical structure allows an individual to search for relevant knowledge quickly (Larkin & Reif, 1979). In addition, a clear structure of existing knowledge allows the user to readily add new knowledge within this structure, without having to re-structure the existing knowledge (ibid). De Jong & Ferguson-Hessler (1996) identified the concept of "schema" as a pattern of thought or behaviour that allows the knowledge user to access different types of knowledge relevant to a specific domain or task. This notion was explored using the prior acknowledgements made by Rumelhart (1980), who showed that multiple schemata could be used in task performance when structured in a hierarchical manner.

2.4.6 **Automated versus non-automated knowledge**

The idea that knowledge could be automated and non-automated was first described by De Jong & Ferguson-Hessler (1996), who related the two concepts to "fluidity" of knowledge access. Automated knowledge occurs in experts, where accessing knowledge that is relevant to a specific task or domain is seamless because knowledge is structured using clear principles and procedures (ibid, p. 108). In comparison, non-automated knowledge occurs when a beginner faces a conscious and step by step process of accessing knowledge (De Jong & Ferguson-Hessler, 1996). Anderson (1983) alluded to the distinction between both concepts by describing an expert's knowledge state as "compiled". Notably, De Jong & Ferguson-Hessler (1996) liken the relationship between automated and non-automated knowledge to that between tacit and explicit knowledge.

2.4.7 **Modality and generality of knowledge**

The modes and generality of knowledge relate to how knowledge is shown and what this knowledge relates to. The modality of knowledge concerns representing knowledge in two forms; via pictures and words (De Jong & Ferguson-Hessler, 1996; Paivio, 1975). The use of pictures helps to simplify and represent large amounts of complex knowledge, particularly in science (Bowen, 1990). In comparison, verbal modes of knowledge are analytic, where the knowledge presented must be read and comprehended (De Jong & Ferguson-Hessler, 1996). These two distinctions are useful when attempting to understand how and in what format knowledge is shared. De Jong & Ferguson-Hessler (1996) also noted the importance of how the nature of knowledge is considered. Larkin (1989) drew distinctions between the types of knowledge that could be transferred from one domain to another. As a result, both very general and domain specific knowledge types were identified. Very general knowledge concerns knowledge that tends to be time independent or homogenous in nature, whilst domain specific knowledge is heavily contextual and contains highly specific detail (De Jong & Ferguson-Hessler, 1996).

2.4.8 **Modes of knowing**

When referring to "modality" and the mode of knowing, De Jong & Ferguson-Hessler (1996) provide indications of whether knowledge is shown using pictures, or shown using words. More recent literature considers various "modes of knowing", where types of knowledge are considered to only provide a static idea of knowledge (Olaisen & Revang, 2018). Sharing knowledge within professional teams involves various modes of knowing, including non-representable knowing, non-represented knowing and representable knowing (Olaisen & Revang, 2018). These three modes represent a fluid scale of knowing, acknowledging that the boundaries between each level are unclear. In addition to these three modes, knowing can occur on both an individual and collective scale.

Non-representable knowing develops over time and cannot be made explicit by an individual (Olaisen & Revang, 2018). This notion is similar to tacit knowledge, where the owner of the knowledge finds it

difficult to express and document this knowledge due to its reliance upon personal experience. Specifically, Olaisen & Revang (2018, p.297) discussed the role of intuitive knowledge and emotions, explaining that decision can sometimes be based on "gut feeling". In a collective setting, non-representative knowing is pronounced to exist within an organisation's culture (Bonora & Revang, 1993). Aarseth (2014) noted that each team within an organisation can create their own culture, and therefore, tacit knowledge. Within the context of energy communities, this might suggest that the tacit knowing within each community is likely to vary depending on the community culture.

In comparison, non-represented knowing is knowledge that can be transferred by observation (Olaisen & Revang, 2018). Orr (1990, p.170) explained this mode of knowing by comparing it to an individual who has the capability to complete a task but struggles to explain how they acted using logic. Within an energy community, an example might involve the community note taker publishing the meeting notes in a specific structure and at a specific time but struggling to explain this process to others. Members within the group may not necessarily know how to produce and publish the meeting notes, but would be able to observe the process and increase their knowledge level as a result. Olaisen & Revang (2018) recommend that this mode of knowing can be transferred into explicit knowing with the rotation of work tasks across an organisation. Such practices can also improve trust and confidence amongst team members.

Finally, representable knowing is considered to be a "product of the context involved" (Olaisen & Revang, 2018, p. 298). This mode of knowing within energy communities would therefore be energy specific, but easily shown and shared in an explicit manner. Olaisen & Revang (2018) note that the transformation of an individual level of this knowing to a collective or group level of knowing requires high levels of synergizing. The rotation of team roles within a community group and the sharing of representable knowing over an expansive time period might support this type of knowing. Olaisen & Revang's (2018) acknowledgement of the "pace of change" shows how the movement between the different modes of knowing requires extensive socialization, which takes time and cannot be planned.

2.4.9 **Knowledge management**

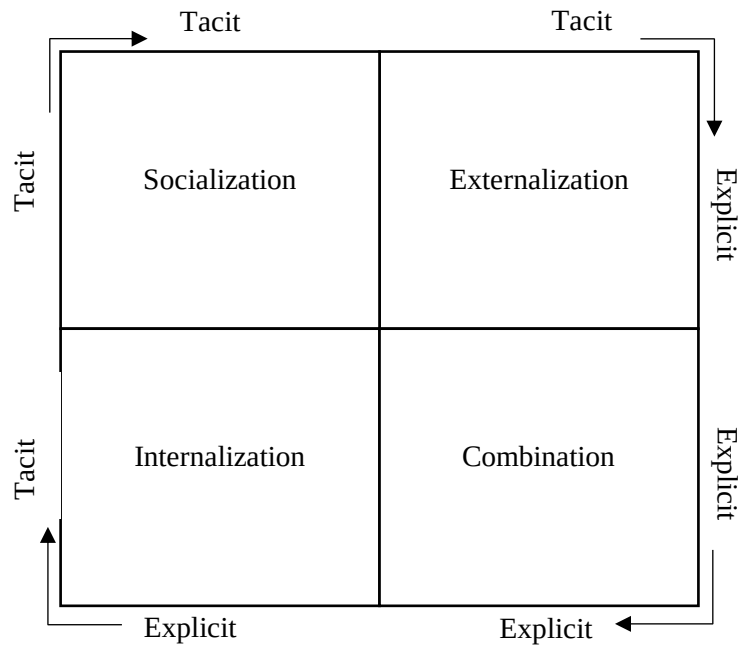
The concept of KM first emerged in the mid-1990s. The literature in the area is still developing (Alavi & Denford, 2015) and as such, new gaps continue to develop across varying contexts, making the study of knowledge particularly relevant (Easterby-Smith & Lyles, 2011). The development of KM is often credited to the work of Nonaka on management, KS and creation (Nonaka, 1991, 2008), but others credit corporate organisations seeking to gain competitive advantage from innovation in IT (Easterby-Smith & Lyles, 2011). Hoffman, Hoelscher and Sherif (2005, p.95) identified KM as a concept that "can lead to decreased cycle times, help firms avoid obsolescence, streamline processes, and give firms a sense of how to respond to change". The role of KM as a strategic department within an organisation is continually changing. Leavitt's (1964) diamond model highlighted task, structure, people and technology as the four key components of KM, a view that Edwards (2011) has since reframed as

encompassing people, processes and technology. In this important examination of KM, Edwards (2008. p299) also notes that the relationship between the three components is reciprocal, where "people help design and then operate processes, while processes define the roles of, and the knowledge needed by people". This notion is important because it emphasises the complex and interdependent nature of managing knowledge, but it also provides underpinning for what has been described as "two generations of knowledge management" that have been explored in the literature to date. Newell et al. (2009) identified these two generations of KM as the cognitive and objective view of knowledge and the community view of knowledge. Edwards (2011) noted that the cognitive view places focus upon technology, whilst the community view focuses on people, personalisation strategy and "knowing".

2.4.10 **Knowledge sharing (KS) and creation**

The review of literature in the following Section investigates KS to identify concepts that can be applied to consumers within the community setting. Witherspoon *et al.* (2013) identified that KS is a critical success factor in an organization's survival strategy, whilst Crossan, Lane and White (1999) view KS as the transfer of knowledge amongst individuals, groups, teams and organizations. Perhaps one of the most cited KS frameworks in the literature is presented by Nonaka (1991), in which the characteristics of knowledge-creating companies are outlined and presented as a foundation for future research. Figure 9 shows the KS framework created by Nonaka (1991), which is otherwise known as the SECI model of knowledge transfer and creation.

Figure 9: SECI model of knowledge sharing and creation



Source: Adapted from Nonaka (1991)

Described as one of the most influential models in the knowledge literature (Choo & Bontis, 2002), this model comprises of four key areas. The process starts with socialization, where people who have forms of tacit knowledge share this knowledge with those who do not. Nonaka (1991, p.64) used the example of learning how to make "tasty bread" from a baker. This example is used because the first bread making machines failed to execute the production of a desirable bread. In this description, the learner observed and interacted with the baker, learning that the baker twisted the dough during the creation process; something that the machine had failed to do. As a result of this learning, the machine was later altered to twist the bread in a way that replicated the actions of the baker (ibid). Following the socialization stage, tacit knowledge is converted into explicit knowledge via the externalization stage. This stage is where tacit knowledge is often documented and codified so that it can be shared across organisations and with other people. The externalization stage is often hard to visualise and Nonaka (1991; Nonaka and Takeuchi, 1996) failed to provide evidence that this stage indeed exists or if it significantly contributes to the process of KS and creation. After the externalization stage, the combination stage occurs. The combination stage is where both explicit and tacit knowledge are united, which is described as a process of "systemizing concepts into a knowledge system" (Nonaka and Takeuchi, 1996, p.67). Finally, the internalization stage involves the conversion of explicit knowledge into tacit knowledge; referred to as "learning by doing" (Nonaka and Takeuchi, 1996, p.69). Within a community setting, tacit knowledge may take the form of an individual who knows and has personal experience of how to use a SMART meter[2] and the benefits of doing so. In comparison, explicit knowledge may be a documented guide on how to use a SMART meter and why.

Despite the recognition that KM has gained "academic legitimacy on the back of Nonaka's work" (Easterby-Smith and Lyles, 2011, p.12), recent critiques of the SECI model have questioned the framework on cultural, social and applicability grounds. For example, Glisby and Holden (2003) questioned the validity of the model beyond the context in which it was created because it was constructed and based on Japanese organisations and society. They point out that the externalization stage is heavily dependent on the worker's commitment and loyalty to an organisation; two factors that have been notoriously high in Japanese working culture, but which may be lower in other cultures (ibid). Indeed, research examining trust relationships between employees and organisations in the UK shows that just 37% of employees trust their senior management and that this trust is continuing to decline (CIPD, 2013). As such, the externalization of knowledge from employees to others in the organisation might occur significantly less in other countries. This is particularly relevant to the community and consumer settings, as consumers may not trust those with whom they are sharing knowledge or the other external stakeholders involved in the process, such as organisations. For example, consumers who

[2] An electronic device that records information such as the consumption of household electric energy and gas.

are involved in communities with low levels of trust may find it difficult to share their personal tacit knowledge with the rest of the group, and even more so with stakeholders or parties beyond that immediate community.

The main weakness of the SECI model is that it assumes that the disseminator of the knowledge has trust in those who are receiving the knowledge. Furthermore, Becerra-Fernandez and Sabherwal (2001) indicate that each SECI transition is influenced by task characteristics, and both externalisation and combination modes positively affect knowledge satisfaction; whereas tacit modes such as internalization and socialization do not have the same effect. This is because internalization and socialization are modes that allow the individual to "learn by doing" and to "observe", which may involve different forms of involvement, based on the activity and context. Since context as a factor can support positive knowledge satisfaction, it is arguably the main influencer of the KM process. Poell and Van der Krogt (2003) described the types of work that employees engage in and the subsequent influence upon the knowledge creation process, which shows the influence that the context can have upon KM processes.

Finally, Gourlay and Nurse (1995) were critical of the SECI process, stating that the process should be presented in a linear way, that it takes place over time and is incremental. Within a community setting, building knowledge around energy and behaviour is a lengthy and time-consuming process and high levels of consumers' knowledge cannot be expected immediately. This problem, which has been regularly reported over the past decade, is not helped by the low levels of consumer engagement in the energy sector (Ofgem, 2012).

Figure 10: Knowledge conversion over time

Source: Gourlay and Nurse (1995, p.304)

Where tk_1= tacit knowledge, ek_1= explicit knowledge

Nonaka's (1991) model does not recognise time, and also ignores the potential for different forms of knowledge to be developed at any stage in the process. For example, at the combination stage, an individual's tacit and explicit knowledge might contribute to the next phase of the process. Figure 10

highlights the possibility of a new knowledge type by showing the process in a linear format and acknowledging that a combination of tk_1 and ek_1 as a result of interaction, leads to $K_{1;}$ which in turn repeats the process and leads to $K_{n.}$ Li, Liu and Zhou (2018) recently used the lens of product development to develop the G-SECI model, where knowledge that is known as "grey knowledge" describes "half-tacit", "half-explicit" tacit knowledge. Thus Li, Liu and Zhou (2018, p.890) refer to grey knowledge as:

> a type of wide-view dynamic knowledge. If the amount of tacit knowledge is scaled as "1" (or the amount of explicit knowledge is scaled as "0"), then the value of grey knowledge can be any value between "0" and "1".

This concept is similar to the notion described by Gourlay and Nurse (1995) as it encompasses "know why" characteristics and forms during the internalization process. The next Section will consider this notion of KS and its relevance for the community context.

2.4.11 **Knowledge sharing frameworks for organisations**

In the following Section, the consideration of the typologies of knowledge will be further developed by exploring the existing literature around how knowledge is shared. Literature has primarily considered the sharing of knowledge in an organisational context, due to the potential for competitive advantage from the application of an effective knowledge strategy (Brown & Woodland, 1999; Jarvenpaa & Staples, 2001; Weiss & Library, 1999). The review of the literature that considers consumers, sales processes, operations and marketing can therefore provide an insight into KS activity and how this sharing occurs.

2.4.12 **Knowledge and the consumer**

Customer Relationship Management (CRM) is used by organisations to manage their relationships with customers by efficiently and effectively delivering products or services, and thus creating customer satisfaction (Du Plessis & Boon, 2004). Although this project is not primarily concerned with CRM's remit to collect data about consumers as the basis for building competitive advantage (Buckley et al., 2002), it is concerned with the KM practices, which are involved in the CRM process. Liew (2008) argued that the analysis of KM systems within the CRM process is vital to achieve a customer relationship that is underpinned by KM and drives value. At this stage, it is important to recognise that Customer Knowledge Management (CKM) is driven and managed by the broader concept of CRM (Gebert et al., 2003).

CKM is primarily concerned with the capturing, sharing and application of consumer knowledge within a particular context (Parirokh et al., 2009). The following review of CKM models will provide insight into how different aspects of knowledge should be applied and aligned with a particular context. Although the CKM models have an organisational focus, their primary aim is to be 1) consumer facing and 2) align aspects of knowledge with processes. This consumer facing approach and organisational

context are able to provide a foundational basis of understanding around how knowledge should be applied in specific contexts and why this could be effective or ineffective.

CKM can be categorized into three key areas; knowledge about the consumer (KAC), knowledge from the consumer (KRC) and knowledge for the consumer (KFC) (Gebert et al., 2003; Parirokh et al., 2009; Shami Zanjani et al., 2008).

1) *Knowledge about the consumer:*

KAC is data or information that can be analysed, interpreted or that has a meaning in a particular context. Organisations often use KAC to better understand their target market (Davenport et al., 2001).

2) *Knowledge from the consumer:*

Knowledge from the consumer is also data that can be analysed or interpreted, but a kind that allows organisations to enhance their product or service to meet the wants and needs of the consumer. An example of knowledge from the consumer can often be presented in the form of feedback.

3) *Knowledge for the consumer:*

KFC is data or information that can be interpreted by the consumer to help them get to know an organisation or the sender of the information better (Shami Zanjani et al., 2008).

The three highlighted CKM areas are underpinned by the notion that these knowledge types can be informed by interactions and relationships between organisations, consumers, competitors and consulting agencies (Shami Zanjani, Rouzbehani and Dabbagh, 2008). Gebert et al. (2003, p. 118) initiated this notion by proposing a CKM model that highlights the "considerable synergy potential" between CKM and KM. More specifically, the CKM process "allows CRM to expand from its mechanistic, technology-driven and data-oriented approach, enabling it to encompass technological and people-orientation elements" (ibid, p.118). The review of this model will help us to understand how the three types of knowledge might support the sharing process within community settings. As Gebert et al. (2003, p. 118) states; "CRM manages knowledge transparency and dissemination of knowledge to customers". Applicable and relevant aspects from this CKM approach could therefore be used and applied to the consumer and community setting, allowing consumers to effectively share knowledge between one another.

Figure 11: Customer Knowledge Management (CKM) model

Source: Gebert et al. (2003, p.118)

The CKM model (Gebert et al., 2003) in Figure 11 is primarily concerned with re-aligning the concept of KM with business processes, as many KM models fail to showcase the value in managing knowledge for organisations. The CKM model presents interaction management and channel management as the guides to an efficient customer process; where interaction management guides all communication with the customer and channel management, which then guides the "configuration and synchronization" (ibid, p.115) of this communication at each stage. Campaign management and lead management are primarily aligned with marketing, offer management and contract management, whilst complaint management is mainly concerned with sales, and service management with the overall service. Lead management provides a connection between marketing and sales, whilst complaint management does the same between sales and the service. It is in these areas that channel management becomes essential to providing the effective management of knowledge. Throughout the CKM process, content, competence, composition and collaboration can be used in the process as a performance indicator. Knowledge for, from, and about the consumer are all integrated into this model, which is a prerequisite as the framework's focus upon customer knowledge (Gebert et al., 2003).

Although the CKM model focuses on the process dimension and thereby addresses the KM and CRM gap (Gebert et al., 2003), it fails to show how processes should be framed and adapted to support KM. Furthermore, the model is presented with a technological focus in mind and provides little assistance for those who wish to adopt the model within organisations. For example, some may want to use the model to improve their sales and marketing operations. An adapted model to provide a more holistic view of the key value areas within an organisation may be needed so that KM can be applied to CRM in a variety of business settings.

In the context of New Product Development (NPD), Chen and Su (2006) presented a model based on the theory of attractive quality and product development, otherwise known as the Kano theory. The Kano questionnaire, evaluation table and survey result table are considered by Chen and Su (2006) as three methods that enable organisations to reflect on customer perceptions. In turn, this allows organisations to turn tacit customer knowledge into explicit customer knowledge (ibid). The Kano method has been well documented by Berger *et al. (*1993) and applied by a variety of stakeholders from academics (Tan & Shen, 2000) to industry professionals (Huiskonen & Pirttilä, 1998). Although this theory has been critiqued for lacking a systematic approach to creating attractive quality (Chen & Su, 2006; Kuo, 2004; Witell & Löfgren, 2007; Yang, 2005), it clearly recognises the importance of tacit knowledge codification throughout its four step process (Figure 12). The consideration of the Kano theory is particularly important to this thesis because it shows how customer tacit knowledge can be obtained and converted into customer explicit knowledge. This process could be adapted and used by energy communities who wish to acquire and understand the knowledge that people in their local community hold.

Figure 12: Kano-CKM model on NPD and attractive quality creation

Source: Chen and Su (2006, p.787)

In comparison to the model proposed by Gebert et al. (2003), this framework considers CKM as comprising four stages; product benefits and preference identification, customer satisfaction categorization, marketing segmentation and customer usage pattern extraction. After the organisation has obtained KAC, the organisation considers the quality level of the service and codifies the tacit customer knowledge into understandable and actionable explicit knowledge. This process also allows new products to be developed. CKM frameworks have been linked closely with information technology (IT), with Su, Chen and Sha (2006) developing an E-CKM version of the model by integrating IT based processes – emails, web-based surveys and data mining - into the process. Wu, Guo and Shi (2013) also applied CKM to IT by creating and validating a conceptual framework that links mechanisms between CKM and IT based business model innovation. Chan (2018) recently developed the CKM process as one that involves all three concepts (KAC, KRC, KFC), but placed greater emphasis on knowledge creation as a key stage between knowledge acquisition and knowledge dissemination.

Understanding KS is the basis for considering KM. As such, Gebert et al. (2003, p.115-116) suggests that:

> CKM does not require self-oriented knowledge management processes. It requires goals for managing the knowledge critical for its business processes. The CKM model therefore transforms the KM process perspective of ontological KM models into a KM goal perspective.

This notion implies that all KM models presented in the literature should be concerned with what the organisation intends to achieve with the knowledge, how they want to use it and why, as opposed to creating a framework that presents knowledge as a process. Therefore, knowledge is able to support business processes that help organisations achieve specific goals, rather than simply being a process (Gebert et al. (2003). The CKM goal perspective considers four potential goals (Gebert et al., 2003, p.116): 1) knowledge transparency 2) knowledge dissemination 3) knowledge development and 4) knowledge efficiency. Similar to the CKM model presented in Figure 11, all four goals are underpinned by competence, collaboration, composition and content. Knowledge transparency supports the management of customer knowledge by defining the requirement for the use of the knowledge. A step towards KM involves the effective sharing of knowledge with all relevant stakeholders within the organisation. Knowledge development defines the needs and requirements of any newly created knowledge that has the potential to be used by the organisation. Finally, knowledge efficiency involves the careful selection of knowledge for a suitable business process by the user within the organisation. In many instances, there may be a wide body of knowledge to choose from, hence the notion that this stage is crucial and leads to effective management. The four goals of effective CKM could be considered and used to review the knowledge sharing activity of an energy community, particularly as the community begins to engage with a variety of different stakeholder that may be external to the group.

2.4.13 Acknowledgement of organisational knowledge sharing frameworks in specific contexts

In addition to the review of the frameworks that consider the sharing of knowledge and consumers, literature also presents several context specific frameworks that consider this process. For example, much has been published within areas such as computing and the internet due to the rise of KS via the web. Various contexts have presented different KS frameworks, showing the importance of the context when sharing knowledge.

Kim & Lee (2004) quantitatively examined the organisational factors affecting KS in e-government, highlighting several key variables. These factors included visions and goals, trust, social networks, centralisation, formalisation, reward systems, infrastructure, end-user focus, years of work and education (ibid, p. 288). Wang & Noe (2009) conducted a review of the existing literature on KS, concurring that there are opportunities for future research within specific contexts, such as the online space. In addition to the virtual and online space for KS, more recent KS frameworks recognise the factors involved in higher education (Khilji et al., 2020) and healthcare (Sibte & Abidi, 2007). Although different contexts consider different factors when sharing knowledge, some contexts present similar factors that should be considered. For example, both Sibte & Abidi (2007) and Khilji et al. (2020) consider the importance of culture and technology in KS.

Ipe (2003) constructed a KS framework that has been widely cited for use within a variety of contexts (Choi et al., 2008; Gagné, 2009; Sohail & Daud, 2009). The framework (see Figure 13) shows the three key areas concerned with how knowledge is shared, namely, the nature of knowledge, motivation to share and opportunities to share.

Figure 13: A model of knowledge sharing between individuals in organisations

Source: Ipe (2003, p. 352)

As Figure 13 shows, the culture of the work environment surrounds and influences all three areas of KS. The influence of culture upon the ability to share and create new knowledge has been noted throughout the KM literature (De Long & Fahey, 2000; Leonard-Barton, 1997; Pan & Scarbrough, 1999). Jarvenpaa & Staples (2001), for example, noted that culture often determines the norms of how knowledge is distributed between individuals within organisations. The nature of knowledge, motivation to share and opportunities to share can all be influenced by these norms and the decision making of the individuals who owns the knowledge.

Within this framework and as previously identified, the nature of knowledge pertains to whether the knowledge shared is tacit or explicit. Lam & Holloway (2000) highlighted that the critical difference between the tacit and explicit level of the knowledge is its codifiability and potential to be collected and distributed. In comparison, the motivation to share knowledge concerns internal factors such as reciprocity and power, along with external factors such as the rewards for sharing and the relationship with the recipient. Davenport et al. (1998, p.45) highlighted motives for sharing knowledge and found an individual's ego and occupation to be particularly important. However, these factors are often not enough to encourage individuals to share knowledge, as individuals may require a specific personal or external motivation to do so. Stenmark (2001) emphasised the role of personal motives in the KS process, explaining how they may be the deciding factor in whether an individual decides to share knowledge. Finally, opportunities to share knowledge in this framework concern the informal and formal channels of opportunity for individuals. For example, Ipe (2003) refers to structured work teams, training programs and technology systems as formal opportunities to share knowledge. In comparison, informal opportunities are mainly available during face-to-face communication, which in turn may help to create a level of trust and therefore a possible friendship (Nahapiet & Ghoshal, 1998).

Although the framework presented in Figure 13 does not show the process of how knowledge is shared, it provides a generic and foundational conceptualization of the factors that influence the process in a variety of contexts. This could consequently be used to frame an exploration of knowledge sharing in a community setting.

2.4.14 **The relevance of the organisational Knowledge Management literature to this thesis**

The consideration of KS within the organisational literature is particularly important to this thesis because this is a key area in which the understanding of knowledge and its sharing has been presented to date. Although this literature has particularly focused on organisations, it has shown the value that knowledge can bring to groups of people attempting to complete tasks or projects. In many cases, organisations use knowledge as a tool for attracting and retaining consumers. Importantly, the considered organisational literature has also shown that KS should be considered as a phase or concept that is separate and distinct from knowledge creation or development. This KS process within organisations has been shown to be extremely tacit and concerned with socialization.

Furthermore, the various frameworks developed within the organisational literature could be reframed and applied in a community context, where a community participant is the equivalent of the consumer. Although the community KS literature is somewhat under researched, this organisational exploration provides a set of clues that can be used to develop a theoretical foundation for KS within energy communities.

2.5 COMMUNITY LITERATURE

In the following Sections, the literature on communities will be explored to provide the researcher and the reader with a clear understanding of what communities are and how they operate. Section 2.5.1 will provide a historical background of communities; Section 2.5.2 will define what is meant by the term "community". Section 2.5.3 will then explore KS within communities, whilst Sections 2.5.4 to 2.5.9 will explore the concept of Communities of Practice (CoPs). Finally, Section 2.5.10 will explore the literature that is specifically relevant to energy communities and CoPs.

2.5.1 Historical background of community theory

The development of community theory has progressed in various directions since the late 1800s. Ferdinand Tonnies (1957) and his book "Community and Society" is considered a key source of discussion about community. Tonnies (1957) compared the differences between human relationships in rural villages and more modern capitalist states. Within this comparison, it was noted that rural-like relationships were usually based upon sentiment, tradition and common values, where one would be viewed by others as significant in one's own right (Lyon & Driskell, 2011). In contrast, an urban-like relationship was viewed as rational, legalist and having foundations of neutrality (ibid). Tonnies (1957) concludes by recognising that no community has ever been dominated by one type of human relationship and that rationality is always mixed with emotion. Extensive studies on community throughout the early 1900s led to the early creation of what is now known as American sociology. This field of research, which was established at the University of Chicago, attempted to investigate the dynamics and structure of various American cities at the time (Lyon & Driskell, 2011). Wirth's (1938) article entitled "Urbanism as a way of life" is widely cited as one of the key articles that first considered variables such as population, size and density as key contributors to communities becoming more urban.

Around the same time that the concept of urbanism was being explored, a more holistic approach to community study was being developed. *Middletown*, published by Robert and Helen Lynd (1929), explored the details of what was considered to be the typical American community, where a mix of cultures and classes of people contributed to a vibrant community. *Middletown* (1929) is considered one of the most famous and influential community studies, due to the examination of one's daily life at the time (Lyon & Driskell, 2011). Within the study, working class and business class were identified as key factors that influence the decisions that the Middletown man, woman or child would make.

> It is after all this division into working class and business class that constitutes the outstanding cleavage in Middletown. The mere fact of being born upon one or the other side of the watershed roughly formed by these two groups is the most significant single cultural factor tending to influence what one does all day long throughout one's life; whom one marries; when one gets up in the morning; whether one belongs to the Holy Roller or Presbyterian church; or drives a Ford or a Buick (Lynd & Lynd, 1929, p.24).

This analysis of how *Middletown* operated set the foundations for further exploration of communities and the factors that influence how people live their lives. Shortly after this exploration of community, Hunter (1953) argued that power structures were fundamental to the way in which communities operate. Using face-to-face interviews as the method of enquiry, Hunter (1953) interviewed leaders across the community after becoming frustrated with the Community Planning Council. Several conclusions emerged about the role of power within communities (see Appendix 2), including the suggestion that power is limited and directed by social policy, which is authorised socially.

By the 1970s, the ideas presented by Tonnies (1957) were considered outdated, as studies moved on to analyse society as a whole, rather than focusing on single communities (Lyon & Driskell, 2011). Within this period, ecologists moved their analysis towards the use of terms such as neighbourhood, place, suburb and region (Lyon & Driskell, 2011). This shift showed that communities were beginning display different characteristics and becoming more urban as time went on (ibid). Lyon & Driskell (2011, p. 12) refer to the 1970s and onwards as a "rise of mass society", where society is a "homogenous society devoid of major ethnic and class divisions and, most importantly for the community, devoid of substantial regional and local variation".

2.5.2 **The term "community"**

To consider KS within a community context, it is important to first understand what is meant by t "community", a term that has been variously used to represent different types and groups of people. The concept of community can therefore be considered to be contested. Within this thesis, to reflect the focus of the research, community is defined as a "social group with a common territorial base; those in the group share interests and have a sense of belonging to the group" (Stebbins, 1987, p.534).

American sociologist Robert Park (1936) was the first to identify community as a concept that comprised of a 1) a territorially organised population 2) that is rooted in the soil it occupies, and 3) involving a relationship of mutual independence. Gusfield (1975, p.16) developed this notion by distinguishing between different types of community: 1) those which are geographically located, such as a town or city; and 2) the "relational" which is associated with the quality of character of the human relationship. The term "community" however, is not new. Berreby (1990) reflected on the "generation X" of workers and made comparisons to hunter gatherers in ancient times. This comparison highlights that the importance of the transfer of tacit knowledge to survive, which is apparent in both current and ancient times. Thus in ancient times, hunter gatherers transferred tacit knowledge for hunting and co-existing; whilst today, generation X workers do the same within the workplace, preferring to work in teams and often disliking being told what to do (Berreby, 1990, p. 71). Elsewhere, the community is portrayed as comprising indviduals that interact with each other for the purpose of achieving a mutually desired goal (Shuster et al., 2006, p.297). As such, there is no universally accepted definition.

Considering the urban context of communities, literature has implied that people can feel lonely and isolated within communities (Pretty et al., 1994). This is something that Ralph Keyes (1973) was keen to highlight, subsequently questioning the persuit of mobility, privacy and convenience. The conclusion made by Keyes (1973, p.20) is that "community is people", and yet people no longer need to be together when working, living and dying. Nisbet (2008) also highlighted that the problems surrounding community are "modern" and the solution to isolation is the creation and growth of small, but responsive communities that are formed from the grass roots. Poplin (1979) summarised the notion of "community" as one that is a moral phenomenum that empowers the individual with a sense of unity and identity within a group, whilst enhancing one's feelings of involvement.

In this project, the term community will be used relationally as it investigates the sharing of knowledge between people and therefore the subsequent socially constructed relationship. McMillan and Chavis (1986) indicated that community has four elements: membership, influence, integration and fulfilment of needs. Adding to the definition provided by Gusfield (1975), the quality of the human relationships within the communities explored may be dependent upon one or more of these four elements. Considering the project aim, these four elements appear to connect with the nature of KS. The nature of this connection will be determined in the data collection.

2.5.3 **Knowledge sharing in communities**

The following Sections will introduce and explore CoP as the key enabler of KS within communities. Wenger and Synder (2000, p. 139) define a CoP as "groups of people informally bound together by shared expertise and passion for a joint enterprise". CoPs are relevant to this research because they can be analysed and used as a way of considering the KS activity that occurs within energy communities.

The gathering of various participants with similar interests in a CoP allows sharers and receivers of knowledge to communicate and build trust levels that are vital for sharing and receiving knowledge. McDermott (2002) identified the importance of CoPs in the KS process by recognising that:

1. CoPs allow individuals to help each other and increase their personal knowledge and ability to solve problems.
2. CoPs improve the strength of relationships and allow members to find out who has specific knowledge. As a result, relationships, interaction and trust improve.
3. CoPs improve member access to information, allowing members to create tools, procedures and document information.

The consideration of these benefits indicate that CoPs may have an important role to play in facilitating the KS within energy communities. This issue can be better understood by exploring the motivations for sharing knowledge within CoPs; an issue that has recently been explored within online and virtual communities, showing how extrinsic, intrinsic and community motivations contribute to influencing the sharing of knowledge (Hao et al., 2019).

2.5.4 **Communities of Practice (CoPs)**

Communities of Practice (CoPs) have been recognised as particularly effective in supporting KS between the members of a group. They also distinctly recognise knowledge as the primary output of CoPs, where the primary purpose is to develop member capability and to build and exchange knowledge (ibid, p.142). This places Wenger and Synder's (2000, p. 139) interpretation of a CoP as a directly applicable concept for this project. Similarly, Lesser and Storck (2005, p. 831) identify a CoP as a "group whose members regularly engage in sharing and learning, based on their common interests". Wenger and Synder (2000) also indicate that CoPs are often viewed as a soft approach to management and influencing behaviour. The description of CoPs being "soft" shows that there may be questions around the effectiveness of CoPs. However, Lesser and Storck (2005) argue that social capital resides within CoPs, which in turn, can be used to influence behavioural changes. Social capital has been described as "encompassing the norms and networks facilitating collective action for mutual benefit" (Woolcock, 1998, p.155). This mediated relationship might suggest that CoP's are simply misunderstood within the literature, or that the transfer of knowledge (as the main output) is particularly hard to measure.

2.5.5 The theoretical development of CoPs

The theoretical development and foundation of the literature on CoPs is credited to three key publications (Li et al., 2009) which are as follows. Lave and Wenger (1991) *Situated Learning: Legitimate Peripheral Participation*, Wenger (1998). *Communities of Practice: Learning, Meaning and Identity*, and Wenger, McDermott, and Snyder (2002), *Cultivating Communities of Practice*.

The development of the area during the eleven-year period spanned by these publications, particularly those from Etienne Wenger, highlights a transition in thinking about the CoP concept. During the early stages of thinking around CoPs, practitioners used the concept as a foundation to understand learning in a variety of social settings (Lave & Wenger, 1991). It was initially thought that learning occurred within the workplace, which became a theme described as "situated learning" (ibid). Throughout, Lave and Wenger's (1991) paper focused upon situated learning. The journey of newcomers with very little knowledge about a topic and their relationship with experts was described, a journey resulting in newcomers eventually becoming experts. The term "legitimate peripheral learning" was used to describe how newcomers to a social settings would learn by receiving opportunities to engage in simple tasks. Cox (2005) later considered this process involving CoPs as focused upon sharing and developing existing skills, but not necessarily creating new ones. During this phase of theoretical development, Lave & Wenger (1991) recognised that various power dynamics may exist between experts and novices within CoPs. Later, Cox (2005) identified power dynamics between CoPs as an under researched area, despite Lave & Wenger's (1991) acknowledgement of the significance of power dynamics within CoPs.

Using previous work in 1991 as a foundation, Wenger began to frame the three interrelated dimensions of a CoP. These were identified as mutual engagement, joint enterprise and shared repertoire (Wenger,

1998a). These three dimensions were paired against fourteen indicators that can be used to show the existence of a CoP. Mutual engagement refers to the interaction and communication between members of the group, whilst working towards an understanding of shared meaning. In comparison, joint enterprise is a slightly more advanced type of interaction, involving the group collaborating and working towards a common goal or purpose. Finally, shared repertoire refers to the shared resources and understanding of the group when working towards a common goal and shared meaning. Table 4 displays the fourteen indicators of a CoP's presence.

Table 4: Indicators of a community of practice and their relevant domain

Source: Wenger (1998, p.125)

Although not all indicators may be present within a CoP, several of the key indicators have a focus upon knowledge and "knowing". Indicator three alludes to the rapid flow of information within the CoP, which could be processed and made into knowledge if it becomes contextual and actionable (Pearlson and Saunders, 2004) (see Figure 6). Indicator seven attains all three domains, where participants within

the CoP "know" and also possess knowing about others within the group. Ultimately, the discussion and concepts presented by Wenger (1998) are underpinned by the notion that CoPs allow participants to learn, know and acquire meaning.

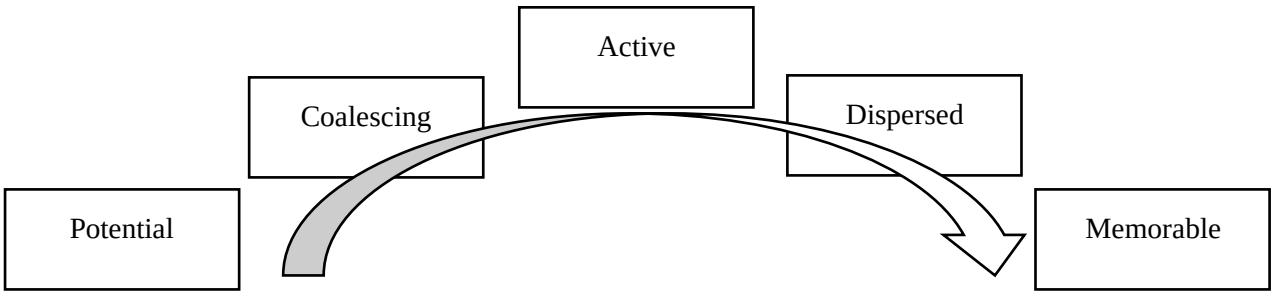
Finally, Wenger et al. (2002) moved their development of the CoP concept away from focusing upon learning and into the purposeful recreation of CoPs for competitive advantage within organisations. Li et al., (2009, p. 6) regard this development as an attempt to "manage knowledge workers", which aligned well with a research agenda from the time that focused upon knowledge and competitive advantage (Argote & Ingram, 2000; Lubit, 2001; Tallman et al., 2004). In moving away from the learning focus of CoPs, Wenger et al. (2002) reframed the three domains of a CoP as "domain", "community" and "practice". The reframing of these domains allowed CoPs to be used and become applicable to organisations and their pursuit of competitive advantage. Li et al., (2009, p.6) refers to the "domain" as a concept that outlines the boundaries of the CoP and allows members to decide "what is worth sharing". "Community" concerns the social structure of the group, whilst "practice" refers to the unique knowledge that the community holds and shares.

In conclusion, over an eleven-year period, the theoretical development of CoPs was reframed and added to. During this period, Etienne Wenger moved the concept through phases of focusing on learning, meaning, identity, and more recently, on organisational competitive advantage. As a result of these developments, the CoP concept is now being applied in a variety of contexts, such as communities.

2.5.6 Stages of a CoP

In addition to the main body of work published on CoPs (see Section 2.4.5), the various stages of a CoP were outlined by Wenger (1998b) when discussing learning as a social system and the role of CoPs within organisations. Figure 14 shows the five stages of CoP maturity that were described.

Figure 14: Stages of a CoP



Source: Adapted from Wenger (1998b)

The first stage, “potential”, is concerned with individuals making intial contact with others who have a similar agenda and objective. Within energy communities, this may involve a number of individuals communicating about the topic of renewable solar energy. At the “coalescing” stage, individuals discuss shared goals and come together as a community. They explore connectedness and define group objectives as part of this comunity creation. Within energy communities, this could be the formal creation of a community structure, such as a co-operative or a community interest company (CIC). Following this stage, becoming “active” refers to member engagement and creating practices that help the CoP function. Throughout a variety of contexts, this may involve joint activities, group meetings and events that facilitate communication between members. Within energy communities, this stage often involves the creation of an annual general meeting (AGM), regular project meetings, energy conferences and general community events at local buildings and amenities. The communication that occurs during this stage allows active members within the CoP to develop relationships and trust with one another. At the “dispersed” stage, members of the CoP do not engage in regular meetings and events, but stay in contact via reunions and advice. The transition from the CoP being active to becoming dispersed is made possible by the strength of relationships between members and the tacit knowledge that the CoP holds. As Wenger (1998b) states, CoPs are capable of retaining tacit knowledge that formal systems and processes struggle to capture. Finally, the “memorable” phase of a CoP signifies the end of the CoPs centrality in the community, but involves the preservation and legacy of the group. Within energy communities, this legacy and memory could be achieved via completed community projects, energy production, reunions and storytelling.

2.5.7 **Types of CoPs**

A number of different types of CoP have become apparent in different contexts. Brown and Duguid (2001) indicate that CoP’s can form and begin functioning without a specific desire to formally create a group, and simply because the participants and members come together to fulfil mutually beneficial needs. In comparison, Lesser and Everest (2001) indicate that CoPs can be created and initiated intentionally by a group or organisation in order to harness or create a specific output or capability. Additionally, Wenger, McDermott and Snyder (2002) empathised with the idea that CoPs can be both formal and informal, where informal communities meet as and when, whilst formal groups meet more routinely and are governed by a strict agenda. In both cases, it is important to note that the intention to create a CoP does not necessarily dictate its formality. For example, an informal and laissez-faire CoP could intentionally be created by local community members who wish to discuss best energy saving practices at a local coffee shop.

2.5.8 **Organisational CoPs**

It is important to recognise the development of CoP’s within organisations across the globe, as this will help identify the constructs that are involved in the KS process between people. Chu and Khosla (2009) highlighted CoP’s ability within organisations to store and distribute both explicit and tacit knowledge,

to enhance member interaction, develop organisational learning and maximise the value of KM using innovation. The existence of CoPs within organisations can range from being totally established and institutionalised to unrecognised (Brown & Duguid, 2001). For example, within energy orgnaisations such as British Gas or EDF energy, employees from various departments may meet regularly to discuss consumer electricity consumption. In some cases, this activity may not be recognised or valued by the organisation, whilst in others, CoPs are more embedded into the structure of the organisation and the value they add is acknowledged. Wenger, McDermott and Snyder (2002) note that an organisationally recognised CoP may command benefits such as the provision of resources and legitimacy, but these benefits need to be managed effectively in order to achieve the CoPs purpose. In addition, the rise of globalization and the need to develop competitive advantage in internatinal markets has placed knowledge-based CoPs at the forefront of attracting top talent and competing for market share (ibid). This is because CoPs bring together multiple prerspectives that enable tacit knowledge to be shared and converted into scientific knowledge. Wenger, McDermott and Snyder (2002) highlight that it is the sharing of these multiple perspectives that allow us to solve ever changing and complex problems in today's society, as well as supporting orgnaisations in competing for market share.

2.5.9 **Framework for the analysis of CoPs**

This Section will provide a framework that can be used to analyse how CoPs function. This is particularly important to this research because it will assist the researcher in identifying specific characteristics that exist within energy communities. These characteristics could subsequently be explored and compared to the characteristics that exist within organisations, showing the researcher how energy communities operate in practice. CoPs have been explored qualitatively in an attempt to understand the nature and characteristcis of a CoP, as well as understanding whether CoP's exist or not (Koliba & Gajda, 2009). However, there have been issues when attempting to generalise and apply CoPs as a theory across different contexts (ibid). Nevertheless, Scarso, Bolisani and Salvador (2009) established the need to "operationalize" and better understand the constructs or pillars of the general CoP by presenting the analytical framework shown in Figure 15.

Figure 15: Framework for analysing the functioning of a CoP

Source: Scarso, Bolisani and Salvador (2009, p. 433)

Figure 15 depicts the critical success factors explored in the literature for CoPs (Coakes & Clarke, 2005; Dubé et al., 2006; Pemberton et al., 2007; Wenger et al., 2002). These factors influence the life and development of a CoP. Figure 15 includes four "internal" pillars and two external influences. The internal pillars are considered to be the foundations of the CoP, with each pillar providing a set of options to the creators, managers or founders of the CoP (Scarso et al., 2009). These options require the founders of the CoP to decide on how they wish operate each pillar. For example, a CoP within a large energy business may choose to share consumption data via the company intranet insead of using email. The four pillars involve the following considerations (ibid);

1. Organisational pillar – the roles and relationships within the CoP and the relationship between the CoP and the rest of the organisation.
2. Cognitive pillar – considers the knowledge area, the practices involved in the CoP and the KM processes that are being assumed.

3. Economic pillar – considers the related costs, benefits and performance of the CoP.
4. Technological pillar – considers the technologies available for use within the CoP.

If we consider the community as the CoP, the organisational pillar could be considered as a community pillar, as the relationships between those within the community are the foundation for the existance of the CoP. The cognitive pillar would display a focus on understanding knowledge and processes, whilst the economic pillar would outline the finances and opportunities available to the energy community. Finally, the technological pillar would examine the technology used within the energy community and the processes that support effective communication.

The success of a CoP is widely dependent on the reactiveness of its members to external and envrionmental challenges. These challenges are represented in the framework by the inclusion of both the context in which the CoP operates and the knowledge strategy pursued by the organisation. The success of the CoP will also depend on the appropriateness of decisions made based on the internal pillars and their implementation (Paik & Choi, 2005; Pemberton et al., 2007). Context is concerned with the organisation's culture, the way in which tasks are carried out, the market (products, services and competitors), the amount of resources available to the CoP and the technological experience of CoP members (Scarso et al., 2009). However, the knowledge strategy outlines the organisation's position and plan on making best use of the knowledge it has available. This knowledge strategy supports the acquisition of a competitive advantage (Zack, 1999).

In reviewing this framework, this research recognises CE groups as being a type of organisation. The review of the framework provides a sound basis for considering the characteristics of a CoP, its critical success factors and potential failure areas. As previously highlighted, Scarso, Bolisani and Salvador (2009) point out that each CoP is entirely dependent upon the context in which it operates. The use of the CoP framework in this research will help the researcher identify the context specific factors that influence the KS process. The energy community specific factors that influence knolwedge sharing will become clear and distinct from the factors that are highlighted below. Scarso, Bolisani and Salvador (2009, p.434) developed ideas to link each internal pillar to the main factors involved in the life of a CoP (see Table 5).

Table 5: The four pillars of a CoP and their subsequent factors

Source: Scarso, Bolisani and Salvador (2009, p.434)

In relation to this project, the four pillars and their correlating factors provide an outline of themes to be explored when considering KS. Some of the relevant themes from this framework will also feature in the conceptual framework developed for the project, which is discussed in Section 2.10.

2.5.10 Energy communities

Although CoPs have been used as a tool within organisations and communities, their application within energy specific communities remains under researched. Studies have highlighted the need and potential for mobilizing and scaling CE (Bomberg & McEwen, 2012; Parrish & Middlemiss, 2010; Roby & Dibb,

2019), whilst others have highlighted the opportunities and threats facing these energy specific groups (Mirzania et al., 2019; Seyfang et al., 2013). The success and longevity of these energy community groups have been attributed to a variety of political, social, environmental, economic and technological (Forman, 2017; Walker, 2008). Studies also highlight subcategories such as access to finance and the need for more technical expertise and knowledge (Seyfang et al., 2013). In their review that compared CE in the UK, Germany and the USA, Brummer (2018) highlighted the main barriers facing CE, as well as the potential benefits to society. He concluded that most researchers agree that CE is concerned with two predominant aspects:

1. An energy system that is more sustainable in its technological aspects.

2. An energy system that allows more participation and democratic control.

In relation to the second aspect, the organisational literature has shown that CoPs can influence the participation of members and the control structures that exist within the group (see Section 2.4.8). CoPs that are constructed within the energy community are distinctly different from those within organisations, as participation and motives for engagement are often non-financial, which subsequently influences the way in which the community operates and creates an agreed agenda. Mohtar and Lawford (2016) recently discussed the importance of the water-energy-food nexus, presenting a specific "WEF nexus community of practice platform" (WNCoP) as the solution to bridging the knowledge gaps that exist in various disciplines and communities, such as science and education. The unique nature of this CoP is that it is focused specifically on allowing various stakeholders to communicate and share knowledge with each other via an online platform. As Mohtar and Lawford (2016, p.197) state, the CoP would "consider site-specific information and enable data transfer, adaptation, and application in multiple contexts to encourage holistic approaches". In addition, there are many other practical examples where CoPs have been created within the energy sector to improve the flow of knowledge between sectors, organisations and communities (Forfia et al., 2016; Houser, 2008; Niet et al., 2021).

2.6 FACTORS THAT INFLUENCE KNOWLEDGE SHARING

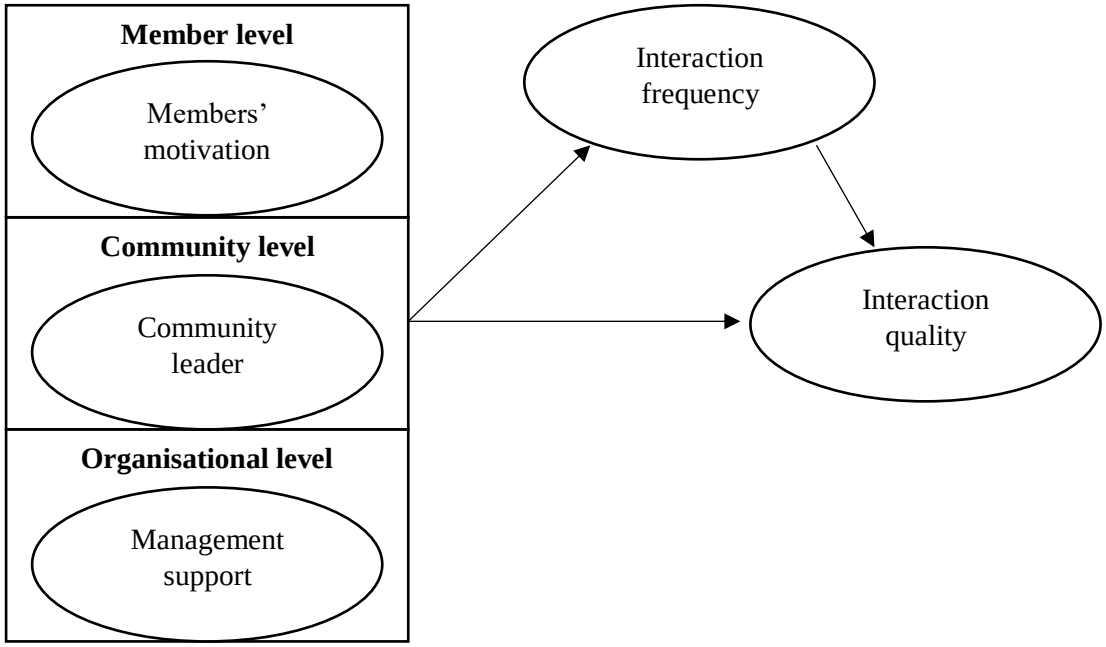
In the following Sections, the factors that influence KS within a CoP will be explored. Firstly, three levels of KS within CoPs will be identified in order to better understand the process. These are member, community and organisational level factors. Considered as member level factors, citizen participation (Section 2.7.1), power (Section 2.7.2), identity and social identity (Section 2.7.3) and generational differences (Section 2.7.4) will be explored. Following this, trust (Section 2.8.1) and reciprocity (Section 2.8.2) will be explored as community level factors. Finally, intellectual capital (Section 2.9.1) and social capital (Section 2.9.2) will be discussed as organisational level factors. Section 2.10 will follow this exploration of the literature by presenting a conceptual framework of the relevant themes from Sections 2.4, 2.5 and 2.6.

2.6.1 Levels of knowledge sharing in CoPs

Numerous studies on the factors that influence KS have identified various different concepts as key influencers. Zboralski (2009) explored the interaction processes within CoPs, identifying trust, cohesion, communication climate and interaction frequency as key influencers upon the interaction process. In addition, a member's motivation, the quality of the community leader and management support were also identified as the three prerequisites required for "quality" KS within a CoP. Despite this literature being widely cited, Zboralski (2009, p. 92) notes that "the CoP concept has undergone significant changes during the past years". This shows the complexity of a CoP and illustrates the need for further research in different contexts.

According to Zboralski (2009), KS within a CoP can be influenced at three different levels. Namely, at the member level, the community level and the organisational level. Figure 16 presents a framework that shows the interactions within a CoP.

Figure 16: Antecedents of interaction quality in CoPs



Source: Adapted from Zboralski (2009)

The three identified levels of sharing also highlight that there is a choice to be made by the individual who shares the knowledge. For example, at the community level, it is often the community leader who has the greatest involvement in the KS process and who chooses to share based on individual interests. Von Krogh (2002) noted that people vary in nature and have different interests, which makes KS a personal and complex decision. The interaction frequency and quality within the group is heavily influenced by the community leader, who plays a key role in facilitating the trust, cohesion and communications between those involved in the KS (Zboralski, 2009). In conclusion, the identification

of the three levels of KS within a CoP could allow for the consideration of various influencing factors based on these levels.

2.7 Member level factors

2.7.1 Citizen participation

Achieving citizen participation in initiatives such as CE, can be challenging. Not all citizens are prepared to engage in CoPs and in KS activities (Lave & Wenger, 1991; Zboralski, 2009). Furthermore, having improved knowledge does not necessarily lead to behaviour change (Blake, 2018). There is no unified defintion of citizen participation, with several different terms being used. These include stakeholder inclusion, interactive decision making, deliberative engagement, civil dialogue, joined-up government, interactive governance and deliberative democracy (Ianniello et al., 2018). These terms all relate to citizen participation, a concept that has historically been at the core of transparency between governments and its citizens (Boudjelida et al., 2016). For example, Beierle (2005) showed that citizen participation can play a critical role in fostering trust in institutions, reducing conflict, and making quality, cost effective decisions.

Within the citizen participation literature, Arnstein's (1969) ladder of participation is widely cited as a tool for showcasing various stages of participation. This source is particularly relevant to communities, as Arnstein (1969) is known to have drawn upon her experience with federal social programs, such as urban renewal and anti-poverty (Connor, 1988). The ladder of participation comprises eight key areas, as shown in Figure 17 below.

Figure 17: Ladder of citizen participation

Source: Arnstein (1969, p.217)

The eight stages of participation in the ladder are grouped into three key themes: non-participation; tokenism; and citizen control. This ladder was designed to be "provocative" and acknowledge the struggle for power between governments and community activists (Gaber, 2019, p.190) Even so, this ladder has a community focus and could be used to consider citizen participation in energy communities. The non-participation theme involving the manipulation and therapy stages, suggests a low level of power for community activists. In the case of an energy community, these stages could reflect citizens who are not currently involved or consulted about CE projects. The tokenism theme involves the informing, consultation and placation stages, where a medium amount of power is in the hands of those who participate. In the case of an energy community, this could relate to those groups which act as external stakeholders but have high interests in the group's agenda. Finally, the citizen control theme would begin with the partnership level of the ladder, where the highest levels of power exist within the hierarchy. Within an energy community, the partnership level could be reframed to refer to the community leader. The highest levels within the citizen control stage are delegation and

citizen control, which might involve a community member using their power to delegate tasks and certain amounts of power to those below them in the hierarchy.

2.7.2 Power

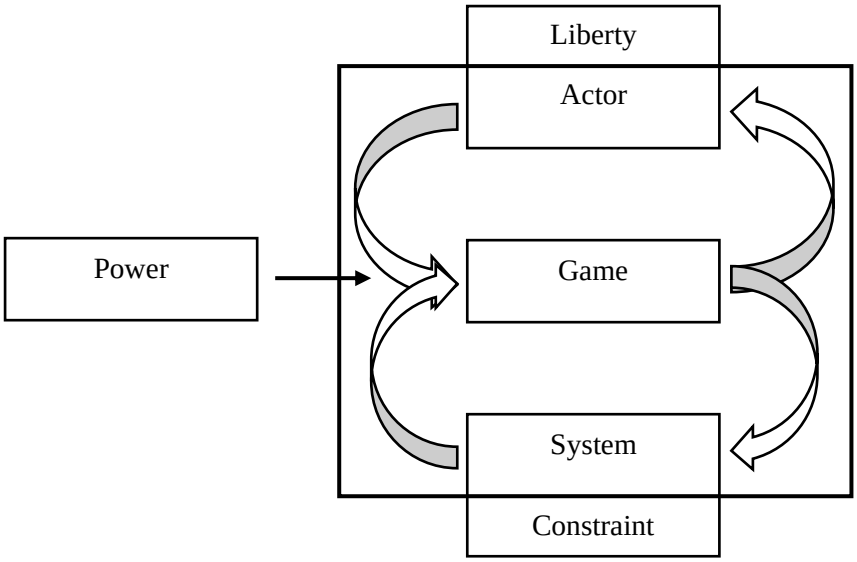
As explained in Section 2.6.1, citizen participation in a community could influence the power dynamics and structure of a community group. Roberts (2006, p. 626) provided a succinct definition of power in relation to CoPs, considering the concept as "the ability or capacity to achieve something, whether by influence, force, or control". The concept of power has been discussed in relation to CoPs and commercial organisations. Within organisations, pressure from internal and external stakeholders has been known to influence the will and ability of workers to engage in the negotiation of meaning (Coopey & Burgoyne, 2000, p. 877). Within a community, the negotiation of meaning relates more to the discussion on group agendas and objectives. Lave and Wenger (1991) highlighted the peripherality of members and their participation in CoPs, showing how participants can move from the periphery of a group to becoming fully engaged. Those who engaged in full participation would then tend to hold more power in the negotiation of meaning. Later work has critiqued Lave and Wenger's (1991) reference to the negotiation of meaning, affirming that these discussions are often extremely complex and encounter many disagreements and misunderstandings (Marshall & Rollinson, 2004). The occurrence of disagreements and misunderstandings within energy communities may be confrontational and the attainment of meaning should not be assumed. For example, disagreements within energy communities may change the power dynamic within the group and reduce the participation of one or more members, resulting in adverse progress towards the original goal of attaining meaning.

Scholars have also been known to criticize the lack of consideration given to issues such as authority, criticism, innovation and initiation of change (Engestrom et al., 1999). Within CoPs, Mitra (2008) highlighted the importance of examining power relations in order to understand how conflict can prevent effective knowledge generation. The generation and sharing of knowledge in a CoP was also considered by Yanow (2004), who explored issues of knowledge recognition based on the power dynamics and structure of a CoP. The relationship between power and knowledge is made clear by Foucault (1979, p.27), who states that:

> there is no power relation without the correlative constitution of a field of knowledge, nor any knowledge that does not presuppose at the same time power relations.

This statement emphasizes the reciprocal relationship between the two concepts, where one concept may lack presence without the other. Within CoPs, Bourdon et al. (2015) explored KS in online communities, seeing power as a key concept in the process. This exploration was carried out by understanding "power games" and using Crozier & Friedberg's (1977) "analyse strategique" framework (Figure 18).

Figure 18: Crozier and Friedberg's model



Source: Adapted from Crozier & Friedberg (1977)

Figure 18 depicts a framework that can be used to analyse the relationships between interdependent actors within CoPs. This framework has been used predominately to analyse individuals rather than groups per se (Bourdon et al., 2015). The framework is based on four notions (ibid, p.13):

1) The concepts of actors and the notion that they act within their own interests.
2) The concept of a system which is formed by interactions between actors.
3) The concept of a strategic game where actors look to exploit "zones of uncertainty".
4) The concept of power, which is viewed as a set of relations between the different actors.

Considering the four highlighted notions, Figure 18 shows the relationship between the actor, the system and the game, which can all be influenced by power. The actor always possesses the freedom to share knowledge or to "do nothing" (Bourdon et al., 2015, p. 13). The system represents a set of relationships within an organisation, where compromise is usually found between the group's formal objectives and the objectives of the individual. Within an energy community, the system may act as a constraint for an individual if their objectives are different from others in the group. Finally, the game at the centre of the framework represents the choices that an individual makes when attempting to achieve their own objectives. The individual needs to have a strategy that allows for the pursuit of both sets of objectives. Based on the three areas within the framework, power is defined by Bourdon et al. (2015, p. 14) as "the ability of an actor to implement their strategies". This framework recognises that actors will pursue this power to control uncertainty within a group situation.

In summary, power as a concept has the potential to influence a collective dynamic, where actors within the group attempt to play the "game". In doing so, a notion of liberty versus constraint appears, where the individual has to carefully strategize their interactions with others. This could be influential within a community setting, as an individual might have a range of motives for engagement and seeking power within a community.

2.7.3 Identity and social identity

Identity and social identity are recognised in the literature as distinctly different concepts (Hogg et al. 1995). Yet both concepts have the potential to influence community and KS dynamics within a CoP, providing a comparison of the two concepts. Identity theory is used to refer to an individual's role related behaviour, whereas social identity is a social and psychological theory that explains processes and relations at a group level (ibid, p. 255).

According to Hogg & Abrams (1988), social identity is comprised of two components, self-categorization and social comparison. Self-categorization occurs when an individual perceives themselves to have an accumulation of characteristics that are shared with the wider category. For example, these characteristics may include values, beliefs, manners of speech or behavioural norms. Social comparison occurs when a group compares itself with the structures and groups that already exist in society. This mainly results in the attainment of benefits such as self-esteem. Hogg & Abrams (1988) noted that self-esteem can be gained when assessing the inner and outer dimensions of a group against a criterion. This occurs when the inner group achieves a positive representation that is greater than that of the outer group.

The concept of identity is similar to social identity, in the respect that both involve individuals viewing themselves based on the meanings that are conveyed within a structured society (McCall & Simmons, 1978; Stryker, 1980). Nevertheless, the level of analysis differentiates the two concepts, as identity theory focuses on labelling an individual as belonging to a specific social category and does not focus on cognitive processes.

With reference to the study of Thompson & Walsham (2004) on the importance of the context of knowledge, Crane (2012) showed the importance of identity and that it is closely bound to the creation and sharing of knowledge. Chung & Koo (2012) considered identity within the context of social networking sites, producing a model and hypothesis that showed that common identity and bond have an influence upon KS. Similarly, Schutte & Barkhuizen (2015) recognised the role of social identity theory in managing knowledge within local government and the public sector. For these reasons, the identity and role of participants within community groups are possible influencers upon KS within this thesis.

2.7.4 Generational differences

Considering the role and identity of potential participants within a community setting, the generational background of these participants should be considered in relation to KS. Various studies allude to the influence of an individual's generation on the tendency to share knowledge (Cavalier, 1990; Lazazzara & Stefano, 2019; Sammarra et al., 2017). Stevens (2010) identified four relevant generations that could influence such KS (see Table 6).

Table 6: Generations identified by year born

Generation	Year born
Pre-baby boomers	1900-1945
Baby boomers	1946-1964
Generation X	1965-1979
Generation Y	1980-1999
Generation Z	2000+

Adapted from Stevens (2010)

In addition to the four generations originally described, a newer generation born between 2000-2021 has been discussed in the literature. Although definitions of these generations and the classification of birth years can differ, this newer generation is often referred to as "Generation Z" (Bencsik et al., 2018; Cilliers, 2017).

According to Reisenwitz & Iyer (2007), pre-baby boomers witnessed the rise of media with television and mass-marketing contributing greatly to this transition. This group has strong purchasing power, due to wealth accumulated over the generations. The participation of this generation in energy communities has the potential to contribute significantly to a community's wealth and knowledge. For example, pre-baby boomers may use personal funds to subsidise specific projects and can bring historical knowledge from other projects in which they have been involved. Kyles (2005) noted that this generation has a tendency to be particularly loyal and conforming, and this has had an impact on their preferred management style, a top-down approach. In comparison, baby boomers have been described as the "forgotten generation" (Reisenwitz & Iyer, 2007) , one that suffered from post-war stress (Stevens, 2010). Despite this, baby boomers are known to prioritise relationship building and often focus on working and being rewarded for levels of commitment and devotion (Gardner & Cennamo, 2008). Within energy communities, this generation is able to contribute towards an open and friendly culture, which may helpful in supporting groups to acquire other knowledgeable members.

Generation X are regarded as an independent generation, reflecting the social and technological changes that occurred during the 1970s. These changes resulted in issues such as social and job insecurity (Gardner & Cennamo, 2008). These characteristics means that the involvement of this generation within energy communities may influence the nature and level of participation within groups. For example,

those with social insecurity may prioritise their personal life over the priorities of the group. Finally, generation Y or millennials experienced the growth of the internet and are extremely comfortable with technology. They are considered to pursue good work-life balance and may prioritise careers that contribute to bettering the world (Kyles, 2005). Researchers are still learning about generation Z, which seems to be a generation that has grown up using the latest technologies and may have much to offer to energy communities.

The consideration of generational differences for KS is particularly important in this thesis, as the needs and conditions for the sharer need to be met to facilitate the highest quality of KS. For example, Stevens (2010) synthesized Wagner's (2009) paper by highlighting the differences in ability when using technology to share knowledge, particularly between generation X and generation Y.

2.8 COMMUNITY LEVEL FACTORS

2.8.1 Trust

The concept of trust has been reviewed as a contributing factor towards the effectiveness of KS in various settings. Barney & Hansen (1994, p. 176) described the relevance of trust in the KS process by stating that "trust is the mutual confidence that no party to an exchange will exploit another's vulnerabilities". Based on this definition, Mcinerney & Mohr (2007, p. 70) consider trust as the "basic environmental factor for knowledge sharing". Mcinerney & Mohr (2007, p.71) further note that trusting someone takes time and in fast paced environments, it is often hard for workers to find the time to get to know their colleagues. In order to create and find this trust, Shaw (1997) suggests that organisational trust can be created by using creative ways to share and present information. In turn, this presents opportunities for the continued creation of knowledge and having an environment that tolerates and encourages risk taking.

Usoro et al. (2007) considered the role of trust within virtual CoPs, presenting a framework that highlighted integrity, competence, and benevolence-based trust as the three primary antecedents to KS in this space. In comparison to traditional CoPs, online virtual communities can support and develop trusting relationships without any direct social interaction, mainly because of the high levels of openness involved in using online communications (ibid). Nevertheless, Bartol & Srivastava (2002) identified trust as a key influencer upon the KS process, particularly within informal interactions.

Given that trust is considered a key influencer on KS in a range of contexts (Kuo, 2013; Swift & Hwang, 2013; Walker et al., 2010), it is necessary to consider its impact on such sharing within the context of communities. Although the literature that considers trust within organisations is substantial (Kuo, 2013; Swift & Hwang, 2013), the consideration of trust and its influence on knowledge sharing in a community setting is limited (Walker et al., 2010).

2.8.2 Reciprocity

The definition of reciprocity, a concept that is widely linked to KS, is heavily contested (Gouldner, 1960). Reciprocity is considered by Ben-Ari & Enosh (2013, p. 426) to be a "process whereby each research party believes that he or she contributes not necessarily to the other party, but to a matter of common interest, an issue of concern, a social phenomenon, or a personal matter".

Within the context of KS and communities, Yan & Jian (2017) suggest that knowledge provided by the people within the community would positively influence the contribution of any new individuals within the group, mainly because people tend to reciprocate the actions of others. Historically, literature from other areas also sees reciprocity as a positive driving force in KS (Chai et al., 2011; Cho et al., 2010; Jeon et al., 2011). Despite acknowledging that reciprocity can have a positive influence on KS, there is also a danger that the sharing of knowledge can result in the "bystander effect" (see Darley & Latane, 1968). This concept posits that the sharing and contribution of knowledge to a group may signal to newcomers that help and further contribution is not required. The concept of reciprocity within KS is reliant upon people being willing to share what they know, which is very similar to the concept of trust (Darley, 1998).

Given the espoused relationship between KS and reciprocity, there is potential for reciprocity to become a key influencer in the KS process within communities. Although this issue has been explored within the organisational setting (Jeon et al., 2011; Kim et al., 2006), it is significantly under researched within energy communities.

2.9 ORGANISATIONAL LEVEL FACTORS

2.9.1 Intellectual capital

Literature considers CoPs to exist at the meeting of both intellectual and social capital; where knowledge is shared and created through social networks (Daniel et al., 2002; E. Lesser & Prusak, 2000; Preece, 2004). Based upon this notion, it is important that both terms are considered in relation to this research. Intellectual capital is notoriously hard to define and identify due to its intangibility (Bontis, 1998) and as such, there is no unified definition (ibid). However, Stewart (1997) refers to the use of intellectual material to create wealth – specifically knowledge, information, intellectual property and experience. Indeed, based on this notion, Stewart (1997) recommended that intellectual capital should be considered as extremely difficult to measure. Dierickx and Cool (1989) identified intellectual capital as a knowledge stock within the organisation, with which Bontis (1998) agreed by highlighting organisational learning as its natural antecedent, where knowledge flows through the organisation and is both captured and valued. Bontis (1998) conceptualised intellectual capital by linking it to three connecting concepts: human capital, structural capital and customer capital.

Figure 19: Conceptualization of intellectual capital

Source: Bontis (1998, p.66)

Figure 19 introduces human, structural and customer capital as three concepts that all contribute to the existence of intellectual capital. As the table within the Figure suggests, human capital is primarily concerned with the human intellect of the member. According to Bontis (1998), this intellect can be measured by volume. The intellect of the member is the source of innovation, from brainstorming ideas at a community meeting to reviewing meeting processes (ibid). In comparison, structural capital considers the organisation's routines and how members use those routines to generate intellect. Specifically, Bontis (1998, p.66) states that the construct:

> deals with the mechanisms and structures of the organization that can help support employees in their quest for optimum intellectual performance and therefore overall business performance.

This idea suggests that the organisation's structure can encourage and present boundaries in which members can harness their intellectual potential. In essence, the structural concept is about providing access to information, where members can then codify this into knowledge (Bontis, 1998). Finally, customer capital encompasses knowledge about marketing channels and customer relationships. This concept is external to the organisation and is often hard to grasp, as the knowledge is both tacit and intagible (Bontis, 1998). Kohli and Jaworski (2012) expand on the manifestation of "market

orientation" within customer capital, as a way of sharing customer driven intelligence and knowledge throughout the organisation. In summary, intellectual capital's intangibility and the difficulty in measuring it is highlighted by the codification Section in Figure 19, where structural capital is considered the easiest of the three concepts to codify.

Although intellectual capital is primarily concerned with organisations, its relevance to KS means that it could be influential within a community setting. As such, there is potential to adapt the conceptualisation in Figure 19 to the community energy setting. Thus the structural pillar could be considered as a community pillar, with customer capital replaced with community capital. In doing so, the boundaries and structures within the community group could be measured, whilst community relationships and their contribution to the creation of intellectual capital could also be assessed. The intellectual capital considered in this thesis, is thus the knowledge shared around energy saving practices within a UK household. Furthermore, the components which underpin these pillars could also be examined.

2.9.2 **Social capital**

Social capital theory originated from the study of communities and the importance of neighbourhood survival and relationships (Jacobs, 1961). A vast literature exists, in which scholars have presented different definitions of social capital. These definitions differ when considering the actual or potential resources that can be accessed through relationships and networks. Baker (1990) indicated that social capital simply concerns the structure of relationships, whereas others extend this idea to consider the mobilization of resources (Bourdieu, 1986; Nahapiet & Ghoshal, 1998; Putnam, 1995). In this research, the extended description of social capital will be used, as this allows for the consideration of the resources that will be used to support knowledge sharing activity within CoPs.

Acknowledging the relevance of social capital in the community setting, therefore allows this research to consider (1) the resources that may be involved in facilitating KS and (2) the resultant resources that become outputs of the process. Indeed, this is one of the reasons that practitioners have focused on social capital as a key factor in impacting energy consumption behaviour. For example, McMichael (2007) indicated that social capital has been directly linked to both influencing household and micro-level consumption as well as macro-level environmental and climate change focused issues. Furthermore, McMichael (2007) recommends that the type of social capital used will vary in different communities, and that each type of social capital will require different resources. For example, the author uses the operation of energy efficiency programmes in well connected communities as an example, which would operate more effectively then fitting extra house insulation in areas that are not as well connected (ibid, p.1899).

The model presented in Figure 20, which highlights how social capital contributes to intellectual capital, shares a number of similarities with the overview of intellectual capital presented by Bontis (1998) in

Figure 19. This is particularly relevant to this research because it shows how energy communities may think about creating intellectual capital. The structural, cognitive and relational dimensions could exist within energy communities and may well need to be adapted to create effective intellectual capital.

Figure 20: Social capital in the creation of intellectual capital

Source: Nahapiet and Ghoshal (1998, p. 251)

In Figure 20, three pillars of social capital are highlighted; these are structural, cognitive and relational dimensions. The structural dimension of the framework relates to how the organisation is configured and the roles, responsibilities and hierarchy of the people. More importantly, this can directly affect the way in which knowledge is shared and the motives for engaging in that process. In a community context, those with energy expertise could either be directing and leading the CoP by engaging with members in person, or acting as advisers from a distance. In many cases, both of these instances could apply at the same time, as the roles in an energy community are often filled in complext ways. Both of these involvement scenarios would require different forms of communication and KS between members, such as team meetings or social media group chats. The cognitive dimension concerns the language used when people interact with each other and includes any stories or metaphors used to facilitate the sharing of knowledge.

Light, Berger and Luckmann (1967) indicated that language has the ability to influence a person's perception of reality, and this could directly impact knowledge sharing and consumption behaviour. The cognitive dimension is also linked to combination capability and the anticipation of value, where participants place a value on the knowledge being shared in the process. In the CE context, members may or may not decide to alter their energy consumption behaviour in the home based upon this knowledge. The relational dimension considers trust, norms, obligation and identification in a way that links with access to parties, anticipation of value, motivations to exchange knowledge intellectual capital and the combination capability. Indeed, Szulanski (1996) established that one of the main contributing factors or barriers towards the sharing of best practice is the relationship between the source and the recipient.

Trust, which epitomises the belief that another's actions will be viewed as acceptable in our point of view (Misztal, 1996), is a concept that Nahapiet and Ghoshal (1998, p. 255) emphasise as a "lubriactor" of co-operation and one that can potentially increase willingness to engage in social exchange (Putnam, 1993). Furthermore, Mishra (2012, p. 5) identified trust as:

> one party's willingness to be vulnerable to another party based on the belief that the latter party is 1) competent, 2) open, 3) concerned, and 4) reliable.

Based on these four characteristics, trust can be considered as multidimensional and as having the ability to provide clarity on complex problems (Luhmann, 1981). The social construction of KS could be considered to exhibit such complexity, due to the tacit nature of the knowledge that is often shared. Trust also highlights the importance of the relationship between the sender and receiver of knowledge and could be crucial in codifying tacit knowledge in the KS process. Finally, norms, obligations and identifications are also noted as key concepts in the creation of intellectual capital as they consider the expectations of those involved in the process and how they intend to influence the sender.

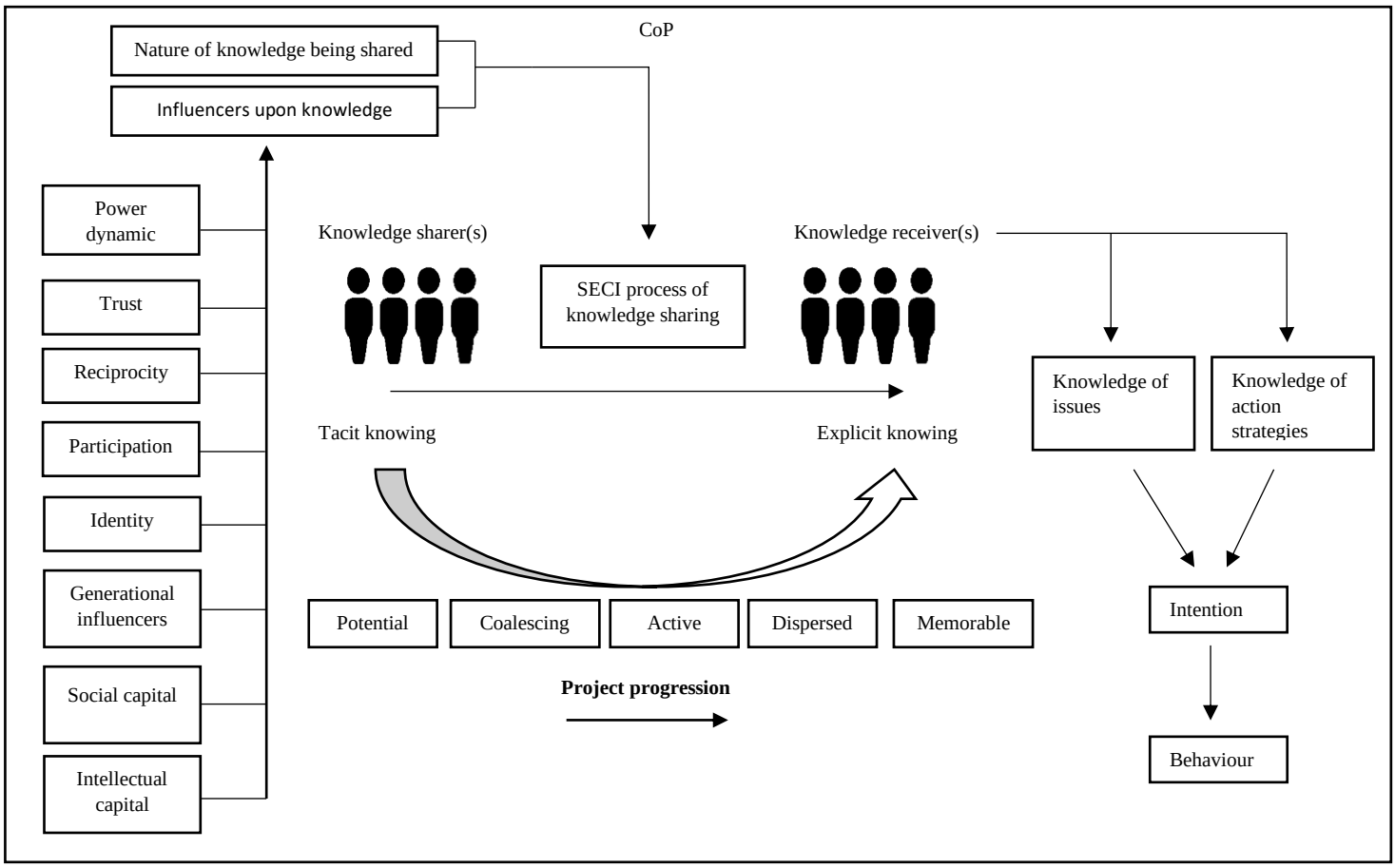
In summary, social capital considers the relationships and networks between members in a way that resources can be identified and measured. In other words, it supports the knowledge flow from human, structural and customer capital until it manifests as intellectual capital. The literature regards this as a "stock" of knowledge that is predominantly intangible and hard to measure, but one that ultimately is able to provide an organisation with potential competitive advantage. In the context of energy communities, this stock of knowledge could be used and shared to influence consumer behaviour within the household.

2.10 IDENTIFICATION OF A CONCEPTUAL FRAMEWORK

Referring to Sections 2.4, 2.5 and 2.6, it is possible to construct a conceptual framework that shows the relationship between the three key areas of literature. This framework will contribute to helping the researcher consider the key concepts when exploring the problem that is central to this research. The

literature on communities, knowledge and the influencing factors upon KS, are all considered in Figure 21 below:

Figure 21: Conceptual framework



This conceptual framework draws on the discussed theories and themes within the literature and provides a conceptual basis for further exploration of the KS topic. This framework will be used to explore:

1) The nature of knowledge being shared within energy communities.
2) The factors that influence the KS process within energy communities.
3) How knowledge is shared within energy communities.

These three areas will be explored to gain a deeper understanding of how energy communities use knowledge in their day-to-day operations to deliver outcomes. These insights will help to provide clues on what could work well when supporting the UK-wide effort to scale up energy communities and reduce carbon emissions. The conceptual framework shows the knowledge sharer within energy communities engaging in a process of sharing tacit knowledge. This knowledge sharing is likely to be

influenced by a variety of factors, all of which are discussed within the literature review in relation to the knowledge sharing process in different organisational settings. At this stage, it would be reasonable to assume that these factors may also be influential in the community setting. For example, Section 2.5.7 showed that different types of CoPs exist in different contexts. In addition, factors such as trust (Walker et al., 2010) and reciprocity (Chai et al., 2011; Cho et al., 2010; Jeon et al., 2011) have both been identified as factors that could influence KS in various contexts. Therefore, reflecting on the discussion in Sections 2.6 to 2.9, a list of factors with the potential to influence knowledge sharing is included within the conceptual framework.

The community power dynamic is incorporated into the conceptual framework to reflect Mitra's (2008) view that conflict within CoPs can prevent effective knowledge generation. This research should therefore explore how the power dynamic that exists within energy communities might influence knowledge sharing. Similarly, trust is included in the conceptual framework to recognise that knowledge sharing relies on a relationship between parties and that understanding needs to be developed between the knowledge sharer and the knowledge receiver. Trust is viewed as a "lubricant" for effective knwoledge sharing within organisations (Kuo, 2013; Swift & Hwang, 2013; Walker et al., 2010) and Walker et al., (2010) have indicated that this may also be the case within community settings. Mcinerney & Mohr (2007, p.71) suggest that it takes time for colleagues to develop a trusting relationship, which is also likely to be the case for energy communities. The conceptual framework places reciprocity next to trust, acknowledging that the two concepts may share a relationship within this context. The inclusion of trust and reciprocity in the framework, suggests that a group member must first be able to trust others within the group before displaying reciprocity. For example, in order for a community member to contribute to a matter of common interest, that member must first be able to trust the receiver of the knowledge. The receiver must also have the competence and intention to manage this knowledge appropriately. If not managed in the correct manner, the literature shows that the "bystander effect" may negatively influence the knowledge shared within communities (Darley & Latane, 1968). For this reason, it is necessary to understand the role of reciprocity in how knowledge is shared within energy communities.

The participation of energy community members within the knowledge sharing process is included within the conceptual framework. It has been shown that not all members within CoPs proactively engage in knowledge sharing (Lave & Wenger, 1991; Zboralski, 2009) and it is expected that the same situation will apply within energy communities. The rationale is that community members may not be willing to share knowledge without first feeling embedded and valued as part of the energy community. The participation of energy community members is particularly important, as citizen participation can play a crucial role in supporting the development of factors such as trust, between group members (Beierle, 2005). The reason for including identity within the conceptual framework is that community members each have specific interests and experiences that relate to their individual identities. As such,

they are likely to carry out roles within different projects that fit with these identities. These individual roles will then influence the social dynamic of the group in ways that influence the knowledge sharing that takes place.

The roles and responsibilities of members within energy communities are also likely to be linked to the age of members, as those at different life stages will have obtained different levels and types of knowledge. Stevens (2010) showed that this is important when considering issues such as technology adoption, with generations X and Y having greater experience of using different technologies as a routine part of their everyday lives. As such, the age and generation of energy community members should be considered, as these different capabilities and experiences are likely to influence the type of knowledge that is shared.

Social capital is also included within the conceptual framework, acknowledging the importance of the relationships between the energy community members. Social capital could be influential in the knowledge sharing process because the relationships within the group are likely to be influenced by different levels of trust and reciprocity. Social capital is often used to organise the resources within a group (Bourdieu, 1986; Nahapiet & Ghoshal, 1998; Putnam, 1995), which could be important when energy communities attempt to share knowledge via their preferred methods. For example, if the relationships between members within an energy community are longstanding and informal, group meetings and knowledge sharing activities may be relaxed and informal. Finally, the inclusion of intellectual capital acknowledges that knowledge can be considered a resource that flows through an energy community as it is shared. To ensure that this knowledge flow remains accessible for the community to draw on, it needs to be captured and stored as intellectual capital.

The SECI process of knowledge sharing explains the progression from tacit knowledge to conversion into a more explicit form of knowledge. The conceptual framework acknowledges that this knowledge sharing process is time bound and may occur in a series of stages. Acknowledging these stages (discussed in Section 2.5.6) within the conceptual framework allows insights to be generated into the types of knowledge that exist at each stage and how these may be able to support the activities of the energy communities.

The conceptual framework shows the nature of knowledge as central to understanding the knowledge sharing process. The complexities involved in understanding how knowledge is shared and how it develops through a series of stages from tacit to explicit are captured within it, as is the myriad of factors that influence the knowledge sharing process. This reveals the complex challenge facing the researcher in integrating both perspectives of knowledge and sharing them within the same framework. By bringing these perspectives together, the research will contribute towards understanding how best to make knowledge readily available and explicit within energy communities.

2.11 IDENTIFICATION OF THE RESEARCH GAP

The literature review has explained the theoretical foundations for the KS arena. Reviewing this existing research has shown that work needs to be done to advance current KS frameworks to make them specific to contexts beyond the commercial organisation (Islam et al., 2010; Jeon et al., 2011; Krogh, 2012), such as in community settings. As such, this study will aim to develop insights into the types of knowledge that are shared within energy communities and the factors that influence knowledge sharing within these communities. The development of new insights into each of these areas will contribute to the creation of a KS framework for energy communities who wish to review their knowledge sharing processes. Using this framework, energy communities will have the opportunity to enhance the effectiveness of their energy projects and thereby their impact on decarbonisation. The broader scalability agenda will also be addressed, with insights provided on how communities can increase their involvement with wider stakeholders. To this researcher's knowledge, only limited contributions exist within the area of KS and decarbonisation (Chao et al., 2017; Gluch et al., 2013; Haddad et al., 2015; Kasim & Drus, 2018; Southwell et al., 2014). CoP members' KS, attitudes and behaviours have previously been explored in one study focused on Korean companies, but this was not considered generalizable to other contexts (Jeon et al., 2011).

This study will explore KS within energy communities, using each community and its relevant knowledge networks as the unit of analysis. This will provide the basis for contributions framed from a KM perspective that may validate and extend the thinking of researchers such as Strengers (2012), who aims to solve problems by using distinctive approaches. McMeekin & Southerton (2012) also specified the importance of understanding the dynamics of social relations between social groups and practice-based approaches to understanding consumption behaviour. The KM and KS literature is relevant to this project's focus on knowledge sharing within energy communities, as it provides insights into some of the types of knowledge and knowledge influencing factors that may influence sharing processes within a community setting.

2.12 PROPOSED RESEARCH QUESTIONS

Considering the overarching research aim (see Section 1.3), the following three research questions are proposed to examine the role of knowledge and KS within energy communities:

RQ1: What is the nature of knowledge being shared within energy communities?

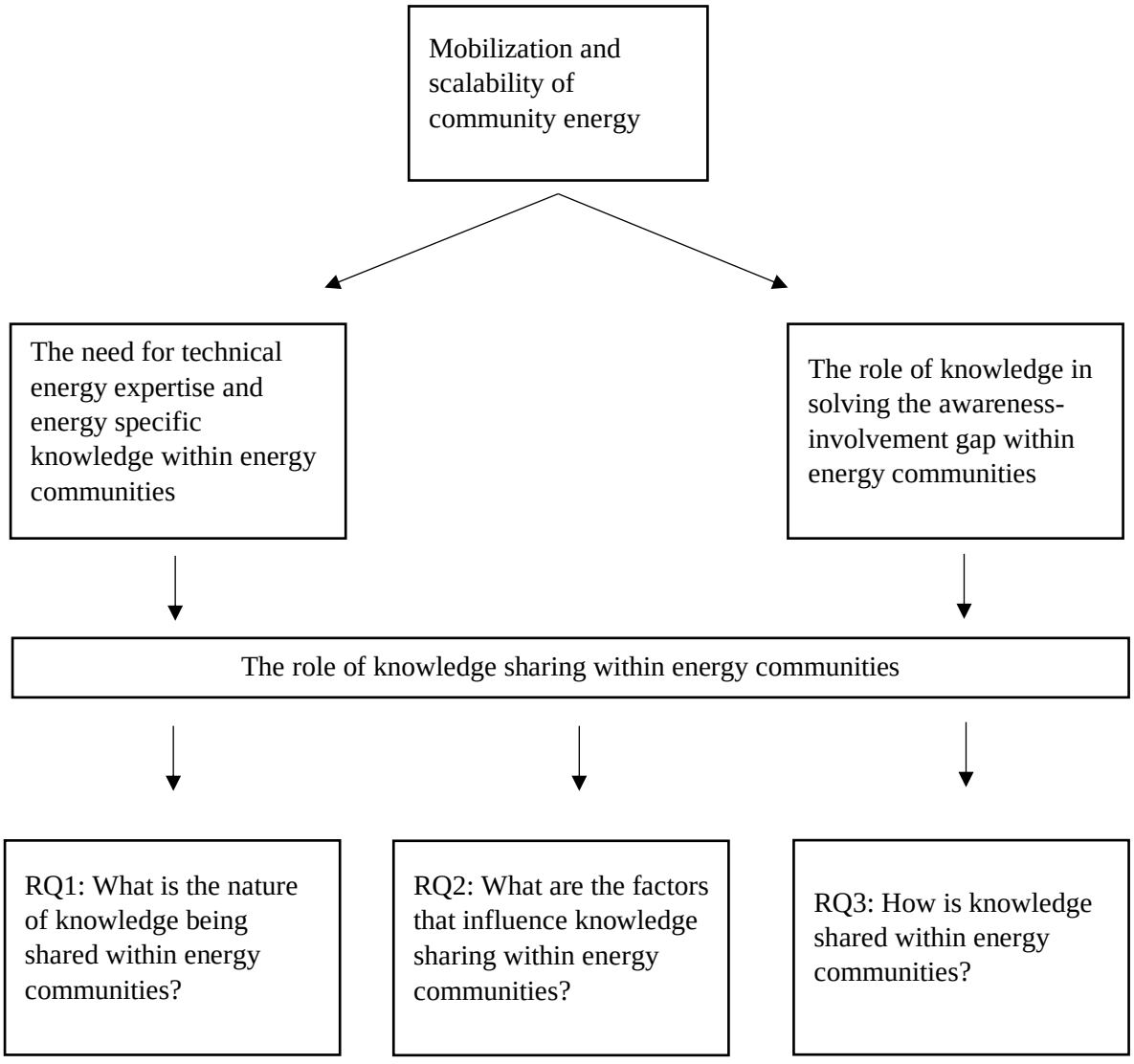
RQ2: What are the factors that influence KS within energy communities?

RQ3: How is knowledge shared within energy communities?

Understanding the nature of knowledge being shared will specifically highlight the different types and characteristics of knowledge needed. In addition, exploring the factors that influence the KS will reveal new insights into the challenges faced in sharing knowledge in this setting. In doing so, this research

will contribute to understanding how communities can exploit the benefits and reduce the drawbacks of these influences. Finally, exploring how knowledge is shared within energy communities will highlight methods of KS and enable the development of a model that shows the KS process within an energy community context. This model will allow comparisons to be drawn between the KS process in organisations and the process within energy communities. Figure 22 displays the alignment between the research aim, the research problems, and the research questions.

Figure 22: Alignment of research questions with the research aim



As shown in Figure 22, all three research questions are aligned with exploring the role of KS in providing technical energy expertise and solving the awareness-involvement gap within energy communities. Exploring these two research problems through the research questions will address the

overarching research aim that concerns the scaling and mobilization of energy communities. Table 7 shows how each research problem is aligned with the literature reviewed.

Table 7: Relevance of the literature to the identified research gaps

Real world problem	Area of literature	Research gap
Lack of technical knowledge within energy communities	Known/unknown matrix (Bolisani & Bratianu, 2018a), modes of knowing (Olaisen & Revang, 2018), types of knowledge (De Jong & Ferguson-Hessler, 1996), how do we know what we know? (Bratianu, 2019).	What is the nature of knowledge being shared within energy communities?
The role of knowledge in solving the awareness-involvement gap within energy communities	KS and creation models, the need for knowledge within specific contexts, types of CoP (Lesser and Everest, 2001), motives for engagement in CoP's, factors that influence KS.	What are the factors that influence KS within energy communities?
	Known/unknown matrix (Bolisani & Bratianu, 2018a), modes of knowing (Olaisen & Revang, 2018), types of knowledge (De Jong & Ferguson-Hessler, 1996), how do we know what we know? (Bratianu, 2019), KS and creation models, the need for knowledge within specific contexts, types of CoP (Lesser and Everest, 2001), motives for engagement in CoP's, factors that influence KS.	How is knowledge shared within energy communities?

2.13 SUMMARY

To conclude, this Chapter has provided a review of the literature in three key areas: the knowledge literature (Section 2.4), community literature (Section 2.5) and the various factors that influence knowledge sharing (Section 2.6).

Data, information and knowledge were identified as three key concepts within this research. Section 2.3 provided an overview of the differences between the concepts and their subsequent relationship. Following this discussion, the review of the knowledge literature examined the historical development of knowledge as a field of expertise. Considering this background, the nature of knowledge was then discussed (Section 2.4.2) and the types (Section 2.4.3), levels (Section 2.4.4), structure (Section 2.4.5) and modality (Sections 2.4.6 to 2.4.8) of knowledge were also reviewed. This discussion showed that knowledge should be considered as a complex concept that can exist in various types, structures, and

modes. Sections 2.4.9 and 2.4.10 reviewed how this knowledge can be managed and shared, which provided this research with frameworks for consideration within a community setting, such as Nonaka's (1991) SECI model of knowledge sharing and creation. Finally, Section 2.4 concluded with a review of how knowledge is shared within organisations (Sections 2.4.11 to 2.4.13), which allowed scenarios that are relevant to a community setting to be identified, such as the importance of stakeholder wants and needs. Ipe's (2003, p. 352) model of knowledge sharing between individuals in organisations also provided insights into the key themes that may influence knowledge sharing in a community.

Section 2.5 explored the literature focused on communities and how they operate. This Section began with a historical background of community theory, which showed the development of community studies research from the late 1800s. Analysis of individual communities in the mid 1900s transitioned into the analysis of society as a whole by the 1970s (Lyon & Driskell, 2011). Based on this initial discussion, the term "community" was defined and explored (Section 2.5.2) and knowledge sharing was introduced as a concept that exists within communities (Section 2.5.3). Following this discussion, the concept of CoPs was explored as a means to analyse the knowledge sharing processes that occur within communities (Section 2.5.4 to Section 2.5.8). Scarso, Bolisani and Salvador's (2009, p. 433) framework for the analysis of a CoP was presented as a tool that could be used within this research to identify the characteristics of a CoP within a community setting (Section 2.5.9). Finally, Section 2.4.10 acknowledged the existence of energy specific communities that are concerned with (1) an energy system that is more sustainable in its technological aspects and (2) an energy system that allows more participation and democratic control (Brummer, 2018).

The final area of literature presented in this review, described the various factors that could influence knowledge sharing in a community context (Section 2.6). These factors were considered to influence knowledge sharing in organisational settings. The review of CoPs in the prior section (Section 2.4) showed that knowledge sharing could be analysed using CoP frameworks. Zboralski's (2009) framework showed how interaction quality within CoPs is dependent upon member, community and organisational level factors. Member level factors (Section 2.7) were considered to include citizen participation, power, identity and social identity and generational differences. Community level factors (Section 2.8) were considered to concern trust and reciprocity, whilst Organisational level factors (Section 2.9) were identified as intellectual capital and social capital.

To conclude this chapter, Section 2.10 considered the relationship between all of the explored concepts in the review by presenting a conceptual framework. This framework was developed to aid the researcher in developing appropriate research questions and constructing an appropriate research methodology. Section 2.11 identified the research gaps within the explored literature, while Section 2.12 presented the proposed research questions.

3 METHODOLOGY: A COMMUNITY FOCUSED RESEARCH PROCESS

3.1 INTRODUCTION

The introduction and literature review chapters outlined the purpose, aims, objectives and boundaries of this research. The Net Zero Carbon agenda set out by the UK government and the role of CoPs have been discussed in the literature review. Given that the KS arena is mostly focused on people interaction and the extraction of tacit knowledge, primarily in organisations, this Chapter discusses suitable methods for obtaining data that are relevant to the outlined research questions. These research questions have been identified as:

RQ1: What is the nature of knowledge being shared within energy communities?

RQ2: What are the factors that influence KS within energy communities?

RQ3: How is knowledge shared within energy communities?

First, the paradigm used to approach this research is discussed so that the project's position and perspective can be located. The justification of the research strategy and the rationale for the type of sub strategy used comes next. The criteria for the case selection follows, so that the communities of choice can be identified clearly and linked to the research strategy. Method and procedural challenges are presented, considering participant selection and sample sizes. Following this, the analysis of the collected data is considered, and thematic analysis is presented as the chosen method of analysis. To conclude the Chapter, the challenges and limitations of the method are highlighted, and solutions are discussed in line with ethical considerations.

3.2 FRAMING OF THE RESEARCH PROCESS

When considering the design and method of this research study, it is important to understand that "research is a process, not just a product" (England, 1994, p. 82), which suggests that this study should contribute to the literature in a way that prompts further investigation. The following Sections outline the research lens and explain the researcher's position, reflecting that research presents a shared space that is shaped by both researchers and participants (England, 1994; Kezar, 2007).

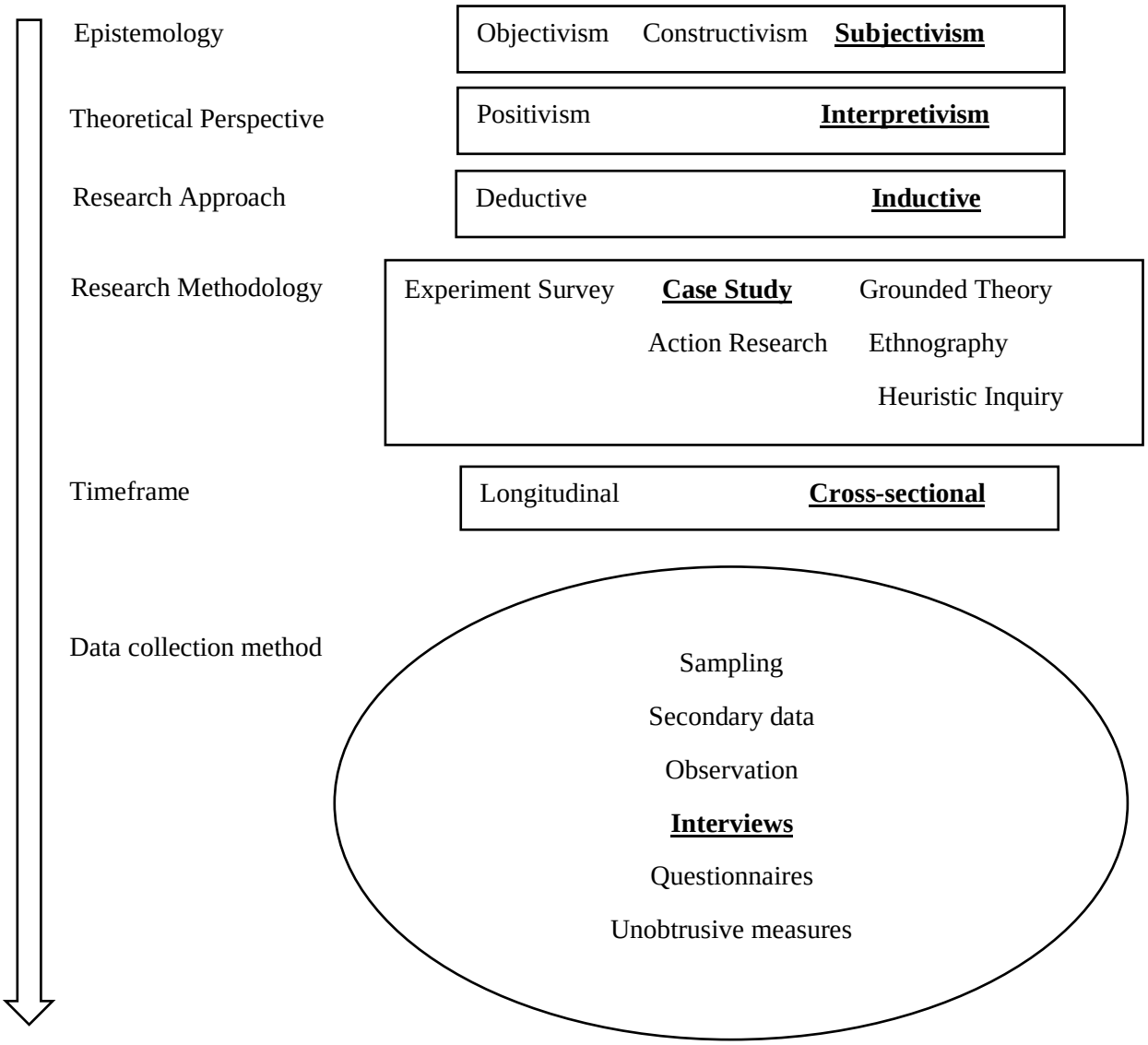
According to Crotty (1998), the research process should involve a process that includes epistomology, a theoretical perspective, methodology and method. Although other researchers provide alternative frameworks, these generally also include philosophy, research approach and research techniques (Saunders et al., 2015). Figure 23 displays "the research onion", which was developed by Saunders et al., (2007) to show six layers of decisions that should be considered when designing a research methodology.

Figure 23: The research onion

Source: Saunders et al., (2007, p.130)

The decisions shown consider philosophy, approaches, strategy, choices, time horizons and techniques. Although the research onion provides a useful overview of research decisions, Gray (2014) amended it to show a clearer set of decisions, which are useful when considering how the research should be framed.

Figure 24: Selected research decisions



Source: Adapted from Gray (2014)

The key words highlighted in Figure 24 outline the decisions needed at each stage of Gray's (2014) process. The following Sections of this Chapter will justify each decision in the context of this research.

3.3 RESEARCH PHILOSOPHY AND THEORETICAL PERSPECTIVE

According to Saunders et al. (2015), research philosophy and theoretical perspective should be considered by exploring ontology, epistemology and axiology, with two sets of extremes; subjectivity and objectivity (ibid). These philosophical views of the world will underpin the research and drive the methodology. From the philosophical view of the research, it is necessary to identify a theoretical perspective that aligns with the researcher's view of the world. Researchers in the social sciences

identify these perspectives as positivism, critical realism, interpretivism, postmodernism, scientific and pragmatism (Crotty, 1998; Easterby-Smith et al., 2015; Gray, 2014; Saunders et al., 2015). Kuhn (1962) discussed the concept of a paradigm, where three main paradigms would be highlighted; the scientific, interpretive and critical theory paradigms. Social science researchers then extended these paradigms to include positivism, postmodernism and pragmatism.

3.3.1 **Epistemology, ontology and axiology**

The term "philosophy", which also means "the love of wisdom" (Cavalier, 1990), originates from ancient Greece and involves the questioning and interpretation of how concepts really work (ibid). The differences between the three key philosophies in social science research have been examined by many authors (e.g. Easterby-Smith et al., 2015; Gray, 2014; Saunders et al., 2015). Morgan & Burrell (2019) suggested that espistemology concerns the assumptions made about knowledge and whether it is acceptable, as well as whether we can share it with others. Saunders et al. (2015, p. 127) referred to the nature of epistemology as "obvious" within the context of social sciences because there are many forms of knowledge, "ranging from numerical data to textual and visual data, from facts to interpretations, and including narratives, stories and even fictional accounts". Saunders et al. (2015, p. 127) also considers ontology as "rather abstract", due to its focus on considering assumptions about the nature of reality and how objects are studied. In practice however, he urges researchers to consider objects, such as businesses, organisations, events and individuals. In the context of this research, the community groups being studied can be considered to be the objects being studied.

Crozier, Denzin, & Lincoln (1994) provided a clear distinction between the three philosophical assumptions, considering ontology as "being", epistemology as "knowing" and axiology as "acting". Patton (2014) built on this views to describe ontology as the questioning of what we believe as reality, epistemology as questioning how we know what we do know, and axiology as the investigation into what we believe to be true. The idea of ontology as "being", Brewer, Newman, & Benz (1999) indicates the questioning of "what is" or "what is meant to be". According to Mittman (2001), the substantial differences between epistemology and ontology can be bridged by the nature of axiology. He views axiology as a philosophy that focuses upon rigour for action in research. In other words, a philosophy that views actions or "the way in which things are done" as fundamental in the way that the researcher views the world.

3.3.2 **Justification of Philosophical approach**

The philosophical approach chosen for this research is epistemology, which will involve examining the "knowing" of participants in different communities. The justification for this stance is based on the overarching aims and research questions. This research is concerned with understanding the nature of knowledge in community groups, how this knowledge is shared and why it is shared in this manner. These research questions align well with this particular epistemological approach, as this philosophy

essentially questions the relationship between the "knower" and the "would be knower" and questions the ways in which this relationship can be influenced and affected (Paul, 1991).

3.3.3 **Theoretical perspective**

A number of theoretical perspectives are available when framing a research project. These are the scientific paradigm, critical realism, pragmatism, postmodernism, positivism and interpretivism (Gray, 2014). The scientific paradigm is underpinned by positivism; a philosophy that only recognises a concept that has been scientifically or mathematically validated (Easterby-Smith et al., 2015). This paradigm is not appropriate for this study, as the aim is not to investigate direct relationships between constructs or prioritise statistical modelling over theorisation. In contrast to positivism, critical realism is concerned with "the real ontological distinctions between the various layers or 'strata' in the natural and social worlds" (Gorski, 2013, p.659). This perspective gives the researcher the ability to observe what is perceived to be unobservable in real world events. Although this lens could fit with this research's philosophical approach, its emphasis on socio-economic structures, theory and use for investigating challenging relationships means it is not the most suitable here (McAvoy & Butler, 2018). As previously implied, this study aims to answer "how" and "why" questions that do not solely involve challenging power structures. As the research is also exploratory in nature, its main focus is to explore the sharing aspect of energy knowledge between consumers within energy communities. The focus on sharing between consumers means that it is vital for the researcher to understand the culture of the sharing environment and how the sharing aspect may be socially constructed.

Pragmatism, which is concerned with practical and logical assessments of the world (Saunders et al., 2015) is considered next as a potential philosophy. Pragmatism is known for attempting to bridge the gap between qualitative and quantitative research and is often used in mixed methods studies. It has been criticised however, for not addressing the different assumptions that qualitative and quantitative research make (Biddle & Schafft, 2015; Hall, 2013). Pragmatism is not used in this research, due to the focus on exploring the "how" and "why" questions in KS, where reasoning may not always be practical and logical. In contrast, postmodernism theory suggests that language and power relations are key to understanding the world and that all sense of order is temporary and "foundationless" (Saunders et al., 2015, p.141). Although this research may acknowledge language and power relations, it is not limited to these constructs. The exploratory nature of the research, which will consider how community groups operate, interact and how knowledge is socially constructed, may uncover other themes that signfiicantly contribute to the KS process. Postmodernism is therefore too focused to be applied to this research.

The two theoretical perspectives that align with this research's epistemology are interpretivism and positivism, as was shown in Figure 24. Whereas positivism involves testing theory using a scientific method, interpretivism, takes a subjective rather than an objective view to understand a particular context that is socially constructed (Willis, 2007). Saunders et al. (2015) provides a useful tool for

understanding the positioning of the key theoretical perspectives in relation to the key philosophies, as shown in Table 8 below.

Table 8: The relationships between philosophy and theoretical approach

Source: Saunders et al. (2015, p. 136-137)

As the table suggests, within the epistemological philosophy, interpretivism would be well suited to this research, as it focuses on narratives, stories and perceptions, typically using smaller samples of participants and relying on qualitative data.

3.3.4 **Justification of theoretical perspective**

It is important that the selected theoretical perspective aligns with the research philosophy. After considering a range of theoretical perspectives, this research will adopt an interpretive theoretical approach. The epistemology relating to this theoretical approach concerns the beliefs, feelings and values of an individual (Scotland, 2012). These issues will be critical to this research because of the KS lens, which will investigate how individuals interact as part of a group and why they interact and share knowledge in particular ways. An interpretive approach has for these reasons previously been used in community research (Andrade, 2009) and has also been used to understand the KS processes from a holistic perspective (Vorakulpipat & Rezgui, 2008).

3.4 QUALITATIVE METHODS VS QUANTITATIVE METHODS

When carrying out social research, multiple methods can be used to frame the investigation (Saunders et al., 2015). The two predominant methods in social science research are qualitative and quantitative methods. This study will employ qualitative methods as the aims are to explore culture and social behaviours (Saunders et al., 2015; Yin, 2014). The nature of knowledge residing within communities and the manner in which it is shared will be examined. It is therefore critical that participant behaviours and experiences are understood in order to achieve significant answers to the "how" and "why" questions.

In contrast, quantitative methods were developed by natural science researchers to investigate natural events (Myers, 1997) and to provide quantified and statistical data to make broader inferences about a specific topic or context (Cornford & Smithson, 2006; Polanyi, 1966; Saunders et al., 2015). Although a quantitative approach is not favoured in this research, it is important to acknowledge the strengths of the approach and to reflect on the fact that many social science authors consider quantitative research to be "the dominant paradigm" (Steckler et al., 1992). The strengths of this approach are considered to include its tendency to view the world as an objective reality outside of humans themselves, to test clear hypothesis, and to provide total clarity on the results found (Almalki, 2016; Steckler et al., 1992). This clarity is usually provided in the form of numerical data (ibid).

Rather than testing hypotheses, this study will develop context specific insights and will make conceptual contributions to the KS and energy sector literature. A qualitative approach provides a suitable platform for exploring such phenomena (Gupta & Polonsky, 2014), aligning well with the exploratory nature of the research, which aims to achieve a better understnading of the KS process. Whilst acknowleding acknowledged the historical and traditional reliance on quantitative methods within psychological and community focused research, Banyard and Miller (1998) discussed the potential of qualitative methods for understanding the "why" of human behaviour.

Two views of the meaning of the term "qualitative" have been proposed. The first view of such research is "strictly methodological" and as a set of tools for investigating a research question, such as focus

groups, case studies, interviews and a variety of other methods (Banyard & Miller, 1998, p.487). The second view considers qualitative research more as a philosophically underpinned approach. For example, social constructivism is recognised as an influence upon the research process (ibid, p.487), where the researcher's position, influence, experience and thoughts all influence the subsequent findings. The latter Sections of this Chapter acknowledge the researcher's role in the research and identify case studies as the chosen tool for investigating the research question.

3.4.1 **Benefits and drawbacks of qualitative research**

The benefits of a qualitative research strategy in social science research have been widely reported (e.g. Easterby-Smith et al., 2015; Saunders et al., 2015; Yin, 2014), with some authors highlighting the richness and depth of insights achieved (Queiros et al., 2017; Steckler et al., 1992). This richness and depth allows the researcher to understand the context of the research and any contextual influences on the gathered views (Steckler et al., 1992). Atieno (2009) presented one of the main strengths of the qualitative approach as its ability to show manageable data that is understandable but does not destroy either the complexity or context. Importantly, the strength of a qualitative approach also lies in its ways of seeing and comprehending existing data (ibid, p. 16). This is crucial in this research, as community groups are often multi-faceted and encompass different group members with different world views. Therefore, it is important to highlight and present these different viewpoints, as all will have important contirbutions to make. However, these issues further reinforce the value of a qualitative approach, since using a quantitative method in such a complex community context might overlook key insights from these different viewpoints.

Although a qualitative approach is appropriate in this instance, it has challenges and drawbacks. Qualitative approaches have been criticised for providing a lens that is limited to smaller sample sizes (Cornford & Smithson, 2006), with researchers sometimes struggling to obtain large samples or to achieve the necessary access to organisations (ibid). The qualitative approach also often provides an extensive amount of complex data at the analysis stage, requiring researcher knowledge and experience deal appropriately with it (Easterby-Smith et al., 2015). As a result, the impact of managing such data can significantly impact the researcher's time and resources (Atieno, 2009), which has to be taken into consideration when limited time is available to complete the research. A further disadvantage is that qualitative findings cannot be generalized as easily as quantitative findings can (Atieno, 2009; Carminati, 2018). Whilst quantitative findings can be statistically tested to see if they are significant, such testing cannot applied to qualitative and context rich data. Many quantitative studies obtain larger sample sizes and have the ability to obtain a representative sample. This may be harder to achieve in qualitative studies as interviews, focus groups and observations, given the time consuming nature of this data gathering (Saunders et al., 2015). However, where findings can be related to prior and existing theory, they will have a greater and broader theoretical significance than the original basis of the resarch

(Marshall & Rossman, 1999). It is therefore important that this research clearly identifies the boundaries in which the findings will be placed.

3.4.2 Justification for the use of a Qualitative research approach

The suitability of using qualitative approaches in community and psychological research has been discussed in the literature. Banyard & Miller (1998, p. 489) presented three justifications for the need to increase the use of qualitative methods in community and psychological research. These are that qualitative methods: 1) support the core values in the field of community psychology; 2) can lay the foundation for the development of quantitative studies; and that 3) qualitative tools are powerful when trying to understand the "why" of human behaviour. These three arguments support the use of qualitative methods in this research, where the unit of analysis is the CoP and the research questions involve the understanding of the "how" and "why" in human behaviour. Furthermore, as Banyard & Miller (1998, p. 487) explained, community psychology is concerned with studying the world from a:

> novel perspective, namely, an ecological perspective that views all behavior in relation to the particular geographic, sociocultural, and historical settings in which it occurs.

This perspective on the world aligns with this research, as the communities studied will differ depending on geographical location, sociocultural structure and the history of how each community is structured. Table 9 justifies the use of qualitative methods in this research in relation to the three justifications provided by Banyar and Miller (1998).

Table 9: Justification of qualitative methods and alignment with Banyard & Miller's (1998) three justifications

Banyard & Miller (1998) justification for qualitative method use	**Thesis justification for qualitative method use**
Supports the key values in the field of community and psychology	Supports the key values of communities
Lays foundation for culturally anchored quantitative methods in new contexts	Helps to identify the key themes that are context specific within communities
Powerful when trying to understand the "how" and "why"	Powerful in understanding the "whether", "how" and "why" in communities

Banyard & Miller's (1998) observation about the core values in community psychology highlights that themes such as diversity, community experience, historical experience, the interactions between people and the setting in which they live, can only be understood and emphasized via qualitative enquiry. Furthermore, the use of qualitative methods in distinct communities such as energy communities are rare. If qualitative inroads can be made when exploring energy communities, there may be potential for theories to be tested quantitatively, as quantitative research in the energy community literature is also

rare. This research aims to understand the "how" and "why" questions in human behaviour and a qualitative method will assist the researcher in extracting these answers in the CE context.

3.5 RESEARCH APPROACH - DEDUCTIVE AND INDUCTIVE

Within the field of qualitative research, deductive and inductive approaches are the two prominent approaches (Saunders et al., 2015). Generally, deductive approaches use theory that already exists within the body of literature to structure the approach to collecting and analysing either qualitative or quantitative data (ibid, p. 489). In comparison, inductive approaches aim to establish theory that is grounded in the collected data (Yin, 2014).

Deductive approaches to collection and evaluation have typically been matched with quantitative methods, as research that is structured on prior theory is often generalizable and aligns well with numerical data (Steckler et al., 1992). Table 10 below highlights some of the differences between qualitative inductive and quantitative inductive evaluation methods.

Table 10: A Typology of Attributes of Quantitative and Qualitative Evaluation Methods

Quantitative Deductive	**Qualitative Inductive**
Verification and outcome oriented	Discovery and process oriented
Measurment tends to be objective	Measurement tends to be subjective
Reliable (technology as an intrument, the evaluator is removed from the data)	Valid (however, the evaluator is close to the data)
Often generalizable	Often ungeneralizable (the insider's perspective, often case oriented)

Source: Adapted from Steckler, Mcleroy, Goodman, Bird, & Mccormick (1992, p.3)

As shown in Table 10, the deductive approach tends to be objective when related to quantitative data. Objectivity is concerned with seeing what we believe to be true (Kramer, 2007). In comparison, inductive qualitative data tends to be subjective, recognising that the researcher establishes their own perceptions of the research process and data collected (ibid). Steckler et al. (1992) note that qualitative and inductive methods are discovery and process oriented, which aligns with Saunders et al. (2015) notion that inductive research involves theorisation from collected data.

3.5.1 Justification of Inductive approach

Considering both deductive and inductive approaches to research, an inductive approach is most appropriate for this research for the following reasons:

1) The research is exploratory in nature and will require a discovery and process driven approach.
2) The measurement of the collected data will be subjective as the researcher will be involved in gathering data from various community groups.
3) Theoretical contributions will be generated from the collected data, as existing theory in the space of CE and KS is scarce.
4) The data collected will be rich, context specific and qualitative, limiting its generalisability to an energy specific context.

Due to the research questions, data that explores the "how" and "why" in KS will need to be collected. These answers are likely to provide both overlaps and differences between the different case studies. The use of an inductive approach will assist the researcher in extracting content rich and experience-based data, where questions are not totally bound to existing theory. Although inductive, in practice, this research will also encompass elements of a deductive approach. Saunders et al. (2015, p. 490) specified that researchers will often "seek to identify a theoretical position and then test its applicability through subsequent data collection and analysis". The theoretical position for this research, which highlights the relationship between several key themes, was identified in the literature review. Although these themes will guide the method of research, the exploratory and inductive nature of the research will allow theory to be constructed from the data rather than from the literature.

3.6 QUALITATIVE RESEARCH METHODS

Within the social sciences, "qualitative methods" are used as an umbrella term to describe a variety of popular methods (Mohajan, 2018, p.7). These usually include narrative, phenomenology, grounded theory, action research, case study research, ethnography, historical research, and content analysis (ibid, p.7; Creswell, 2007). The consideration of the following methods could be used in combination by the researcher, but this research opted to use one qualitative approach.

The narrative method focuses on the analysis of narrative texts about relationships between humans in a range of different social and cultural contexts (Hoshmand, 2005). Rather than unpacking themes from a data set, the narrative method seeks to identify a story of unfolding events from beginning to end to help the researcher understand the individual (Mohajan, 2018). This method will not be employed in this research as the "storyline" aspect of the data is not the focus. Although the stories behind KS may offer a direction for future research, it would be too time consuming here, a drawback that Bruce, Beuthin, Sheilds, Molzahn, & Schick-Makaroff (2016) identify as a key barrier to its use. Similarly, phenomenological research is concerned with understanding the individual and specifically their life and experience (Saunders et al., 2015). The phenomenological researcher investigates subjective phenomena (Creswell, 2007) and attempts to display research findings through the eyes of their participants. This approach is particularly useful when conducting research in an area in which there is little prior knowledge (Mohajan, 2018). Although the subjective approach that underpins

phenomenology could apply to KS research, investigating the experiences of participants is not the primary motivation, which means this method is not suitable here.

Grounded theory has remained a popular method in qualitative research, particularly because of its sociological history and its focus on building theory from analysed data (Yeh & Inman, 2007). This approach aims to answer the "what" and "how" questions in a structured manner (Christiansen & Chandan, 2017), but poses questions, as the theory itself leads to misunderstanding (Walsh et al., 2015). This misunderstanding has been shown by qualitative studies that start with an open-ended question and merely employ interviews (Noble & Mitchell, 2016), whereas Glaser & Strauss (2017) state that grounded theory actually involves the analysis of patterns in the data and the identification of key concepts. Although this research seeks to investigate "what" and "how" questions relating to KS in communities, a grounded theory method might not answer the crucial "why" questions in as much detail as other methods.

Within the community context, action research is often used where the community is considered as the unit of analysis. This approach would align well with this research as it will also use community groups as the unit of analysis. Action research is considered to be a social process where the researcher works with the group or organisation to change a situation (Lewin, 1946). He is often referred to as the pioneer of action research and is recognised for a model that identifies the need to plan, act, analyse and reflect when conducting this kind of research (Tripp, 1990). Similarly, Cunningham (1993) described the action research process as involving research, planning, theorising, learning and development. Although an action research approach could be used in this research to reflect upon interaction with different community groups, it may not be well suited to meeting the research objectives because the direct influence of the researcher upon participants could influence the KS process. Such interaction could potentially influence the findings from the "how" and "why" research questions. In addition, the time consuming nature of action research, which involves the need for continuous reflection, could be problematic (Saunders et al., 2015; Tripp, 1990).

The theme of being particularly "close" to the participant during data collection is prevalent within the ethnographic research strategy. Ethnographic research is concerned with the prolonged observation of the participant's everyday life, where researchers often immerse themselves in the world of the participant (Easterby-Smith et al., 2015). This process is otherwise known as viewing the world through the eyes of the participant. Denzin & Lincoln (2011) state that the ethnographic approach involves the investigation of beliefs, social interactions and behaviours over a period of time. The depth of insight into the actions of participants is considered one of the greatest benefits of ethnographic research, as an in-depth questioning of assumptions that may be taken for granted is possible (Myers, 1999). However, ethnographic research also suffers from a lack of breadth and is extremely time consuming to conduct (ibid). Those who choose to employ an ethnographic approach often only study one organization,

culture or phenomenon because of these time constraints (Myers, 1999). Within this research, the use of an ethnographic approach is not the best fit with the overarching research aim and would be challenging to complete in the time available.

Historical research is often employed as a research method that allows a researcher to analyse a series of facts that are focused upon a chosen topic. Jones (1998) referred to a number of steps that should be followed when looking to employ such a method. These were identified as choosing a topic, gathering data, analysing and interpreting the data, and writing up the results. The predominant benefit of using a historical method with qualitative data is that it allows the researcher to formulate hypotheses, develop theories and identify emerging themes (Belk et al., 1988). Argyres et al. (2020) stated that a history-informed approach could allow for a rich insight into decision making in a specific context. Such an analytical and rich approach could be useful within the CE setting, as it may allow the researcher to explore the decision making of previous and existing CE groups. However, one of the disadvantages of the historical research method is that it relies upon a large historical data set (Argyres et al., 2020). Energy communities have only become prevalent within the past decade due to government incentives and a UK wide focus on alternative renewable energy sources, such as solar PV. For this reason, a historical research method would not be useful in this research, as the data available for exploring KS activity may be particularly limited within the UK.

Finally, content analysis could be considered as appropriate for use within this research. Hsieh & Shannon (2005) identified three distinctive types of content analysis: conventional; directed; and summative. The use of a directed method considers existing theory and uses this to formulate research questions for the study (ibid). In comparison, a summative content analysis uses keywords to form the research and analyse the collected data (Hsieh & Shannon, 2005). Neither of these approaches are applicable to this research, as the researcher is looking to explore the knowledge shared within energy communities and allow the data to guide the analysis. A conventional content analysis uses codes derived from the data in combination with the researcher's observations (Hsieh & Shannon, 2005). Despite these benefits, this research method will not be used in this research due to the exploratory nature of enquiry that the researcher wishes to employ. The researcher's preferred approach is to allow the data to speak for itself and for the themes to emerge, as will be discussed in Section 3.9.

In summary, although some of the discussed qualitative research methods may be suitable for this research, the researcher has decided not to apply these. This research seeks to explore the nature of KS between participants and will compare and contrast the themes that emerge from the data. Research strategies need to be developed that align with the dynamics of a particular situation or context (Eisenhardt & Graebner, 2007). They can be employed in many forms and include experiments, surveys, action research, grounded theory, ethnography and archival research (Saunders et al., 2015). The choice of a strategy depends on the nature of the research and the questions that structure the

research (Yin, 2014). In line with the proposed epistemological view, this study chooses to employ a case study method and strategy. The following Sections will outline the advantages and disadvantages of using case studies, the case selection of communities and the rationale for the type of case study used.

3.7 CASE STUDY RESEARCH

The following Section will discuss how the use of case study method in this research. Section 3.7.1 will discuss the definitions of the case study method. Section 3.7.2 will then then consider different case study strategies, whilst Section 3.7.3 will discuss different types of case studies. Finally, Section 3.7.4 will present the type of case study that will be used in this research and justify why the method chosen is suitable.

3.7.1 Definitions of the case study method

The definition of case study research has been disputed by varying authors. Although perhaps one of the most widely cited definitions is provided by Yin (2003), who sees a case study as comprising the following parts. The first is an empirical enquiry that investigates a contemporary phenomenon within its real-life context. The second is the reliance upon multiple sources of evidence. The third, is that the study usually benefits from prior theoretical development to guide data collection and analysis. Myers (2013) critiqued Yin's (2003) view that case studies usually involve studying business issues within organizations, suggesting that case study research can also apply to communities and educational programmes.

Yin (2003) recommended the prior development of hypothesis and to ensure the validity and reliability of the cases; conditions that are not used in interpretive research. Easterby-Smith, Thorpe, & Jackson (2012) concur, arguing that whilst helping, Yin's (2003) definition of case study research favours a positivist philosophical approach, and argue that it should be expanded beyond this emphasis on positivism and validity. Considering the interpretivist nature of the primary data collection in this research, the preferred definition of a case study is presented by Hammersley (1989, p. 93), who refers to the term "case study" as:

> The collection of detailed, relatively unstructured information from a range of sources about a particular individual, group or institution, usually including the accounts of subjects themselves.

This definition is appropriate because it acknowledges the variety of participants that can be involved in a community and recognises that the collected data could be both detailed and unstructured.

3.7.2 Case study strategies

Case study approaches have been previously used in KS research (Dyer & Nobeoka, 2000; Ford & Chan, 2003; Hew & Hara, 2007), as this approach has the ability to answer "why" questions (Yin, 2014). Furthermore, as Yin (2014) explains, case study approaches are often used to explore topical

issues, where a phenomonen needs to be considered in its real world environment (ibid). The use of a case study approach therefore allows the researcher to explore the unfamiliar concept of KS within the energy setting in the community.

Case study research provides an in-depth examination of predefined phenomena, variables that are not explicitly controlled within the presented context (Cavaye & Cragg, 1995). The strategy is appropriate for this research because the researcher is attempting to understand the context of the energy sector and the variables that influence KS within communities. However, it is worth noting that case study approaches have been described as difficult to use when trying to generalize research results (Darke et al., 1998). This is because of the subjectivity that is introduced, as the researcher's view of the world will "always intervene to shape their investigations" (Orlikowski & Baroudi, 1991). Consequently, it can be difficult to extend the applicabilty of the results to another case or context.

In addition, the case study approach has been criticised for being a preliminary approach to research. Although research methods are still contested, some social scientists believe that a traditional hierarchical approach to research should be employed (Yin, 2014). This involves using surveys for the descriptive research phase, whilst using experiments for the explanatory phase (ibid, p.6). Yin (2014) however disagreed and stated that some of the most successful case studies have included all three stages; exploratory, descriptive and explanatory. Easterby-Smith et al. (2012, p. 57) provided a useful epistemological summary of case study research features (see Table 11). This table is useful because it shows how researcher have different episemological positions when approaching case study research.

Table 11: Features of case study methods

Source: Easterby-Smith et al. (2012, p.57)

Referring to the table, The selection of a constructionist case study approach is most appropriate for this research for various reasons. Firstly, the design of the case study will be emergent. This research is exploratory in nature, with few prior studies examining KS in energy focused community groups. Three different communities will be explored and used as case studies within this research. After the data are collected, both cross case and within case analysis will be used to elaborate on the theories highlighted in the conceptual framework. Cross case analysis will be used to compare and contrast the findings

from the different community groups, whereas within case analysis will be used to identify and explore case specific findings.

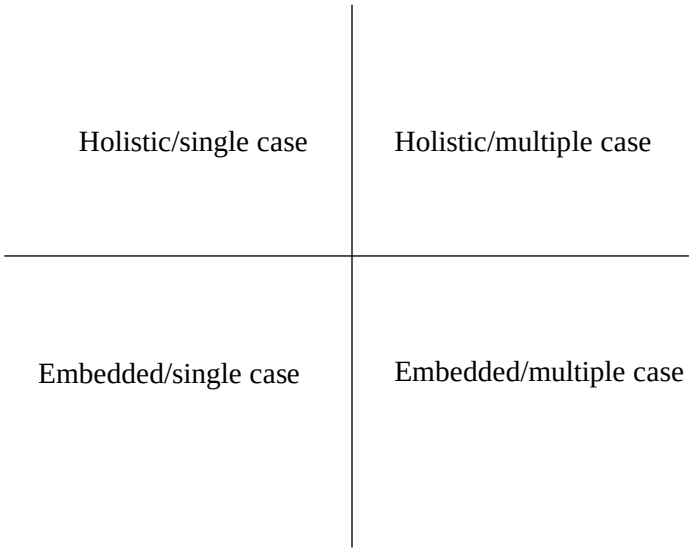
3.7.3 **Types of case studies**

When choosing the type of case study appropriate for research, Saunders et al. (2015, p.186) state that the choice should be made based on two considerations; single versus multiple cases and holistic versus embedded cases. These choices relate to the number of cases used and the depth of the phenomenon being explored. In addition, the researcher has to decide whether the case study approach will be exploratory, explanatory or descriptive (Yin, 2014).

Exploratory research seeks to investigate a phenomenon within the data to open further avenues of enquiry (Stebbins, 2011). Prior work within the chosen field may be conducted as a pilot study to guide the research questions and to inform further stages of data collection (McDonough & McDonough, 2014; Yin, 2014). In comparison, an explanatory approach is used to consider the data at both the surface and deeper levels of enquiry (Yin, 1981b). This approach is often used in causal cases to pattern match data and investigate very specific phenomena (Yin, 1981a). Finally, a descriptive case study provides a narrative and describes the natural phenomena of interest from the explored data (McDonough & McDonough, 2014).

After the selection of an appropriate case study approach, the type of case study must be selected to align with the research questions. Single cases are often used where the case being examined is unique and critical to the research question (Saunders et al., 2015). For example, this strategy could be employed where the context of the research is particularly niche, and the research adds distinct knowledge to the field of literature. In comparison, multiple cases are often employed where similar findings are expected to be produced from each one, but the researcher sees value in comparing and contrasting the different cases (Saunders et al., 2015). Yin (2014) refers to this process as “literal replication”, as opposed to “theoretical replication”, where case results are anticipated to be different but align with the reviewed literature. Figure 25 below highlights these different types of case study.

Figure 25: Types of case studies



Source: Adapted from Yin (2014)

As shown in Figure 25, alongside the choice of a single or multiple case study is the option of an embedded or holistic case study. The holistic case study approach views the case as the unit of analysis, as it provides a view that looks over the phenomenon being studied. In comparison, the embedded approach allows the researcher to attain a level of depth in analysis by examining a more limited number of aspects (Easterby-Smith et al., 2015).

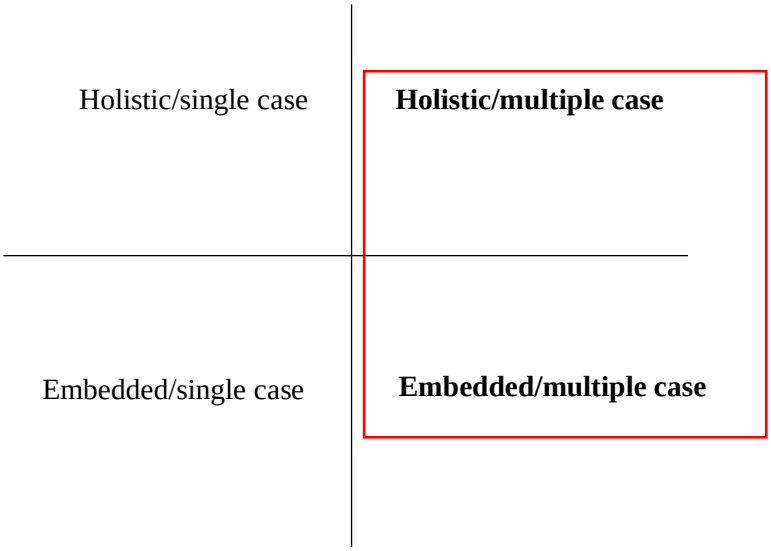
3.7.4 **Justification of case study approach**

The following decisions were made in relation to the case study approach to be used. An exploratory approach was taken, beginning with a pilot phase to help refine and sharpen the research questions. Within the KS and community literature, a limited amount of published research focuses on the energy sector. The completion of key informant interviews to better understand the research area and refine the questions helped to open the relevant lines of enquiry. Following these interviews, multiple cases were identified and accessed by the researcher (Yin, 2014). This approach helped to improve the validity of the research and supported the researcher in seeking "literal replication" (Yin, 2014). Due to the exploratory nature of the cases, the researcher needed to ensure that the findings from the data collection were valid and not limited to one specific case.

After considering the various case study options for this research, the following selection strategies were employed for choosing the case studies:

1. Holistic/multiple case.
2. Embedded/multiple case.

Figure 26: Selection of case studies



Source: Adapted from Yin (2014)

In this research, both a holistic and embedded approach will be used to explore knowledge sharing within energy communities. Figure 26 shows that an embedded approach to exploring phenomena complements the choice of multiple cases, as the researcher can identify specific measurement aspects for each. In this research, the aspects being measured are derived from the research questions relating to community, KS and energy. An embedded approach gives the researcher the opportunity to examine the KS activity of each participant in detail. In comparison, the use of a holistic view of each case would provide an overall view of KS activity for each case, from the perspective of the group. These two views provide the researcher with the opportunity to compare the findings both within and between each case.

3.8 CHOICE OF DATA COLLECTION TECHNIQUE

According to Saunders et al. (2015), it is vital that the choice of data collection technique aligns with the research questions and the nature and type of qualitative research approach being employed. The most prominent techniques applicable to case study research are interviews, observations and focus groups. These three techniques are all relevant as this research is exploring the community context via the lens of KS and how participant thoughts and perceptions are socially constructed and shared.

Observations are predominantly used in case study research, due to the need for the researcher to spend considerable amounts of time in the field gathering the data and studying the phenomenon within the social and cultural context (Iacono et al., 2009). This focus on observations enables a rich and deep understanding of the context and the thoughts and beliefs of the participants to be achieved (Saunders

et al., 2015). Although these observations capture rich detail, they have also been criticised for lacking objectivity, as the researcher is a participant and cannot behave as an independent observer (Iacono et al., 2009).

Focus groups, which became popular in social science research during the 1990s (Wilkinson, 1998), involve gathering data from a group of between six to twelve participants (Smithson, 2000), brought together by the researcher to discuss a specific topic (Hughes & DuMont, 1993). One of the key benefits of this approach is their ability to collect rich data in a short time period, from a number of participants (Smithson, 2000). However, these groups also require all participants to be together and in one place at the same time, which can be problematic (Pini, 2002). The practicalities of achieving this outcome in each of the energy community case studies ruled it out as an approach. The researcher also decided that it would be beneficial to hear from each participant individually, so that issues of relative power and status within the communities would be less likely to influence the gathered data.

3.8.1 The role of key informant interviews

Considering the choice of semi-structured interviews as the data collection technique for use within this research, key informant interviews will also be chosen to inform the line of questioning within the semi-structured interviews and communities. Discussions with key informants help researchers to familiarise themselves with the area that they are researching (Parsons, 2011). In this instance, the key informants chosen will have significant levels of expertise in energy, sustainability, or communities. Parsons (2011) noted that a successful range of key informant interviews can allow a researcher to obtain a broad and wide-ranging understanding of what the important topics are within an area of inquiry. Understanding the topics on which energy communities share knowledge could be vital for ensuring that the semi-structured interviews guide participants in answering the chosen research questions. In addition, the key informants that were selected provided a source of valuable data, as those chosen had vast experience of working within the energy sector and with community energy groups.

Bois 1

3.8.2 Semi-structured interviews

After considering the suitability of the different data gathering approaches, the researcher decided to use structured interviews to explore the thoughts and perceptions of participants within each community case study. Interviews provide participants with the opportunity to expand upon their understandings and experiences without distraction from others in the group or any other influencers (Bourke, 2014). To gain this deep understanding and to ensure the necessary flexibility, the researcher opted to use a semi-structured approach to the interviews, guiding the key informant interviews and energy community interviews using an interview checklist (see Appendices 5 and 6), thus minimising the influence on the participants responses. Although this approach aims to reduce bias, as has already been noted, all research is influenced by the researcher's positionality (Kezar, 2007). Semi-structured interviews enable the interviewer to guide the discussion in ways that answer and benefit the research

questions, allowing the participant to speak freely (Currie, 2005). In comparison, structured interviews tend to follow a strict guide of questions and have less freedom (ibid).

The overarching aim of the project is to explore the aim to explore the knowledge shared and managed within energy communities, which requires a good understanding of the context in which the knowledge is shared and for in-depth responses to be provided. The choice of a semi-structured approach will therefore allow the researcher to be flexible when interviewing participants and probe for deeper responses using a guide of key issues.

3.9 CRITERIA FOR COMMUNITY SELECTION

The criteria for the cases chosen within this research are discussed as follows. Section 3.9.1 will highlight the number of communities that will be selected and what this number of cases will seek to achieve. Section 3.9.2 will discuss the purposive approach used to select participants. Section 3.9.3 will discuss the unit and level of analysis. Sections 3.9.4 and 3.9.5 will explain the choice of case study and explore issues linked to the generalisability of the findings. Section 3.9.6 will consider the time frame for this research. Sections 3.9.7 to 3.9.10 will discuss the interview process and the access, sample size and selection of participants. Finally, Section 3.9.11 will conclude by describing how the data was collected in practice.

3.9.1 Community energy groups

According to Yin (2014), the number of cases selected depends on the aims of the research. Two or three cases is adequate if the researcher is aiming for a literal replication, whereas four to six may be more suitable for those looking for theoretical replication (ibid). As this research is seeking to achieve literal replication, a sample of three case studies would allow the researcher to generalise the findings if the cases chosen are similar. The literature defines a CoP as a group of individuals who are informally bound by mutual interest and shared expertise (Wenger and Synder, 2000, p. 139). Therefore, to investigate KS as the phenomenon, the interest of the members of the group have to be focused in one area. CE groups align with this definition, with three case studies being selected using a purposive sampling strategy.

3.9.2 Purposive sampling

The use of a purposive sample will allow the researcher to strategically choose CE groups to participate in the research. This choice will improve the chances of literal replication and help ensure that the results from the case studies can be compared. Mason (2002) indicated that the choice of a specific sample group indicates that the group have unique perspectives to share on the research in question. The purposive sample of key informants from various backgrounds will help sharpen the research questions. In addition, there is a clear research gap within KM literature for contextually focused solutions to KS, and a purposive sample will help to provide findings from the CE context.

3.9.3 **Unit and level of analysis**

When deciding on research design, both the level of analysis and unit of analysis must be considered by the researcher. Both terms have variously defined in different disciplines. Yurdusev (1993, p. 87) clearly distinguished between the two concepts by identifying with the level of analysis as a concept that is concerned with the contexts and frameworks involved with the study, in comparison to the unit of analysis which is more concerned with the "actor" or "entity" being studied. However, Yurdusev (1993, p.87) also makes it clear that whichever level of analysis is chosen, the researcher must also consider the other possible levels for the analysis to be "comprehensive and precise". Accordingly, the level of analysis in this research is the context of energy communities and the factors that influence the emergence of CoPs, whilst the unit of analysis will be the knowledge networks within each energy focused community group. This distinction places boundaries around the research objectives and acknowledges that the findings will be energy and community specific. In addition, it highlights knowledge and how it is transferred through different knowledge networks as the phenomena to be studied.

3.9.4 **Choices of case study**

The use of a purposive sampling strategy allowed the researcher to choose case studies that were relevant to the proposed research questions. The research context offered the researcher only limited scope for access to communities. These access issues are caused by the fact that CE groups are anyway limited in number in the UK and because of the resources available to them are often unable to engage with research students. The sample size for this research is therefore limited to three cases. In addition, this research considers energy communities as a type of CoP, where groups of people are "informally bound together by shared expertise and passion for a joint enterprise" (Wenger & Synder, 2000, p. 139). Moroni et al. (2019) highlighted these energy communities as communities of choice, and not fate or chance, as well as deducing clear distinctions between the types of community that exist in the space. This research uses these distinctions to identify the cases chosen for the research.

Table 12 identifies different types of energy communities, according to their purpose and location of the community. Energy communities vary from having a single focus, such as the producing energy via solar PV, to having multiple focuses such as producing, purchasing, and managing energy. Whilst non-place-based communities are not limited to one location and often have a presence online, place-based communities focus on one geographical area and their membership is mostly limited to people who reside within the areas local to the group.

Table 12: Types of energy related communities

	Non-place-based communities	Place-based communities
Single purpose	Set up for the sole purpose of producing, managing or purchasing energy in accordance with shared rules	Set up for the sole purpose of producing, managing or purchasing energy in accordance with shared rules
Multi-purpose	Set up for the purposes of sharing production, management or purchasing of various goods and services including energy	Set up for the purposes of sharing production, management or purchasing of various goods and offering services including energy

Source: Adapted from Moroni et al. (2019)

In addition to Table 12, Table 13 below further displays the characteristics of each energy community. This is valuable because it shows characteristics that are similar and different across the communities.

Table 13: Further identification of cases

	Case Study 1	Case Study 2	Case Study 3
Place-based community	Yes	Yes	Yes
Place type	Rural	Urban	Urban
Purpose(s)	Develop community assets, produce energy, sell energy, educate the wider community	To produce and sell energy from community assets for a return on investment	Develop community assets, produce energy, sell energy, educate the wider community
Number of participants on board of directors	8	7	10
Number of participants interviewed	5	4	4
Membership age	40 - 80	25 – 80	50 - 80
Online presence	Yes – limited website	Yes – limited website and social media	Yes – limited website
Single/Multi-purpose	Multi-purpose	Single purpose	Multi-purpose

As shown, the key differences between the cases concern the age of the directors involved, the purpose of the community and how decisions are made. These differences will be considered in the analysis to understand whether they influence the knowledge shared within each case. The cases are all similar in the number of participants involved on their boards and also in their aspirations to produce and sell energy. Their similar aspirations affirm their positions as CoPs, as these groups are bound together by a mutual purpose. In addition, all of the case studies included in this research are place-based communities that are specific to one location, with membership restricted to that area. Two of these communities have multiple purposes, whilst the third has a single purpose. The single purpose of community two is to install solar PV on local community buildings and export this energy for use within the local community.

Most energy communities focus on their local geographical areas, rather than being UK wide. This is partly because the impact they can make due to resources and engagement levels is limited and tends to be suited to their local constituency and partly because the low carbon transition in the UK aims to

decentralise the production and use of energy via the creation of these geographically based energy communities. The specific cases chosen were identified in the key informant interviews, with all three recommended by participants as ideal cases due to their reputation for making an impact. Although all three cases are located within the West Midlands, they are all known to CEE and all associate closely with large UK organisations within the energy sector.

3.9.5 Generalisability of the chosen cases

The ability to generalise findings from case studies has been heavily contested in the literature (Firestone, 1993; Gerring, 2007; Sharp, 1998). Mintzberg (2005, p.10) noted that a failure to generalise beyond the collected data would result in a lack of theory, suggesting that "no theory, no insight. And if no insight, why do research?". Criticisms such as these are underpinned by the notion that levels of subjective valuation cannot be logically legitimised (Firestone, 1993). Despite these criticisms, Yin (2013, p. 325) considered a case study approach offers potential for a researcher to "generalize from a small number of cases to a larger population of cases". Ruddin (2006, p.799) also defended the generalisability of a case study approach, arguing that without generalisation, people cannot interact with the surrounding world in a coherent manner. Despite the evident conflicting views (Flyvbjerg, 2001, 2006), Ruddin (2006, p.800) argued that generalisation is simply misunderstood and that case study research allows the researcher to construct meaning "onto" the case study, rather than inferring meaning "from" a case study.

Yin (2014) stated that conducting case study research can support a researcher in attempting to generate hypotheses. Similarly, Cronbach (1975, p.125) described case study research as a process that supports the creation of a "working hypotheses", where every result contributes to either accepting or critiquing an existing theory. As such, the exploration of three energy communities in this research allows for generalisation, but not beyond the type of case explored. In this instance, the findings support contributions made within energy communities. This research will follow Kennedy's (1979) four steps to achieving generalisation. These steps are as follows. Firstly, the researcher must examine a wide range of attributes across the chosen cases. Within this research, these attributes encompass the nature of knowledge shared, the factors influencing KS and the process of sharing knowledge within these communities. Secondly, there must be many similarities between the chosen cases. The similarities between the cases in this research are shown in Table 13. Thirdly, there must be very few points of difference between the case studies. Within this research, the only notable differences between the chosen cases are their locations and minor differences in membership age and numbers involved. Finally, the chosen case studies should have relevant attributes to the chosen research questions. In this research, all of the chosen cases are energy specific and seek to produce renewable energy for consumption in their local communities. Therefore, the cases chosen meet these four steps to achieving generalisation.

3.9.6 **Consideration of the time frame for the research**

According to Saunders et al. (2015), research is conducted in either a cross-sectional or longitudinal manner. Cross-sectional research attempts to take a snapshot of specific cases at one moment in time, perhaps because the research is limited in time and resource (ibid). In comparison, longitudinal research investigates the same set of variables or groups over different points in time. In this research, there is a limited window of time to identify the participants and conduct the interviews. Accordingly, a cross-sectional approach was used, and various case studies were explored simultaneously to provide a snapshot of KS activity in different CoPs.

3.9.7 **Access to participants**

The researcher attended energy and climate change conferences using both known and new networks in academia and industry to identify communities to access. A "snowballing" (Easterby-Smith et al., 2015) sample approach was then used to identify and get in contact with new participants, as those interviewed often provided contact details of other participants of interest. Importantly, an existing participant always introduced the researcher to another participant, with the researcher gaining contact details and permission to contact these participants prior to making contact. Once contact was made, the participant recommended the time and meeting place for the interview, read the participant Information Sheet and signed the provided Consent Form. Additionally, each participant verbally agreed to participate in the research.

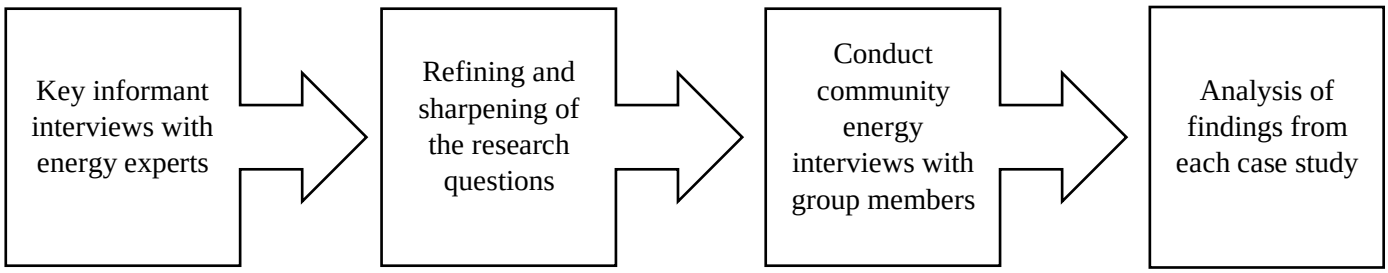
3.9.8 **Sample size of participants**

When considering the sample size for interviews, Yin (2014) recognized that there is no predetermined number of participants required in the data collection stage. It is imperative that the sampling strategy is well aligned with the research aims and objectives (Mack et al., 2011). Due to the context of the study and the identified research objectives, a purposive sample method was employed to specifically choose participants who could provide rich data relating to the overall research aim. The sharing of knowledge within a community involves multiple stakeholders, and it is therefore vital that the chosen participants provide a clear and relevant contribution to the data. Alongside interviewing community members, a range of key informant interviews with other stakeholders were conducted in order to extend the researcher's understanding of KS and the role of the stakeholders involved. These stakeholders included energy experts, local councils, CE groups and organisations.

3.9.9 **Overview of interview process**

Shown below, Figure 27 provides an overview of the data collection process using semi-structured interviews.

Figure 27: Flow chart showing the interview process



Firstly, key informant interviews were conducted with participants who had specific and relevant energy expertise. The key informant checklist that was used is shown in Appendix 5. This checklist provided the researcher with a list of topics that structured the ensuing discussion. The topics explored were the state of the energy sector, the role of communities in delivering energy projects, and the role of knowledge and knowledge sharing. Key informants were also given the opportunity of opening the interview with a discussion about their background and experience. All interview topics were informed by the three research questions and designed to provide deeper insight into the research problem. Discussions about the energy sector and communities allowed participants to share their experiences of how community energy groups operate. In addition, asking about knowledge sharing allowed the researcher to understand the nature of knowledge needed and being shared within these communities and the factors that influence this sharing.

The selected participants had experience in a wide range of energy focused roles in organisations, council, community groups and academia. The selection of such a wide range of expertise allowed the researcher to gain a broad understanding of the challenges in the energy sector and some of the key themes that will help to refine and sharpen the more in-depth questions for the chosen community cases.

3.9.10 **Selection of participants**

As shown in Table 14 below, the participants selected at the key informant stage had a range of relevant roles and experience. According to Morse (2000), the number of participants selected at this stage should not be influenced by the research of others, but determined by the amount of participants it takes to reach a saturation point. This is otherwise known as the point at which the findings from the interviews repeat similar themes, and the value of collecting more data becomes minimal.

Table 14: Key informant interview participants

Participant Sector and Role	Participant Identification	Duration of interview
Education – Director of Estates	Participant A	55 minutes
Education - Professor	Participant B	82 minutes
Small Limited Company – Managing Director	Participant C	57 minutes
Education – Senior Lecturer	Participant D	79 minutes
Small Limited Company – Managing Director	Participant E	71 minutes
Multinational Corporation – Head of Clean Energy & Investment	Participant F	58 minutes
Small Medium Enterprise – Managing Partner	Participant G	61 minutes
Large Corporation – CE Channel Manager	Participant H	63 minutes
Local Council – Sustainability Manager	Participant I	59 minutes
Education - Research Fellow	Participant J	65 minutes
Large Corporation – Head of Sustainability	Participant K	61 minutes
Large Corporation – Future Energy Technology Evangelist	Participant L	70 minutes

After the completion of the interviews listed in Table 14, the semi-structured checklist of issues for the energy focused community case studies was constructed, sharpened and refined to reflect the issues arising from the key informant interviews. Although the same broad themes concerning the energy sector, the role of communities and the nature of knowledge sharing were explored, the questions were adjusted to align more specifically with the research questions. For example, the key informant interviews probed participants' views on the energy sector and the role of community energy. In comparison, the energy community checklist aimed to explore in more detail how these energy communities operate.

After a period of attending meetings and networking within the communities, the participants from across the three case studies, as shown in Table 15, were recruited.

Table 15: Case study interviews

Case study	Participant	Role	Interview Duration
Case Study 1	Participant 1A	Group leader & investor	75 minutes
Case Study 1	Participant 1B	Minute taker & investor	77 minutes
Case Study 1	Participant 1C	Member & investor	59 minutes
Case Study 1	Participant 1D	Member & investor	65 minutes
Case Study 1	Participant 1E	Member & investor	62 minutes
Case Study 2	Participant 2A	Group leader & investor	54 minutes
Case Study 2	Participant 2B	Minute taker & investor	59 minutes
Case Study 2	Participant 2C	Member & investor	77 minutes
Case Study 2	Participant 2D	Member & investor	66 minutes
Case Study 3	Participant 3A	Group leader & investor	60 minutes
Case Study 3	Participant 3B	Minute taker & investor	75 minutes
Case Study 3	Participant 3C	Member & investor	88 minutes
Case Study 3	Participant 3D	Member & investor	65 minutes

As shown in Table 15, the number of participants from each case study varied, reflecting willingness to engage in participation by community members, and also data saturation. Each case study community had a unique place of operation and a regular meeting place to conduct community meetings. Although the geographical location of each case study differed, the agenda for each community group remained focused around the theme of energy.

3.9.11 Data collection in practice

The data collection involved the researcher arranging interviews and then meeting participants in various locations to gather the relevant data. In the first instance, key informant interviews were arranged via emails and cold calls. Key informant interviews were mostly conducted at participant offices and local amenities such as coffee shops. During these interviews, several community energy

groups were mentioned, which the researcher later gained access to. This was achieved through "snowballing" and purposely choosing the most relevant communities. After making initial contact via email and phone calls, the researcher then attended fortnightly meetings and AGMs within each community, which allowed him to network with members and arrange semi-structured case study interviews. Access to the meetings conducted by communities also enabled the researcher to immerse himself in the activities and culture of each community, resulting in a deeper understanding of how each community operated.

Table 16 outlines the range of events and meetings that the researcher attended prior to and during the data collection process. The first three conference events shown in the Table were networking opportunities for the researcher, where a number of key informant participants were recruited to take part in the research. As already explained, these key informant interviews helped draw the researcher's attention to the wide-ranging issues that community energy faces in the UK, such as the lack of policy and funding for local communities.

The remainder of the energy community meetings in Table 16 were specific to each community and took place in their usual local meeting locations. In addition to providing a deeper understanding of energy communities and the research context, these activities were crucial in helping the researcher develop a relationship of trust with individuals from the different energy communities and with those who were interviewed. As the researcher got to know group members and immersed himself in the communities' activities, those interviewed were able to build up trust in him, with the result that they were prepared to disclose detailed information. Some of the events and meetings listed in Table 16 also provided opportunities for the interviews to take place.

Table 16: Data collection activities

Event	Attendees	Location	Duration
Climate change conference – "Consequences into Solutions".	50 energy and sustainability professionals from different organisations, educational institutions, and councils.	Tallyho Conference Centre, Birmingham.	6 hours
Climate change conference – "Regional Approaches to Decarbonisation"	30 colleagues from a large organisation based in Warwick. 10 of these colleagues are part of the environmental steering group and others make up the community energy team.	Co-operative House, Warwick.	5 hours
Coventry City council climate change national lottery funding meeting.	40 stakeholders that are engaged in local community energy projects across the West Midlands, alongside Coventry City council representatives and students.	Coventry City Council Building, Coventry.	3 hours
Energy community one – group meeting at the village library	8 energy community members, including the group leader.	Village Library & Café, Harbury.	2 hours
Energy community one – group meeting at the village library	7 energy community members, including the group leader.	Village Library & Café, Harbury.	2 hours
Energy community one – group meeting at the village library	8 energy community members, including the group leader.	Village Library & Café, Harbury.	2 hours
Energy community one – community coffee morning at the village library	8 energy community members, including the group leader.	Village Library & Café, Harbury.	3 hours
Energy community two – annual general meeting	5 energy community members, including the group leader.	Kings Heath Community Centre, Kings Heath.	3 hours
Energy community two – Will King introduction meeting at the local community centre	5 energy community members, including the group leader.	Kings Heath Community Centre, Kings Heath.	1 hour
Energy community two – group meeting at the local community centre	5 energy community members, including the group leader.	Kings Heath Community Centre, Kings Heath.	2 hours
Energy community two – group meeting at the local community centre	5 energy community members, including the group leader.	Kings Heath Community Centre, Kings Heath.	2 hours
Energy community three – annual general meeting	8 energy community members, including the group leader.	All Saints Church, Kings Heath.	2 hours
Energy community three – group meeting at the church offices	8 energy community members, including the group leader.	Church Offices, Temple Row, Birmingham.	2 hours

Since completion of the interviews, the researcher continues to engage with each community and has agreed to share the findings of this research with each group. This research will also provide each community with several practical implications that these communities can consider when determining their future agenda.

3.10 ANALYSIS OF DATA

Before deciding on the approach to the analysis of the data collected, Saunders et al. (2015) highlight the importance of considering the deductive or inductive nature that data has been collected. As discussed previously, the primary data collection in this research uses an inductive approach, which was justified by the need to construct themes from the data rather than rely directly on those from the literature. The inductive nature of the data collection also allowed the researcher to adjust any future data collection to ensure that relevant data exists in cases that are being considered for research (Strauss & Corbin, 1998). This approach therefore aligns with a purposive sampling technique, where the researcher specifically chooses a sample participant for reasons that align with the research questions.

3.10.1 Approaches to analysis

Considering the inductive nature of this research, the various data analysis techniques recommended by Saunders et al. (2015) can be filtered to find the most relevant. Qualitative techniques such as template analysis, explanation building and testing, narrative analysis, discourse analysis, grounded theory, content analysis and thematic analysis can all be considered for the kind of data collected.

Template analysis is considered by Saunders et al. (2015) as a variant of thematic analysis, that involves coding by themes. However, this technique is different from thematic analysis because it is completed using a pre-configured template of codes and themes (Symon et al., 2017). Many examples of template analysis use codes and themes that are taken from the literature, therefore using a deductive approach. However, as the purpose of this research is to explore emerging themes from the data using an inductive approach, template analysis was ruled out. In comparison, explanation building and testing is primarily concerned with providing an explanation of "why a particular state of affairs exists, often contrary to expectations" (Mills et al., 2012, p.4). The expectations that occur within explanation building are often presented in the form of an existing theory or model (ibid). Given the exploratory focus of this research and the fact it does not seek to explain findings in relation to a specific existing theory, this approach will not be employed.

Narrative analysis is a form of analysis used to recognise the importance of lived experiences and the stories that participants express (Thorne, 2000). These stories often comprise of a beginning, middle and end, requiring the researcher to re-tell the story and provide causal links between ideas (Liamputtong, 2009). This research does not apply this form of analysis to the data, predominantly because there may be underlying themes that could be missed if the researcher focused upon the stories

and chronology of each community. Discourse analysis is another often used method, which focuses on finding out how socially produced ideas were created and how they exist within a period of time (Phillips & Hardy, 2002). Although this approach could potential answer the "how" questions in this research, it is less helpful in assisting the researcher in understanding why socially produced ideas exist. The understanding of "why" will produce contextually unique insights within this research and as such, the use of discourse analysis can be ruled out.

Grounded theory is an analysis technique that focuses on generating theory from the analysed data (Forman & Damschroder, 2007). Groat & Wang (2002, p.181) stated that grounded theory is an "intensive, open-ended, and iterative process that simultaneously involves data collection, coding, and memo-writing". Although this technique could be used within this research, the research questions in this study do not just focus upon theory building. Conceptual and practical considerations will also be considered as key contributions. It was also vital that the researcher had time to familiarise themselves with the data in order to find the underlying meanings and "let the data speak". This process of familiarisation with the data allowed this research to generate and present a level of depth to the insights presented.

Finally, content analysis uses predetermined categories when analysing the data, and represents a systematic and objective way of describing and quantifying phenomena (Downe-Wamboldt, 1992). Content analysis can be used both deductively and inductively, which provides flexibility for the researcher. However, it will not be used in this research, because the aim is to explore the KS activity of communities rather than look to objectively analyse themes or quantify phenomena.

3.10.2 **Justification for the choice of thematic analysis**

Thematic analysis is considered by Saunders et al. (2015) as a bedrock of qualitative research and is also considered the most generic approach to analysis. Importantly, the approach is not strictly aligned with one philosophical position and can be used flexibly to support differing research approaches. Thematic analysis is concerned with identifying key themes and codes from a qualitative data set and is useful for the research that is attempting to draw conclusions from a large data set and understand relationships between identified themes (Easterby-Smith et al., 2015; Saunders et al., 2015). The consideration of themes across the three chosen communities allowed this research to highlight similar tendencies and characteristics within the KS process. In addition, the semi-structured and exploratory nature of each interview provided the researcher with a significantly large and rich qualitative data set to undertake this kind of analysis. As such, this research used thematic analysis, following Braun & Clarke's (2006) phases to structure and analyse the collected data so that informative and valuable conclusions can be drawn.

Table 17: Phases of thematic analysis

Phase	Description of the process
Familiarisation with the data	Transcribing data, reading and re-reading the data, noting down initial ideas
Generating initial codes	Coding interesting features of the data in a systematic fashion across the entire data set, collating data relevant to each code
Searching for themes	Collating codes into potential themes, gathering all data relevant to each potential theme
Reviewing themes	Checking if the themes work in relation to the coded extracts (Level 1) and the entire data set (Level 2), generating a thematic "map" of the analysis
Defining and naming themes	Ongoing analysis to refine the specifics of each theme, and the overall story the analysis tells, generating clear definitions and names for each theme
Producing the report	The final opportunity for analysis. Selection of vivid, compelling extract examples, final analysis of selected extracts, relating back of the analysis to the research question and literature, producing a scholarly report of the analysis

Source: Adapted from Braun & Clarke (2006, p.87)

The predominant benefit of using this thematic analysis approach is that it provides the researcher with flexibility when analysing the data. The wide range of analytical options means that a variety of interpretations can be drawn from the collected data. Given the exploratory nature of this research, such an approach would be particularly beneficial, as it will enable insightful and context specific findings to be generated. Braun & Clarke (2006) stated that thematic analysis is particularly strong at generating unanticipated insights.

Despite the benefits of using thematic analysis, it is necessary to be aware of potential disadvantages, such as the potential for no analysis to be carried out at all. Braun & Clarke (2006) state the importance of using extracts of collected data to support an analysis that goes beyond the content. Furthermore, there is a danger of the researcher simply restating the questions from interviews as themes within the

findings (Braun & Clarke, 2006). This danger could lead to the researcher overlooking insightful and valuable findings, simply restating what is already known. Within this research, these dangers were mitigated by following the six steps outlined in Table 17. More specifically, the researcher used a significant period to read the findings and to become familiar with the collected data. This reading took place both electronically and on paper after transcription. The generation of initial codes was also done on paper and via the use of CAQDAS[3] software, such as NVivo 12 and Microsoft office's Excel program. The use of both paper and electronic familiarisation with the collected data ensured that the researcher allowed the "data to speak" and find the most appropriate insights to form the themes and research findings.

Considering the use of a thematic analysis further, Braun & Clarke (2006) stated that themes within the data can be identified using two methods; inductive and theoretical. The theoretical approach to thematic analysis allows a researcher to use guiding theory when developing the themes from the collected data (Braun & Clarke, 2006). This approach is often used to answer a particular research question and provides detailed analysis of a specific aspect of the data, rather than the data as a whole (ibid). This thematic approach was not applied within this research, as the research questions sought to explore KS and develop themes relating to it from the data. Instead, an inductive thematic approach will be used, that allows the data to determine the direction of the subsequent analysis (Braun & Clarke, 2006b). This kind of inductive approach will allow the researcher to "let the data speak" and develop themes that may not necessarily be coherent with existing theoretical interests.

Finally, thematic analysis can also be considered in terms of the layers of data that are analysed (Braun & Clarke, 2006c). Boyatzis (1998) stated that these levels should be described as semantic or latent. The semantic level involves the organisation of themes to show patterns within the data, where the researcher can then attempt to theorize and discuss wider meanings and implications (Patton, 1990). This level of analysis would not be applicable to this research, as the exploratory and inductive nature of the research attempts to analyse beyond the surface level responses of participants. In comparison, the latent level of analysis allows a researcher to identify "underlying ideas, assumptions, and conceptualizations" (Braun & Clarke, 2006, p.84). These underlying conceptualizations contribute to structuring and forming the semantic level of analysis. This research therefore employs a latent level of thematic analysis, as it supports the organisation of the themes that are inductively found within the data. The latent level of analysis will also help the researcher provide "how" and "why" answers when exploring and discussing the three research questions.

[3] Computer-assisted qualitative data analysis software.

3.11 LIMITATIONS AND BOUNDARIES OF THE METHODOLOGY AND HOW THEY WERE HANDLED

Considering the discussed research methodology, several limitations need to be considered by the researcher. This Section presents three key limitations of the methodology and discusses the potential solutions.

Firstly, it became clear when discussing the data collection that energy communities are difficult to approach and gain access to. This is because energy communities are small groups with close relationships, which rarely allow access to outsiders who do not have pre-existing relationships with individuals within the group. The researcher therefore must gain the trust and understanding of the chosen communities to obtain access to participants. This limits the number of cases that the researcher can access, with implications for the generalizability of the research beyond the communities to which access was gained. However, the adopted methodology attempts to reduce this limitation by ensuring that the chosen cases are similar, thus supporting generalisability to other cases that share these characteristics. The characteristics of the cases were shown in Table 13.

Secondly, the limited number of members often seen in these communities also restricts the number of interviews that the researcher can conduct within each community. It is therefore vital that the researcher chooses cases where there is a willingness to participate and which have the potential to provide rich and detailed responses. In addition, key informant interviews strengthen the knowledge of the researcher on the CE sector, allowing particularly informed and specific themes to prompt detailed discussions. Finally, the time frame that the researcher had to complete data collection and analysis is limited. To handle this, a cross-sectional case study approach was chosen, which acknowledges that this research presents a snapshot of energy communities at a particular point in time. To provide a more comprehensive exploration, a longer time frame when completing the data collection and analysis would allow the researcher to consider other methods, such as a longitudinal study.

3.12 RELIABILITY AND VALIDITY IN CASE STUDY RESEARCH

The reliability and validity of qualitative research has been widely considered (Ali & Yusof, 2011; LeCompte & Goetz, 1982; Lincoln & Guba, 1985; Maxwell, 1996). Reliability can be defined as the degree to which a study can replicated to achieve the same outcomes (LeCompte & Goetz, 1982). Validity concerns the accuracy of the study and how well it represents participant realities and social phenomena (Schwandt, 1997). The consideration of both issues is particularly important to this research, as qualitative researchers are under pressure to prove that their research is credible (Creswell & Miller, 2000). Within this research, reliability and validity have been ensured by using Yin's (2014) four case study tests to structure the design, data collection and data analysis.

Table 18: Reliability and validity in case research

Test	Case study tactic	Phase of research in which tactic occurs
Construct validity	Use multiple sources of evidence	Data collection
	Establish the chain of evidence	Data collection
	Key informants review the draft study report	Composition
Internal validity	Pattern matching, explanation building or time series analysis	Data analysis
External validity	Use replication logic in multiple case studies	Research design
Reliability	Use study protocol	Data collection
	Develop case study database	Data collection

Source: Adapted from Yin (2014)

The tests shown in Table 18 are applicable to the case study method applied in this research. To achieve construct validity, this research explored three communities and therefore provide multiple sources of evidence. Furthermore, the key informant interviews were conducted so that the researcher can develop their knowledge of the CE sector and formulate appropriate questions for the energy community interviews. Key informants had the opportunity of supporting the researcher by reviewing and discussing the planned research design.

Internal validity was achieved within the data analysis, as the researcher employed a thematic analysis that will identify similar themes and patterns across the three explored communities. The process of identifying patterns and similar codes within the data showed that the researcher conducted the data collection efficiently and that the communities do indeed have similar characteristics. In contrast, external validity was shown by using the same methods within each community. Yin (2014) stated that this is particularly important as it allows the researcher to compare the findings. The same prompts were used during the semi-structured interviews conducted within each community. Finally, the reliability of this research was shown by the creation of a comprehensive research methodology that has been widely used in similar qualitative studies. Each stage of this methodology aligns with the stated research questions.

3.13 ETHICAL CONSIDERATIONS

When undertaking primary research, it is vital that the researcher considers the role of research ethics (Saunders et al., 2015). This research followed the Coventry University Ethics guidelines throughout. When approaching potential participants, the researcher formally introduced themselves via email and requested that the participant read the attached "Participant Information Form" and "Participant Consent Form" before agreeing to participate. No pressure or obligation was placed upon the participant and potential interviewees had the right to withdraw their offer of participation at any time during the study.

This study presents a "Participant Information Form"[4] that was sent to participants prior to the arrangement of any interview. This allowed the participant to review the purpose of the study and ensure that they were willing to participate under the stated terms and conditions. The participant was then presented with a "Participant Consent Form"[5], to sign and agree to the terms and conditions of the study. When signing the "Participant Consent Form", the participant consented to the transcription and storage of the data that is collected. It is important that the participant knows the researcher's intentions, so that this study can comply with the requirements of the Data Protection Act of 2018. Accordingly, all responses and interview data are recorded and stored on the secure Coventry University One Drive server, to ensure that all data remains safe and protected against potential theft. All participants were asked if they wish to remain anonymous, and any dissemination from the study will not involve the identification of participants unless specifically agreed. The greatest ethical risk to the project is the storage of participant data. This risk has been eliminated by encryption of the data and by relying on the security of the Coventry University server. Upon completion of the study, all primary data that was collected by the researcher was destroyed.

Finally, as required by the Coventry University Ethics guidelines, this research will ensure that all participants remain anonymous and that their identify is disguised when reporting the findings. This anonymity and consistency will apply throughout the study to provide participants with confidence that ethical and legal boundaries have been maintained.

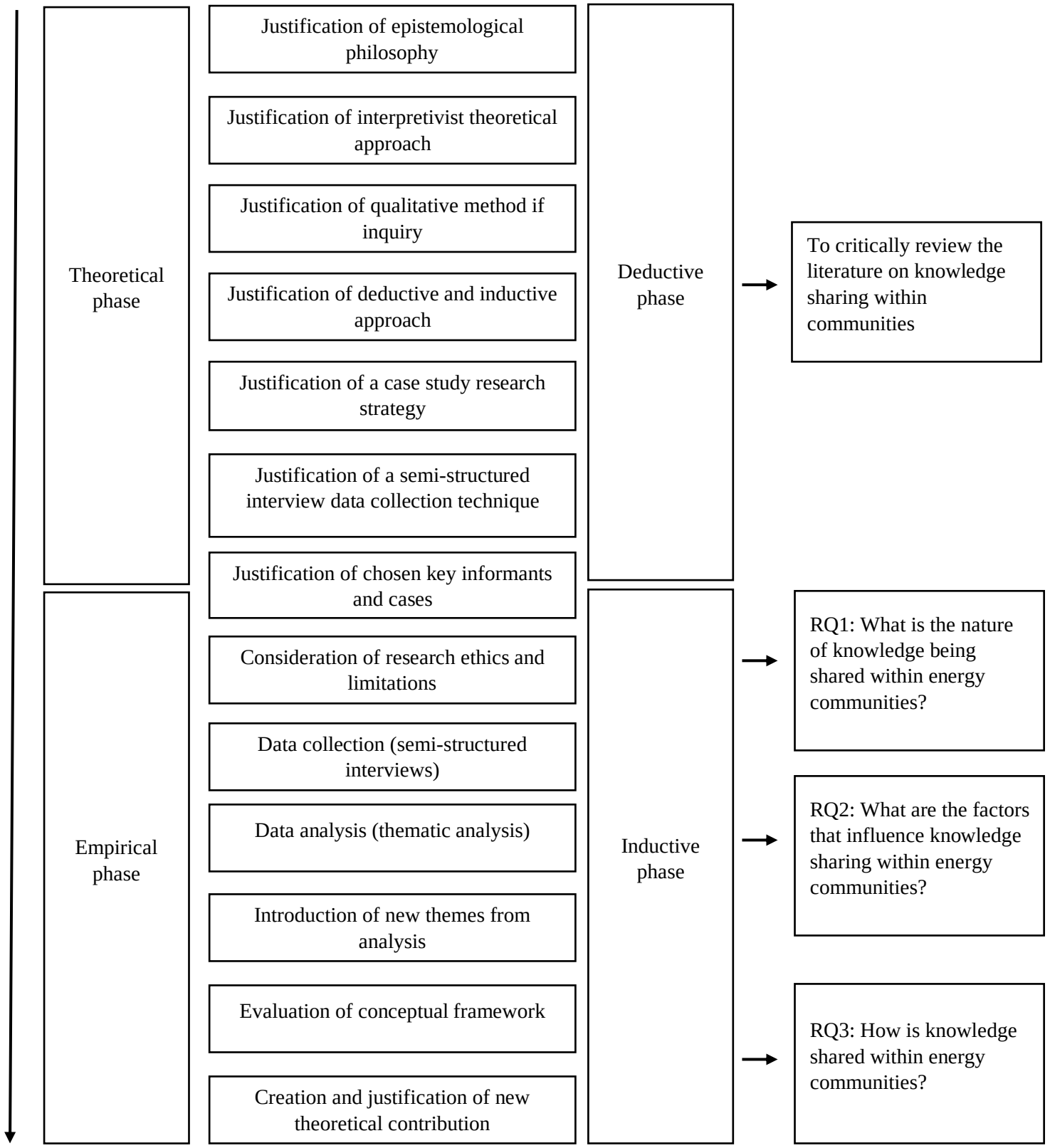
[4] Appendix 3 presents the "Participant Information Form" that will be given to participants before any interview is arranged and conducted.

[5] Appendix 4 present the "Participant Consent Form" that will be acknowledged and signed by participants before any interview can take place.

3.14 OVERVIEW OF METHODOLOGICAL APPROACH DIAGRAM

To provide an overview of the structure of the discussed research methodology, Figure 28 displays how each key Section aligns with the specified research questions. These research questions were identified from the review of relevant literature in Chapter 2. The overview of the methodological approach shows that this research progressed through both a deductive and inductive phase. The deductive phase aligns the justified approaches with theory and the inductive phase aligns data collection and analysis with an empirical phase.

Figure 28: Alignment of research methodology with the research questions



Source: Adapted from Alkhuraiji *et al.*(2014)

3.15 SUMMARY

The philosophical and methodological approach presented in this Chapter aligns with the presented research questions emerging from the literature review. The presented methodology allows the researcher to explore the knowledge and community specific concepts. In the first instance, an epistemological philosophy was chosen to underpin the research as it allowed the researcher to consider the assumptions made about knowledge and whether they were acceptable. In addition, this philosophical approach helped the researcher to question the relationships between the "knower" and the "would be knower". Aligned with the epistemological philosophy, the choice of a subjectivist stance allowed the researcher to consider human subjectivity and develop understanding. Considering a theoretical perspective, an interpretivist approach focusing upon narratives, stories, perceptions, new understandings and different worldviews was used. The interpretivist approach views the theories and concepts presented in Chapter 2 as too simplistic and has allowed the researcher to generate context specific insights.

To support the epistemological, subjective, and interpretative approach to this research, a qualitative method of inquiry was chosen to allow the researcher to explore the "how", "why" and "whether" within the three research questions. Although this research encompasses an initial phase of deductive inquiry using the explored literature, an inductive approach was chosen to assist the researcher in extracting rich and experience-based data. As the depth and richness of this data may not be already linked to existing theory within the CE context, an inductive approach was appropriate. Following the consideration of the research approach, a holistic and embedded multiple case study approach was chosen. The use of this approach allowed the researcher to examine the data from a general and higher level perspective, showing the KS activity of each case. The embedded approach supports the researcher in examining the KS activity of participants in more detail. The case study approach was used as an opportunity to compare the activity of several communities and achieve "literal replication", which may improve validity and reliability.

Following the choice of research philosophy, approach and strategy, the data collection consisted of semi-structured interviews with key informants and participants from three different communities. These are appropriate as they allowed the participant to expand on their understanding and experiences without the distraction or influence of others. The semi-structured nature of the interviews provided a less structured feel to the interview, allowing the participant to provide depth and detail in their responses. Twelve key informants with expertise in CE were purposively chosen to help sharpen and construct the interview prompts for the community interviews. These interviews led to the selection of three different energy communities with similar characteristics for the case studies. The similarities between the cases allowed for a degree of generalisation from the findings. Once the data was collected, a thematic analysis was employed using Braun & Clarke's (2006) six stages of analysis. The use of a

thematic analysis allowed the researcher to generate codes from the data and identify patterns that occur across the different communities.

Finally, limitations, reliability, validity, and ethical considerations are presented in Sections 3.11, 3.12, and 3.13, with a summary of the methodological approach presented as a Figure in Section 3.14 After the publication of this research, all data that has been collected and stored on the Coventry University One Drive will be destroyed.

4 FINDINGS: A TALE OF POWER AND THE COMMUNITY JOURNEY

4.1 INTRODUCTION

This Chapter provides an overview of the emerging themes that became apparent during the analysis of the data collected in the semi-structured interviews, which were underpinned by the issues covered in the three research questions. As shown in the Chapter 3, the themes emerged from discussions with key informants and participants from three different energy communities. The purpose of this Chapter is to "let the data speak" and unpick the emergent story using the key themes. This approach is concurrent with Braun & Clarke's (2006) six steps of thematic analysis, which is discussed in Section 3.10.2.

The ensuing structure of this Chapter is derived from the themes that were identified within the collected and analysed data. The data presented is drawn from both the key informant interviews and the participant interviews from across the three cases. Pulling these data together in this way enables rich discussion of the themes emerging from across these sources of data. As such, this Chapter is ordered as follows. Section 4.1.1 provides a short biography of each energy community and also describes the various stages of the project lifecycle that occur through a more detailed example of a community energy project. Section 4.2 introduces power within knowledge networks as a key theme. Sections 4.2.1 to 4.2.3 discuss the ensuing subthemes of "hierarchy and structure of the group", "knowledge ownership" and "discussion of the group agenda". Following this, Section 4.3 highlights the second key theme as the enablers of KS. Sub Sections 4.3.1 to 4.3.3 then discuss a "culture of openness", "finance and innovation" and the "awareness of the group". Section 4.4 identifies the stage of the community journey as a key theme. Sub Sections 4.4.1 to 4.4.4 discuss "membership", "networking", "trust" and the "size of the group". Finally, Section 4.5 provides an overview of the key themes that contribute to the story that the data tells.

4.1.1 Community biographies

This Section provides an overview of the three energy communities that were the subject of the case studies in this research. Providing this background shows how each community was initially formed and how their objectives, completed projects and membership groups differ.

4.1.1.1 Energy community one

Comprising of twelve directors, community case study one is a community energy group based within a small rural town within the West Midlands. The community group was originally founded in 2010 by the group leader and two friends who wanted to intervene to prevent the closure of the town's community library and café. Having extensive experience in a professional capacity, the group leader recognised that there may be an opportunity to apply for various forms of private and government funding to save the library and café. However, the group also realised that such funding was limited

and may not be sufficient to sustain the library and café in the long term. Energy became particularly important to the community because it allowed the library and café to operate heating and lighting with lower monthly energy bills. The group quickly identified solar energy as a vehicle that could help the community provide energy for the village library and café, but also offer a useful financial contribution. At this point, the potential to provide cheaper energy for the rest of the village also emerged. As a first step to pursuing these plans, the group signed up for a community energy conference and began sharing the ideas that they heard with other members of the village. After completing various funding applications, the group was awarded a large sum of money from a government renewable energy scheme that was designed to support the installation of solar PV within communities. The energy community then began to host and advertise community meetings at the library café before it was due to close. After a further period of fund raising and acquiring finance from a variety of funding sources, the three initial directors grew the group to twelve community directors, installing their first solar panels on the village library. The installation of these panels allowed the group to produce energy for the operation of the library and café, but also attract various individuals from the village who were willing to work in the library café on a voluntary basis. As a result of the energy communities' activities, the library café is still open and continues to operate.

4.1.1.2 Energy community two

Energy community two is an urban community group that comprises of eight elected directors, who make decisions on behalf of other members of the community group. The energy community was initially established in 2011 by three friends who all lived and worked in the Birmingham area. Coming from a range of professional backgrounds, they saw an opportunity to obtain energy-related funding and provide cheaper energy for local schools, community centres and office buildings. Wider group memberships can be obtained for a nominal one-pound amount, which allows members access to annual general meetings and hosted community events. However, the wider group members tend to play a passive role and have minimal investment in the group. Since inception, the group have completed seven successful solar PV projects, displacing more than one hundred tonnes of carbon dioxide that would have been used from grid electricity. In their most recent 2020/2021 project, the group installed 30 kilowatts of solar PV on a local sports stadium that also hosts community events. They share their successes and community updates by hosting meetings once a month and publishing articles on their community website.

4.1.1.3 Energy community three

Energy community three is an urban community group situated within a small town in the Birmingham area. The community group comprises of ten board directors, who are also members within their local Baptist church. The founder of the energy community was originally a member of energy community two but decided to leave the group and create a similar community with members of her local church. This energy community hold their fortnightly meetings within the church. The basis for creating the

energy community in 2015, was to install solar PV on the church roof and generate energy for the church's routine needs. Since the successful development and implementation of this project, the energy community has held another community share offer, following the initial share offer that was launched in 2015. This offer has allowed the community to gather the finance and knowledge needed to install solar PV on a number of other local community buildings. The included buildings are no longer confined to similar churches, having been expanded to include schools and religious buildings from other faiths, such as a local mosque.

4.1.1.4 The stages of an energy community project: the case of energy community one

The various project stages that energy community group one experienced during their most recent solar PV project are mapped below. The occurrence and point in time at which these stages occur are likely to vary based on the type of project that the energy community engages in.

- Identification of funding opportunity for community solar.
- Group discussion on potential funding uses and local buildings that could be used.
- Delegation of tasks and identification of group roles and responsibilities.
- Completion of funding application draft.
- Submission of application for funding.
- Receipt of funding.
- Reflection about group roles and responsibilities.
- Interaction with wider stakeholders, such as the council, wider community, and current building owner.
- Completion of individual tasks and discussion at group meetings once a month.
- Application of community solar to the village library and café.
- Sharing success via the community magazine.
- Hosting of village library community coffee mornings and recruitment of group members and volunteers to run the library café.
- Reflection about group roles, funding and maintenance of the library and café.
- Identification of next funding opportunity.

These stages are limited to this example, as different stages of knowledge sharing may occur within other energy communities or for other types of energy-related projects. Displaying the various stages of different projects allows this research to provide insight on possible similarities between the stages across other types of projects.

4.2 POWER WITHIN KNOWLEDGE NETWORKS

Throughout the collected data, both the key informants and the three different communities highlighted the theme of power as a recurring issue. It became evident that varying levels of power exist within each community, depending on the structure of the group, the owners of the knowledge and way in which agendas were formed.

4.2.1 Hierarchy and structure of the group

As shown in Chapter 3, the three energy communities have different structures and formulate their groups depending on their purpose and those involved. This Sub Section will explore the nature of the structure used for each community and show how it contributes to the power dynamic. The story from the findings shows the following:

(1) There is no commonly utilised structure of an energy community, only ones that fit the purpose of the group.
(2) The group structure is decided based on the skills and experience of the group members, and this results in a community specific power dynamic.
(3) The formal structure of the group varies depending on the group's agenda and board members.

4.2.1.1 There is no widely utilised structure of an energy community

The data make it apparent that the concept of power is related to how each community is structured and operates. This is evident across all the key informant participants and each of the three community case studies. Although the three communities are structured legally as CICs, the consensus amongst key informant participants is that there is no unified and recognised way that an energy community should be structured. Participant H recognised this and acknowledged that the structure of the group is dependent on the needs of the surrounding community:

> There might be templates out there but not like a model that they all follow. It may be that we have to operate differently to how we do in England and Wales to how we deal with Scotland. It's great to have a model that fits all, but that's not in a realistic world. You have to tailor little bits of your model to fit different elements (Key informant, Participant H, CE channel manager).

It is clear from Participant H's acknowledgement of different geographical locations that there are differences in the needs of communities, which then affect their subsequent structures. For example, locations in rural Scotland may require different sources of energy in comparison to urban locations in central England. The projects that each community work on vary and each community may therefore need a different structure.

All of the communities involved are CIC's and are set up with the purpose of developing community assets and potentially making a profit, as Participant D explains:

> You don't hand over a million quid to a particular community. Turn yourself into a company and then you can make a million quid for yourselves (Key informant, Participant D, senior lecturer).

When reflecting on this type of structure, this participant insinuated that communities are often focused on operating like a sustainable business, and that large grants or funding for projects are not realistic for such communities. There is a notion that the sustainability and commercial nature of the group is important for it to operate. Although the sustainability of communities is implied as a key feature of becoming a CIC by Participant D, the culture of sustainability and the longevity of energy communities is questioned by Participant 1A:

> I can't say I've done very much about ensuring a legacy and ensuring continuity. I don't know how to do it to be honest. We just have to accept whoever's attracted to us and work with us (Participant 1A).

Participant 1A referred to the future of the group by discussing legacy and continuity. In this instance, it seems as though the group leader wants to continue his/her involvement, whilst building a legacy that the community can remember. However, there seems to be a lack of knowledge on how to best achieve this outcome. Despite emphasizing a personal and group lack of know how, Participant 1A hints that the recruitment of other group members is a key part of building legacy and continuity.

In this particular community, it is clear that the group is struggling with member engagement and therefore accepts engagement from anyone interested in contributing to the group. However, the lack of success in legacy, continuity and member engagement acknowledged by Participant 1A is not a consequence of their low levels of enthusiasm for the community. Despite a lack of group knowledge on creating legacy and continuity, Participant 1D strongly acknowledged Participant 1A as the leader of the group and commends him for his enthusiasm and role in involving those in the community.

> Why? Because he's so dammed enthusiastic and we won't let him resign. He is permanent chairman whether he likes it or not and, to be quite honest, I won't make any bones about it, there's a good chance it would fall apart if he wasn't there. He is keen, he's enthusiastic and he's great. There are other people who are very enthusiastic but whether they could hold that group together or not, that's another issue all together (Participant 1D).

The commitment and enthusiasm of Participant 1A in the group is clear, and it seems to contribute to the relationship between others in the community, with him described as the "chairman". Although others in the group are equally enthusiastic, their ability to lead the group and their networking skills are questioned by Participant 1D. Group members in the community are all reluctant to let the group leader resign or move away from the position of power, highlighting the power dynamic in the

community. It is clear that the group leader may be feeling some form of social pressure to continue in the role, particularly from those in the community.

> Well it is but it's dangerous because everybody sits back and says okay, what's Bob's next big idea. But actually, other people are now coming forward with ideas which is terrific (Participant 1A).

The notion of a form of social pressure being placed upon Participant 1A is shown by the initial worry they will have to contribute the next innovative idea for the group. However, the subsequent description of relief that others within the community are contributing ideas shows how this social pressure may have eased over time.

Despite the social pressure that Participant 1A may be feeling, Participant 1C reinforced that the community has a governance structure and the power is held by all of the members of the community.

> Obviously we do have someone that looks after the finances because obviously we do get grants and we have to spend them, so we have got a finance and a sort of secretary role. And we do obviously have an annual AGM[6], so it's properly constituted (Participant 1C).

Participant 1C explained that the group structure is agreed at the AGM. The consideration of finance roles within the group also shows that each member has their own position and role within the group. The same individual elaborated, suggesting that:

> There's always different roles that people can play in the energy group. So, I think it's ensuring you have a mix of that. And I think sometimes it's identifying also what we think the key skills are and sometimes that key skill may have to be bought in and they may not be necessarily paid for but it could be somebody, could come from another group or could come from an energy organisation that might be able to plug that gap (Participant 1C).

This statement suggests that the structure of the group is reliant upon group members' ability to recognise each other's skills and experience. This can only happen when the group members are able to exchange and share their knowledge and when the group's main decision maker acknowledges each member's skillset.

In summary, energy communities have different structures, which are shaped by the power dynamics of the community. The explored data makes it clear that the group members influence the necessary structure and that this is not solely decided by the community leader. The preferred CIC community structure seen in the three communities seems to allow the group members to form a structure that

[6] AGM – Annual General Meeting.

benefits the group agenda and the needs of those involved. These are themes that will be further explored in the Sections to follow.

4.2.1.2 The skills and experience of group members

The previous Section introduced the notion that community members play a role in shaping a group structure that not only suits the community leader, but also the skills and experiences of those involved. The following sub Section will explore this issue further.

Like participants in community one, Participant 2B acknowledged that different members in community two have specific skills and different levels of experience.

> Also, the expertise, so (name of participant) has a lot of the HR capability, she knows about Governments and policies and she can, whilst not as good as we should be because we're full of volunteers, we're a lot better than the majority (Participant 2B).

In addition to recognising group members' specific HR experience, Participant 2B notes that volunteers are "not as good as they should be", implying that paid or full time professionals may provide greater benefit to the group. Although Participant 2B considered the group "better than the majority", there is a clear acknowledgement that the group has the potential to increase its combined knowledge and experience levels. Similarly, Participant 2A provided an example of how the group adjusts their structure and their roles, whilst sourcing knowledge and expertise from outsiders to the group.

> No, I mean (name of participant) and I meet regularly because I kind of fell into the position of helping him with the Annual Report and the VAT Return, dreaded VAT Return, simply because he needed help. We did get a trainee accountant helping us, we advertised through the Birmingham… Birmingham Council for Voluntary Services" (Participant 2A).

This example suggests that the group adjusts its structure and acknowledges the need for additional knowledge and support when completing specific tasks. As Participant 2A indicated, two members of the group were willing to help each other to meet the needs of the wider group. This occurred in an informal manner, where one participant felt obliged to help, rather than follow instructions from either the group leader or the wider group. This finding may show that some group members have more time and resources to contribute than others, as Participant 2B recognises:

> There's definitely two and that's (name of participant) and (name of participant). So, there's two things with that really, one, they have the most time, (name of participant) retired, (name of participant), whilst not retired, is I think in a position in his life where he doesn't have to earn a full time wage, so he works in projects here and there and he goes between (Participant 2B).

This quote indicates that the power in the group would seem to lie with those who can contribute the most time and resource to the group's agenda. This may explain why many of the participants involved in the community group are of an older age profile.

Although community two seems to have adopted more of an informal group structure, discussions with Participant G, who is the Managing partner of an energy consultancy, suggested that a more formal structure of commercial professionals would generate additional benefits. Participant G indicates that:

> They've created a proper commercial team. So, they do lots of projects, lots of activities and it's not just developing solar projects. There's also a project called Cosy Homes which they've launched, again in conjunction with the Council. So, they get support from that. So, they do raise money from other groups, but that's because there's a positive channel for what they're doing, and the Cosy Homes is looking at insulation and boiler and things for people who are in energy poverty. So, it's helping the local authority achieve a lot of its own objectives (Key informant, Participant G, managing partner)

The concept of a commercial team implies that members are paid and in this particular group, the Council seems to be providing support with both funding and other resources. Although the scale and the size of the Cosy Homes project is unclear, Participant G referred to the team as "proper", which implies it is professional and formal in its approach to meeting the group's objectives. The need for a commercial focus and professional structure in energy communities is further emphasized by Participant K, who leads the sustainability department at a large national corporation:

> I think the successful CE groups have actually a really professional structure to them because sometimes people think of a community initiative as perhaps being, well it is voluntary, perhaps its seen as being not very professional but actually the ones that, Westmill Wind Farms' a good example of this, there's a board who've got fantastic expertise on there, they've got a range of people with corporate expertise, renewable expertise, engineering... (Key informant, Participant K, head of sustainability).

The comparison between a more or less formal group structure is shaped by whether or not the group is voluntary and how much expertise resides within it. Indeed, Participant K's statement indicates that the more formal groups tend to have higher levels of expertise. This may be because the people involved have organisational backgrounds and see their role within the group as not being too different from what a corporate role would be. They are therefore aligning their group structure with their past experiences.

In summary, regardless of whether the structure of the community is formal or informal, the power dynamic within the group seems to be influenced by those who make large time and knowledge contributions to the agenda.

4.2.1.3 The structure of the community is dependent on group objectives

Sections 4.2.1.1 and 4.2.1.2 explored the idea that there is no widely recognised "go to" model for structuring an energy community, but the skills and experience of group members play a vital role in deciding the structure. This Section will add to these findings by discussing the role of community objectives in relation to chosen community structures.

In community one, the group's meeting schedule is referred to as a factor that fluctuates due to the changing agenda of the group, as Participant 1C stated:

> I think the energy group has decided to not be very rigid on always meeting every month but we meet more frequently when there's more projects active or grant deadlines or we've got to spend the money or we've got to do something in terms of the initiative we're doing and respond to that. So, it will sort of ebb and flow in terms of the regularity of its meeting. But the key thing is to still to promote energy efficiency and sustainability awareness in the community and actually secure people's time and or funding to make it happen (Participant 1C)

The discussion concerning the group's meetings shows the informal nature of the community in this community and reveals how the group's structure is related to its agenda, projects and deadlines. The idea that the regularity of the meetings' "ebb and flow" shows the flexibility and informal nature of the group's participants and signals its informal structure.

In comparison to community one, Participant 2B in community two discusses the relevance of the board election process to the structure of the group:

> I mean it's usually not very controversial in these kinds of organisations, unless things go horribly wrong you'd expect to be voted on unless you're about to shut up shop or embezzle some money far away. You'd expect to be re-elected (Participant 2B).

The nature of the group's structure is described as non-controversial, implying that the group members are relaxed and participate in an informal manner. Furthermore, members often get re-elected as they have little to no intention of harming the group or the community structure. The focus on community benefit in the way the group is structured is emphasized by Participant 2D:

> It isn't a situation where somebody is actually trying to line their own pockets from this. So the benefit is for the community and it's structured in such a way that if somebody did want to line their pockets they wouldn't be able to do so (Participant 2D).

Although the informal nature of the case studies has been emphasized, it seems that the communities are structured to benefit each member. This means that the power structure and decision-making influence across the group is shared amongst the board and cannot be influenced by one person for their own gain and personal motives.

Finally, the group in community three follows a similar approach to the other communities by structuring themselves based on community benefit and not financial interest, as Participant 3B explains:

> If we had too many people who were members who were not shareholders, they could make decisions at a general meeting that would not be in the interests of the people that have put their money in. So, we're not quite sure, we'd have to be, we'd have to look into it carefully about how to bring in members who are not, who haven't got a financial interest (Participant 3B).

This statement displays the group's intention to limit the number of members in the community and ensure that they have interests that align with the incumbent members. The community objective of focusing upon energy issues, particularly around religious buildings, shows how its agenda is influencing both those who are involved and the group's structure.

To summarize, discussions with the energy community participants from all three community cases show that the structure of each community tends to be influenced by the objectives and agenda of each group. Section 4.2.1 has explored the notion that there is a relationship between the structure of each community and the power dynamics within each group. Firstly, the findings show that there is no single or widely accepted way to structure an energy community. The community case studies in this research were structured as CIC's, but members openly acknowledge that other potential group structures could be adopted. For all three communities, the rationale for being structured as a CIC, is that their groups are set up to benefit the community and also to generate profit. Participants identify that the structure of these CICs is usually informal, where members are not just motivated by making profits. Such a structure seems to be happily accepted by members, in addition to democratic re-election processes and the acceptance of a group leader.

Furthermore, the group structure discussion has also shown that the energy communities are structured based on the skills and experience of those within the group. In particular, in community two it was apparent that those members who have more time, resource and experience in similar roles were willing to take on and accept more responsibility within the group. Finally, it has become clear that each group's structure is also dependent on its objectives and culture. In community one, the structure of the group was informal and not particularly professional, whilst community two there was greater flexibility in objectives, with the group altering meeting times to match the intensity of the schedule. Taken together, the consideration of the three sub themes within this Section show how the power within each community is constructed and shared amongst members.

4.2.2 **Knowledge ownership**

In the following Section, the role of knowledge ownership is considered, together with its relationship with how each group is structured. For each community, the knowledge owned by each member is

distinctly different, both in terms of the specific subject and the expertise level. The exploration of knowledge ownership encompassed the following three findings:

(1) Interests in energy and a thirst for knowledge binds the group members together.
(2) Knowledge levels differ, yet everyone's knowledge is valued.
(3) The leader of the group does not always possess the most knowledge and expertise.

4.2.2.1 Interest in energy and thirst for knowledge binds the group members together

Participants from each case discussed their motivations for learning more about the energy sector and improving their personal knowledge around energy communities. They also described those who get involved as being particularly proactive and willing to contribute significant personal resources for the benefit of the group. Discussions with Participant J, who conducts academic research on communities, explains that this description aligns with a specific profile of individuals who are likely to get involved within the community context:

> They have to be champions, and champions do not happen by accident. There are organisations like (name of organisation) that work specifically with cultivating champions. They identify people who may be willing to get into it, to invest time (Key informant, Participant J, Research fellow).

The term "champion" is a particularly strong word to use to describe those involved in energy communities, as it suggests they go above and beyond the required responsibilities and exceed expectations in their performance. Participant J also relates the term "champion" to those who are willing to "get into it" and "invest time", suggesting that their commitment level and sacrifice of personal resources is particularly high. This notion among energy communities is also described in community one by Participant 1B, who explains:

> You're not attracting converts; you're attracting a certain type of person (Participant 1B).

In other words, those involved in these energy communities are more likely to have interests in energy and in supporting the community. This means that the existing group does not have to spend time attempting to ignite the interest of new participants to the group's agenda. Similarly, in community two, Participant 2A describes one of the more influential members long-term interests in sustainability:

> I mean he did his PhD at Aston I think probably at least twenty years ago, probably longer, about aspects of sustainability and his whole life is dedicated to sustainability, recycling and all of that. He's got a little video on YouTube that shows how he gets, his annual black bag waste is one bag, he generates one black bag a year (Participant 2A).

This description shows that the individual has a lifelong interest in sustainability and issues surrounding energy. The member has also been educated to a very high level in these issues, which appears to have

given him the confidence and capability to change his day-to-day lifestyle, whilst also sharing knowledge on YouTube. Meanwhile, Participant 2C regarded all group members as having some kind of individual interest and experience in communities and energy-related activity.

> No we didn't necessarily know each other before, some of us knew some of us, so, but clearly, but yeah, I think each of us almost all of us were either involved in the kind of community sector, or the environmental sector or both. So clearly, because this is the overlap between the community sector and the environment sector that we're talking about, people had, to some extent, become aware of, got involved with those things. And we're people who had sufficient knowledge, confidence etc to join a board of directors and undertake the duties of being a director, so they may have been directors of other social enterprises in the past or still are (Participant 2C).

Participants in the group are therefore bounded by their interest in donating their own time and resources to causes that support the community and environmental sector. Participant 2C recognised that this energy community may not be the only group in which participants are involved. These issues could have a significant impact on the power within the group, depending on which individuals are involved in which other organisations outside of the energy community. For example, a director who is involved in a decision-making within a large social enterprise may have more influence, respect and decision-making power than others in the group. Furthermore, knowledge ownership seems to reside with those directors who have multiple experiences in other organisational settings and can reflect on experiences from outside the group. Using past experiences from similar energy communities or environmentally focused community groups may have a major influence on the participants' tacit knowledge levels.

4.2.2.2 Knowledge levels differ throughout the group, yet everyone's knowledge is valued

The data from the three communities consistently revealed the power relationships within the group. Although knowledge levels about different issues vary in each group and by individual, everyone's knowledge seemed to be valued, regardless of the level of insight or context. When discussing experiences of projects with energy communities across the UK, key informant Participant D explained the importance of two-way knowledge flow within these groups:

> I think that's the important point is that it is a two-way thing and it is about not privileging one particular form of knowledge over others. There's a tendency to privilege expert knowledge about energy in this field. And again, it comes back to this whole point about are you seeing energy from within or from without? And you know, if you're seeing it from within, you privilege energy expertise. And in the process, you exclude the people that actually matter (Key informant, Participant D, senior lecturer).

Reference is made to privileging expert knowledge, which the participant may have encountered in other groups. However, it is suggested that all knowledge within the group should be considered irrespective of the expertise of the sender. The participant justified this notion by relating it to how individuals view their role within the group and who owns the knowledge shared. This is done by questioning whether those in the group see energy from within or from without. It is suggested that those who see energy from within often have the tendency to "privilege energy expertise" and "exclude the people that actually matter" (Participant D), which highlights the importance of knowledge that is not necessarily energy specific. Participant D is suggesting that non-energy-specific knowledge often has the same importance within the group as energy specific knowledge. This factor could directly influence the power dynamics in the group, as individuals do not necessarily need to be energy experts to contribute important knowledge. For example, a newer member of the community could contribute significant amounts of project management knowledge and be valued just as highly as an energy expert within the community.

Participant J, who also works within HE, identified that knowledge gatekeeping and trust are important factors in the group's KS activity.

> It would be a very situational gatekeeper because maybe they trust (name of participant, group leader) when it comes to community in any project because he's an expert in solar panels and wind projects. But maybe if they had a completely different project about, I don't know, the programmes of vandalism because of teenagers in the shopping mall, they would want a completely different gatekeeper, somebody who was working with the community youth groups, for example (Key informant, Participant J, research fellow).

This statement indicates that knowledge levels within the group vary depending on the situation or project being completed. The participant uses the example of an expert in solar panels within the group, stating that their specific knowledge would be called upon and used effectively if needed for a solar project. However, the participant also referred to "knowledge gatekeepers" and suggested that one must be trusted within the group, otherwise their knowledge on a specific subject may not be considered as applicable as that of others. This comment indicates a possible censoring of KS within the group, based on trust and who owns or holds the knowledge.

Participant J also discusses the knowledge levels within the group and describes high level knowledge owners as "champions", but also highlights the importance of having strong social skills to complement expert energy knowledge.

> The social by far because technical, you can spend an afternoon learning about different kinds of energy schemes about crowdsourcing, crowdfunding, about wind generation, solar generation. To be a champion, you need to be familiar with the technologies, and you can't do that in one afternoon on the technology side, but you also need to understand your community,

> the needs of your community, who in your community will need to invest, and it may not be individuals (Key informant, Participant J, research fellow).

Participant J displays the importance of having social knowledge, as it allows group members to use their technical knowledge and meet the needs and wants of the surrounding community. The use of both types of knowledge seem to complement each other, which Participant J related to achieving the status of a "champion" (Participant D).

The notion that energy communities have a variety of knowledge pools and do not tend to privilege one form of knowledge is alluded to in community three. Participant 3D states that:

> There are different levels of experience, but (name of participant) is very good both on the technology side but also on the finance side. But we have got a strong pool of knowledge on both of those (Participant 3D).

The type of knowledge existing within the group could be highly tacit, as its ownership within the group is specific to the individual and their experiences. In addition, the group's knowledge is also referred to as a "pool", implying that the group's collective knowledge is owned by everyone in the group. Participant 3D reflects this view:

> We are pretty egalitarian in the way that we operate. We pool our skills. I mean perhaps, you know, we decided that (name of participant) would be better at Chairing the board meetings than (name of participant). So we were able to make that change. I think (name of participant) was not there the day you came. He's got a great friend who's an engineer in, a qualified heating engineer. So both can give us quite a lot of input about technical matters (Participant 3D).

The emphasis on the equal nature of everyone's role and the importance of their knowledge within the group is highlighted by Participant 3D's description of the power relationships as "egalitarian". This type of description implies that everyone in the group is equal, regardless of their experience or depth of knowledge on a particular topic. However, although the power culture within the group is described in this way, Participant 3D then recalls an instance where the group allowed a particular individual to conduct a role based on their expertise and specialised knowledge. This emphasizes the willingness of the group to trust each other, regardless of whether that places a particular individual in a position of power for the foreseeable future.

The placing of value upon all knowledge within the group is similar in community two. Participant 2C described the varying expertise of several members within the group.

> There have been a considerable comings and goings and I think we've done that rather well, in that we've had enough comings and goings to keep some new ideas and energy coming in, but

> if you just started from scratch with a whole load of ideas and energy, it wouldn't work because there wouldn't be enough knowledge of what we're doing to do it (Participant 2C).

Although it seems there has been a high rotation of participants within this energy community, Participant 2C emphasizes how new ideas are valued regardless of the fact that newer members may "come and go". Participant 2C is also describing a core range of ideas that the group follows. This issue is further described later in the discussion:

> We've got quite a number of people who are quite experienced with all this now, having done this for some years. I am aware that some groups, the directors have sort of drifted off so I hear, and left one person probably trying to do it which is not good and something we absolutely try to avoid I think. So we need, I said seven people to have a conversation, but you don't want one person doing everything, that would be a disaster, because that person would get ill, you know stop doing it (Participant 2C).

The comparison between this energy community and other energy communities is drawn by Participant 2C, who acknowledged the importance of retaining a core group of directors. Despite acknowledging the importance of this core group, they also stated that the involvement of more members in the KS process is vital, mainly because this responsibility could become too much for one person to manage. Considering the power relationships within the group, community two seems to encourage the involvement of more members irrespective of any potential changes in the balance of power.

Community one presents a different perspective on how the group values different types of knowledge, as Participant 1A stated:

> They've started that process and they look at things like the district council strategy and they look at county climate emergency strategy and try and fit into it. I can't be bothered. It's too much waiting. I know it's probably a lazy view but I'm retired. I just don't want to get professional. You see the two people driving the Lepton thing are both professionally from that background (Participant 1A).

As the group leader, Participant 1A showed more of an autocratic leadership style and a reluctance to accept ideas from those who may have a more professional background in the field of energy. In justifying this position by stating that they are "retired" and "don't want to get professional" (Participant 1A), this individual showed a clear rejection of a more formal culture within the group and indicated that they do not value knowledge if it does not align with their ideas. Perhaps this group leader is wary of someone more knowledgeable and professional threatening their leadership role within the group.

Despite the rejection from Participant 1A of a more formal structure and the potential for the owners of more knowledge to get involved with the community agenda, Participant 1E shows both acceptance and respect for the group leader's knowledge.

> I don't know how he does it, I really don't, but he always manages to find some fund which he can apply to and most of the time he gets the money. He's a magician (Participant 1E).

Although this shows clear acceptance and praise for the group leader, it also shows a lack of understanding of how the leader obtains funding for the group. In this instance, the leader may be purposely suppressing and withholding their expertise from the rest of the group in order to retain an authoritarian leadership role. This individual's knowledge is clearly valued by those in the group, yet the group leader does not seem to value professional knowledge from those who want to enter the group. This indicates that there may be a one-way flow of knowledge within the group, beginning with the group leader.

The knowledge levels within each community seem to differ, yet each community values and respects the different knowledge held by each group member. When possible, the ownership of the knowledge possessed is transferred from the individual to the group, via the sharing of knowledge in different projects. In some communities, a high turnover of members makes this a challenging process, but nonetheless, members attempt to "pool" their skills (Participant 3D). The power dynamic within each community seems to be spread in a way that allows each member to contribute their knowledge in a trustworthy manner.

4.2.2.3 The elected leader of the group does not always possess the most knowledge and expertise

Throughout discussion with various participants in all case studies, the energy community leader does not always necessarily possess the most knowledge within the group. This notion was also highlighted by key informants, who referred to the importance of perceptions, power, and the social aspect to energy communities, as Participant C states:

> You're a social scientist and you're actually looking at people's perceptions and power. I wouldn't call myself a heating engineer because I've actually got a degree. So, that enables me to make good designs but also I'm not particularly bright and thermodynamics is really easy to understand if you open your mind to it. A lot of women understand thermodynamics. They understand, if there is a draft coming under the door, that putting something in the way will stop it (Key informant, Participant C, managing director).

The need to understand the perceptions and power of the group is described as being similar to thermodynamics. Although this is a scientific term that relates to the transfer of heat, Participant C uses this scientific terminology as a metaphor for understanding the intangible nature of power and group relationships. It could also be suggested that a member does not need to be an expert in order to grasp the basics of a concept and therefore be in a position of power. In addition, Participant C seems to suggest that an individual's knowledge within the group is not necessarily the deciding factor in a power relationship.

Participant I, a manager of sustainability for a local council, associates those involved in energy communities who have a younger profile as being more knowledgeable about climate change than those who are older and more experienced.

> So the community group I was thinking about in terms of the hydro project they were the profiling you talk about. But there was a younger generation who developed sustainability, transition of sustainability. That was the other end of the profile. Younger, more savvy. Students, some of them were actually students. So they were doing this in their own time as well. Trying to make a difference. Looking at how they could make a difference. Very knowledgeable about these issues, climate change (Key informant, Participant I, sustainability manager).

When describing the younger profile of those involved in energy communities, Participant I is clearly surprised about the level of knowledge that is possessed by students on energy and sustainability issues. They also proposed that the younger generation are "more savvy", which implies that they may have an edge and use their knowledge more productively in comparison to older generations.

Knowledge levels within a community have been shown by members to vary, but compliment the use of different knowledge types. In community one, Participant 1A, who is the group leader, acknowledged their lack of technical knowledge and emphasizes that the group is bound by mutual interests:

> I needed technical information because I'm not very technical and I needed people to work with that have a common view and a common shared interest where we felt we could really make a difference. So that's how it all started (Participant 1A).

The common interests of the group and their vision of making a difference seems to be emphasized by Participant 1A as a more important factor than the knowledge level of both individuals and the group as a collective. In particular, the shared vision of the group is described as being particularly important to the group leader at the start of the group journey. Participant 1A states that he needed "people to work with", implying that a prerequisite when joining the group would be an acceptance of the leader's lower technical knowledge level. However, this could also show that the group leader is accepting of his low knowledge level and is looking for others to bridge that gap. When discussing the longevity of the group and the varying roles, Participant 1A explains:

> I think actually the network would continue because as other communities have come in we've picked up some very clever and very experienced people. Including people whose professional life has been in energy or, you know, housing or whatever. So they have much more inside information than me. I have to rely on other people to tell me. Because I'm not very technical. I'm a gardener (Participant 1A).

It is clear from this statement that the group leader has recruited new members from a variety of knowledgeable and professional backgrounds. Participant 1A described how he is reliant upon the levels of knowledge of others within the group, yet he still assumes the leadership position within the group. This suggests that a leadership role within energy communities is not overly dependent upon technical and specific energy knowledge.

Although it is clear that the leader of community one has a lower level of knowledge, there are examples of long-term participants that have maintained a high knowledge level and failed to share the vast majority of this knowledge with the group leader. Participant 1D is an example of a long-standing member of the group with specific energy knowledge:

> I'm retired. I've been retired for twelve years now but I have a degree in electrical engineering. Having said that, I've been out of engineering for a long time. The last part of my career was in sales, some of it technical but some of it not, so I've always had an interest in the engineering world (Participant 1D).

This individual has a vast amount of technical expertise and tacit knowledge, and despite being retired, does not assume the key leadership position within the group. Although this may be for personal reasons, this group member clearly has the interest and time to commit to such a position.

The knowledge of those that have the time and interest in the group has proven to be vital in the structuring and organisation of the community, particularly as they provide an alternative knowledge source for those leading the community. Within community two, Participant 2C expressed the culture and importance of varying knowledge sources within community two:

> But as I say, we couldn't have a board with 100 people on it, so it's extremely important to conserve, really, the knowledge that we have. If two thirds of us left tomorrow, it would be very difficult actually. If we suddenly went out onto the street and recruited a load of people who didn't know anything about it, we would have lost a huge amount actually by that. So it's what you call social capital that people know how to do things, and that's extremely important. So obviously, you need to refresh yourself, so it's not literally the same individuals going on and on and on and on forever (Participant 2C).

The importance of the current knowledge levels within the group and the significance of safeguarding that knowledge is conveyed. There is a suggestion that the group is fearful of losing the knowledge it obtained and that social capital is a key part of retaining this knowledge. The reference to social capital also shows that the group member values group engagement, social relationships and trust as key values in the KS process.

In community three, there is also evidence that the leader does not hold the most technical or energy specific knowledge, as Participant 3A illustrates:

> Because I had no technical knowledge, but one of the things I had to do was an energy performance certificate for my house, and I found that really interesting, to the extent that I thought, okay, I'd like to train to be a domestic energy assessor (Participant 3A).

As the group leader, this participant acknowledges that she is not the most knowledgeable within the group, but shows her personal interest in developing her energy knowledge and improving the energy performance of her house. This sets an example for the rest of the group and perhaps displays the qualities that the rest of the group perceive as valuable in the energy community.

In conclusion, it has been shown that the leader of a community does not always possess the most knowledge. Both technical and social forms of knowledge have emerged as two key forms of knowledge that complement each other. For example, it is clear that the group leader of community one has large amounts of social expertise and uses that to extract more tacit and technical knowledge from those around him.

4.2.3 Agenda discussion (democratic & autocratic)

Throughout the discussion with group participants, the leadership style within each group became apparent when considering KS experiences. All three of the energy communities showed elements of both democratic and autocratic leadership tendencies, whilst key informant participants also discussed how these tendencies may affect KS within communities. Within this Section, the exploration of the community agenda will showcase the following findings:

1) The democratic nature of the group is expressed by the openness of group discussions.
2) The decision-making power within the group is directly related to trust and interpersonal relationships.
3) There is a danger of "founders' syndrome".

4.2.3.1 The democratic nature of the group is expressed by the openness of group discussions

The following Section explores the group discussions that occur within each community and how these discussions contribute to the varying power dynamics. The openness of group discussions and danger of the group reverting to an autocratic culture is expressed by Participant 1A:

> Well it (the community leadership dynamic) is but it's dangerous because everybody sits back and says okay, what's Bob's next big idea. But actually, other people are now coming forward with ideas which is terrific. That's what I'd hoped would happen. So, we have probably at least three ideas floating about at the moment that are in embryonic stages (Participant 1A).

The transition from an autocratic culture to a more democratic KS environment is highlighted by the group leader, where Participant 1A applauds the transition. In addition, the group leader also describes the over reliance of one person's knowledge as "dangerous", implying that a democratic group culture

and discussion of knowledge is to be desired by the group. This democratic and open culture is shown within community two. Participant 2A states:

> So, that's okay and, you know, I think we're very open with them (the investors) and we've established a position of mutual trust. They understand that we're not trying to make money out of this, that we're trying to give them a decent rate of interest and four percent is still a decent rate of interest (Participant 2A).

The recognition of mutual trust within the group implies that each group member is happy to share their knowledge, perhaps knowing that those involved in the group will not threaten to use the knowledge for personal gain or affluence. Indeed, Participant 2A acknowledged that nobody in the group is participating for specific financial gain, although a minimal return is expected. The open culture in community two, particularly when discussing the group's agenda is further emphasized by Participant 2C:

> What we're trying to achieve is very lumpy. So we've done this (solar installation on a local building) seven times, and we're trying to do it for the eighth time. So we don't do this very often. So we have lots of meetings for everyone to come and discuss this (Participant 2C).

The regular discussion within the group and the culture of encouraging this discussion is justified by Participant 2C describing the nature of the group's operation as "very lumpy". Although it seems the group has completed similar tasks multiple times, discussion is still taking place between members, implying that the nature of the knowledge may be extremely complex and context specific. The nature of the group's agenda also shows that discussion may play a key role in mitigating the risk of the group making poor decisions.

Finally, similar beliefs are presented within community three, where Participant 3A alluded to the idea that the whole group participates in pursuing the desired the agenda:

> The, the only final thing that I wanted to touch on was**, is there anybody that you perceive to be kind of the key driver of the, is there any one person that's the key driver of everything that the group does or is it a kind of a group…** Oh I think, I think you'd say it was a group effort (Participant 3A).

The recognition by all three communities that there is regular discussion around the group's agenda shows that the nature of these communities is particularly democratic. Although the leadership traits of the group leaders are often autocratic, all three communities seem to engage in regular discussion where each group member's knowledge is trusted and valued. This seems to contribute to a shared power dynamic throughout each community, where every member can participate in KS discussions.

4.2.3.2 The decision-making power within the group is directly related to trust and interpersonal relationships

Throughout discussion with participants within each community, the concept of trust and the social relationships became particularly apparent when considering KS activity. In particular, the decision-making power seemed to become more centralised and shared when higher levels of trust were portrayed by participants.

In community two, where the group of core members seem to have particularly high knowledge levels due to previous industry experience, Participant 2A alluded to the ease with which the group raises finance:

> The group is very fortunate that we've got this kind of core group of investors who have invested once, twice, three times with us and they've put their hands up and, because we've sent an email around asking for expressions of interest on this new scheme, and yeah, no questions, they'll put in £500, £1,000, £2,000, whatever (Participant 2A).

The notion that the core group of investors is willing to invest significant sums of money without raising any questions shows that there is relationship of trust between the investors. In addition, the method of raising the finance via email is formal and professional, showing how the group communicates when making financial decisions. Additionally, Participant 2B provided clarity on the nature of the relationships between those in the group and those who have similar interests but are involved in other communities:

> So, that's really important because it grows the bond between the people involved. The people involved, if they go to the pub together they become friends. So, for example, I've gone on holiday with people from Friends of the Earth, to Germany, to Portugal, some other places (Participant 2B).

The depth of the relationships between members in this community and others is shown by their activities outside of the group. In this example, group members are friends outside of the community, meeting at the local pub and socialising on holidays in other countries. The informal nature and strength of group relationships therefore adds justification to each participant's reason for community involvement. The bonding of the group could be argued to be deeper than simply having interests in energy and the environment.

Finally, the importance of trust and relationships is explained by Participant 3A, who acknowledged the importance of physical buildings and assets in building trusting relationships.

> The buildings that are dear to the heart of the community, so if all those buildings started having solar panels, that's actually sending, it, that's actually a strong message…and the undermining, but it undermines, it's just undermining relationships all the time and so when you talk about

> community and want to build up community work, you're building up healthier relationships between people again (Participant 3A).

As this individual suggests, the power of the group as a collective is often determined by the views of the surrounding community. In this instance, Participant 3A uses solar panels on community buildings as an example of how tangible assets viewed by the community could increase the trust and belief that they have in the responsible energy community. The participant also mentioned the danger of "undermining" (Participant 3A) the relationship between the community and the energy group if trust is not present in the relationship.

In conclusion, the decision making both within and between communities is heavily influenced by the relationships between members. It seems that friendship between members allows decisions to be made confidently and efficiently, as community members seem to have known each other for lengthy periods of time.

4.2.3.3 There is a danger of "founders' syndrome"

Although the democratic nature and culture of the group has been explored and demonstrated by various participants, a more autocratic culture was also acknowledged by those within the communities. Participant D, a senior lecturer in a higher education setting, clearly outlined a number of alternative views for the researcher to consider and explore before beginning the community interviews:

> But these are the kind of elites as it were within the groups. And so you often actually get, and this is an interesting thing that's coming out in some of the work we've been doing more recently, is community energy's often presented as this kind of wonderful benevolent democratic thing that is almost romantically envisioned as something you can't criticise, 'cause it's communities doing it for themselves right. But what you often see is it's a small group within that community that's doing stuff. And it may or may not engage especially well with the wider community that it's part of (Key informant, Participant D, senior lecturer).

Intriguingly, Participant D critiqued the way in which energy communities are generally perceived and maintains that there is more to the culture and style of each group than the simple observation of it being a democratic community. The lack of engagement with the wider community may show that a small group within the community have their own agenda.

Within community one, the agenda seems to be driven by Participant 1A, where it could be argued that they are influencing the decision making because of "founder's syndrome", as Participant 1A acknowledged:

> You've got to have some people who have got the drive and energy to say "Let's just do it." Other people then come in. Of course, there are dangers with that in that you get founder's syndrome. In that you've got somebody who's a sort of, who set it all up so everybody thinks

> they're going to be there forever but sooner or later I'm going to stop doing what I'm doing, someone else will have to do it. And then either the vision will change and move on or it will just collapse (Participant 1A).

Whilst the participant presents "founder's syndrome" as a danger, this is also legitimised by the notion that the personnel within the group will change at some point in the group's journey and is further justified by their view that the key person within the group is the leader:

> I think it is all about who is leading the project. I'm impatient so I just bash on regardless. Other people have a very different way of working (Participant 1A).

Although Participant 1A further emphasized the importance of the group leader, they also recognised that this may not be the only way to operate and lead a group in the community space. Other participants within the group seem to allow Participant 1A to make decisions, whilst relinquishing leadership responsibilities willingly, as Participant 1D describes:

> Make no mistake about it, it's very much, (name of participant). He knows the people. He's got the drive. He'll do it (Participant 1D).

The acceptance of the autocratic leadership style within the group is justified by the individual's skill set and knowledge level. Participant 1D seemingly relinquishes their personal responsibility to engage in tasks, knowing that the group leader will complete the task on behalf of the group. Whilst community three shows similar signs of an autocratic leadership style and founder's syndrome, the group leader openly engages with the rest of the group when discussing the group's agenda. Participant 3C states that:

> (Name of participant), he writes the minutes, sends them to (name of participant) to approve and then she sends the minutes round. At the same time, she constructs an agenda and talks it through with me because I chair the meeting. I mean she's been very open about this but she gets carried away in speaking sometimes and I was getting out from having been there at two, getting out at five (Participant 3C).

It is clear from this statement that although the group leader approved the minutes and constructed the agenda, she shared responsibility of chairing the meeting and writing the notes with the wider group. This show of delegation indicates that the sign of a "founders' syndrome" is less prominent in community three, but exists when the group leader speaks too much at the expense of others. The leader is limiting the KS opportunity for others within the group and this emphasizes a type of power dynamic held by the leader.

In conclusion, there seems to be a danger that the leader of a community can limit the KS opportunity for others within the group. This may occur because the community leader possesses their own agenda,

whilst the remainder of the group seem happy relinquishing their opportunities because of the social knowledge possessed by the group leader. In community one, group members showed a vast amount of respect for the leader's skills and experience.

4.3 ENABLERS OF KNOWLEDGE SHARING

Throughout the data analysis, one of the emerging key themes associated with the various case studies were the key enablers that facilitated the sharing of knowledge within the group. In this Section, these will be referred to as "enablers of KS". Within this theme, the subthemes of openness, finance and innovation, and the group's direction of attention will be explored. Their role in facilitating KS activity will also be considered. The discussion of this theme will be used to explore the issues that will contribute to answering research question two.

4.3.1 Openness and friendship

Throughout the discussions with key informants and the three communities, it became apparent that openness and friendship helped facilitate KS both within the group and with other communities. In the context of this research, openness is where one participant shows a willingness to share knowledge, be transparent and display honesty with another. The level of openness was also accompanied by friendships within and between different communities. In this Section, the following three areas will be explored as themes within openness and friendship:

1) Friendships contribute to creating a culture of KS.
2) Openness is used to try and recruit new members.
3) The community drives the agenda of the group, the open culture is the bridge between the community and the group.

4.3.1.1 Friendships contribute to creating a culture of knowledge sharing

When exploring the culture of the various communities, it became evident in group discussions that friendships and an eagerness to hold meetings contributed towards the way in which knowledge was shared between participants. Prior to exploring the participants within the case studies, key informant Participant I inferred that honesty is respected when disagreements occur within groups:

> Not because I'm an unpleasant person or they're an unpleasant person but you can have disagreements about how you get to somewhere. But I don't see that as a problem personally. Because I think actually you can work around that. You can be honest with each other and you can say okay" (Key informant, Participant I, sustainability manager).

This deduction is significant because it highlights the role of honesty and compromise when two participants in the group disagree on a route to achieving the agreed agenda outcomes. It would be fair to assume that without a level of honesty or commitment to "working around" the disagreement, the group would struggle to operate and share knowledge effectively.

The openness and friendships within community one are made evident by Participant 1A, who discussed the tendency for group members to meet at the local village club for alcoholic beverages and discussion.

> The social element, which is really, that you're alluding to a bit is really important. So we always meet at the village club because we can get cheap beer. So we have a drink and a chat. And that's an important part of it. I mean you know, yeah it's funny but it's an important part of it. Different communities work in different ways and I guess it depends who's running the project. See, I'm impatient (Participant 1A).

Here the importance of the social aspect of the group is being emphasized, but this individual also revealed that his impatience influences the fact the group meets primarily in social settings, such as pubs. Indeed, Participant 1A also recognises that there are other groups that share knowledge differently. In comparison, Participant 2D from community two describes the social cohesion of the group as reliant upon long-term personal relationships with "people who you can trust for 20 years":

> These are long-term projects, for example you are getting into a relationship with somebody for 20 years. So, if you are actually borrowing share capital and that share capital has to be paid over a long period of time it's very important that you have relationships with people who you can trust for 20 years (Participant 2D).

This participant also described the cohesion in the group as "getting into a relationship with somebody for 20 years", which implies that the commitment when joining the group is significant. In this example, borrowing share capital is mentioned as one of the factors that makes the commitment so important, as the group as a collective is liable for large amounts of money. However, the risk of taking on this commitment is seemingly outweighed, as Participant 2D continues to describe the importance of social cohesion for community interest:

> I think that the community benefit society model holds a lot of promise because it actually creates the possibility of bringing people together and actually creating, and the possibility of using community shares in the form of actually capitalising effort. Funding effort. Makes it a very powerful model of future operation. Because think about it, what has happened here is that over a period of time there are assets which are owned by the community, for the benefit of the community, funded by the community (Participant 2D).

This statement indicates that the group has an open and collaborative culture. There is also a clear recognition that this community model and subsequent openness of the group is particularly powerful, as it allows the community to involve more people, generate more funds and allow assets to be controlled by the community.

Within the same group, Participant 2B also highlighted the openness of the group in the way that they socialise. Although the consistency of regular meetings may fluctuate due to times of the year and the agenda, the willingness of the group to socialise in an informal manner is made clear:

> We do socialise, we might go for a curry once or twice a year but it's not the same, I mean with Friends of the Earth it's more of a, you do campaigning and then some people socialise and because the meetings are every Monday there's more opportunity to bond whereas CE Birmingham meetings are once a month if there's lots of stuff going on. If it's a quiet period or we think there's nothing happening, it might be every two months (Participant 2B).

Similar to Participant 2D, an informal meeting place is mentioned which highlights the relaxed and open nature of the group when sharing knowledge. The status of the group as a CoP also becomes evident, as Participant 2D indicated that the group only socialises informally to meet the needs of the agenda. The regularity of the meetings is mentioned, showing that members only meet socially once or twice a year in comparison to other more sociable communities. Although friendships exist within community two, the agenda of the group does not require members to meet as frequently.

In community three, a similar pattern of openness is shown and linked to long-lasting friendships between the members. Participant 3B discusses his personal relationships with other members of the group and alludes to the notion that most of the group knew each other in different capacities, before the group was created:

> I mean I've been friends with (name of participant) since about 1970. And we lived together in a Christian community in Aston for ten years. So we've got a very long history. And (name of participant), I met (name of participant) through Eco Sutton and he was, he'll call himself a self-confessed green nut. And (name of participant) used to attend (name of participant's) church in Kings Heath. So that's how she linked in. And then we ran a public meeting to discuss things and that's how (name of participant) found us. And I mean she had already been for years working away in Solihull running something called Solihull Green Fayre. And (name of participant) was also a member of a church with (name of participant) and (name of participant). So it's, we're quite a sort of close friendship group (Participant 3B).

In addition to showcasing the long-lasting friendships between members of the group, Participant 2D also showed how the openness of the group has played a role in the recruitment of new members. The discussion of the group's agenda at a public meeting resulted in a new participant joining the group. In this case, she also had the same personal interests as those already within the group, showing the true nature of the group as a CoP. However, it is clear that the new member may have known the leaders of the community before joining. The closeness and friendships within the group result in high levels of openness internally but could be seen as cliquey and exclusive to outsiders that are looking to join the community.

In conclusion, all three case studies have shown how the personal relationships within each group have played a role in defining the culture of openness within the group. In community one, this was emphasized by honesty, discussion and meeting regularly at informal meeting places for discussion.

Community two presented a similar story and showed the importance of long-lasting relationships and openness when making a long-term commitment to the group and its community owned assets. Finally, community three displayed how the nature of the groups friendships resulted in openness and the recruitment of new members.

4.3.1.2 Openness is used to try and recruit new members

Evidence of the sharing of this culture of openness is also seen in relation to subsequent recruitment of members. The three communities went on to show how they were aware of the challenges facing the longevity of the group, and the need to recruit a younger age demographic. In community one, Participant 1B states that:

> A big thing that we need to change is the age profile. When I've been, it's predominantly retired people. You'll get different profiles of people at the start, but it's normally retired people and of a certain type. They're caring, nice people. We need a few people that aren't as nice and aren't possibly as caring and maybe a few more risk takers involved who will push things about" (Participant 1B).

When discussing the age profile within the group, Participant 1B associated those who are not pensioners as members that could be less caring and more willing to take risks. The suggestion here is that the current older profile of the group are "too nice" and engage in lower risk activity. Participant 1D adds to this by highlighting the need for newer ideas:

> I mean, people come and go because they're seriously tied up with grandchildren right now so we don't see as much of them, but then other younger people have joined, which is good. We've had some new faces recently who have come in with new ideas and that's what we need. We need to involve more people, younger people, and just get more ideas generated (Participant 1D).

The focus of this group on recruiting younger members shows that they are open and willing to face such as power, hierarchy and knowledge ownership. This is somewhat surprising as change may also move the group from the autocratic and top-down nature of KS that is seen in this community. Nonetheless, the group appears to be unified and open to change.

Data from community two displays a similar openness and attempts to recruit a younger age demographic by sharing knowledge. Participant 2D shares the group's discussions on visiting local schools, whilst viewing it as a potential focus of the group's agenda in the future:

> One of the things we were talking about last year, because we thought energy as an infrastructure was going to be over, was doing more community work, so things like going to schools and talking about CE, going to other community groups and talking about why this is

> important, but there's only so much you can do and one of the questions, talking about trends, is once this final installation over there isn't actually a pathway (Participant 2D).

Although this comment shows how the openness of the group can be used to discuss why CE is important more widely within the community, they also acknowledged that the future of community work could involve the education of the next generation. The lack of a pathway for the group is clearly worrying, yet they still show a level of openness and share their worried thoughts in the discussion.

To conclude, communities one and two are both using the open nature of their group and discussions in an attempt to attract a younger age demographic. The reasons for this are that they are both seeking new ideas to drive forward their future energy agenda within their specific communities. In addition, both communities are using the interaction with other demographics as an opportunity to share knowledge.

4.3.1.3 The open culture is the bridge between the community and the group

The exploration of openness and how the concept is used by the various energy communities can be used as a probe for exploring the relationship between the groups and the wider community. Participants showed that openness played a key role in developing the relationship between each energy group and their wider communities. Participant K, who is head of sustainability for a large corporation, discussed the importance of having open meetings with the wider community to show this openness:

> To enable that sharing discussion to take place, you've got the right people in the room but I also think it's then worth having the more open meetings, like Westmill Wind farm do, whether it's the AGM or educational events, where all the community are invited to it and the ideas and best practises are then shared locally, you know, whether it's a technical fault with a wind turbine where you've got someone with engineering expertise who can talk about why that's happening and then you've got somebody else from perhaps more renewable energy expertise who will understand the wind patterns and they would then share that knowledge with the engineer, the wind pattern expert and they would then sort of come up with probably like a really good solution of perhaps when the turbine needs to be optimised and when it doesn't (Key informant, Participant K, head of sustainability).

The openness of meetings with the wider community can be seen to contribute to the KS process. In the above example, best practices on a topic can be shared locally between participants of different community groups. Participant K also acknowledged that different people bring different areas of expertise, which could diversify the types of knowledge shared within the group. Similarly, the group leader of community one, Participant 1A, also alluded to the role of openness in managing the relationship between the group and the wider community:

> I think what we're trying to do is provide as much resource as possible and then let people because it really has to be what that community wants to do. So in some communities they're

> much more interested in community woodlands or orchards or community growing projects you know, eco projects of that kind, much more land based. So if that's what they want to do, it's all needed so fine. It's much better to take people from where they are and then let them build. It's what we did (Participant 1A).

The openness between the group and the community seems to be a result of the honesty and clarity around the group's agenda. The community clearly has a key role in influencing the projects in which the group decides to engage. In acknowledging this point, there is the suggestion that there is a two-way knowledge flow across a metaphorical "bridge" created by openness between the wider community and the actual energy community. This relationship is also evident in community three, where Participant 3D explains the methods of engagement that the group use to communicate with the wider community.

> That equates to, at least, globally reducing carbon emissions by 50%. Some would say that it's actually… we should be going well beyond that but we're on the background where the emissions are globally rising. So, that really is our starting point, to engage and this has engaged us with a very wide range of organisations. Over the years, we've run conferences, exhibitions, seminars, workshops and so on, to help effect that vision (Participant 3D).

This high level of openness and clarity is similar to the points made by Participant K, where the group is clear and open about its vision and invites the wider community to numerous events across the year. In this case, Participant 3D indicates that these events help the group meet their vision of reducing carbon emissions, which suggests that events are a key vehicle through which the group can share its knowledge with the wider community.

Throughout the discussion with participants, the role of openness in the KS process became more apparent when thinking about the group's agenda and the wider community. Having openness and a willingness to engage for both parties could be viewed as a key enabler to sharing knowledge in this context.

4.3.2 **Finance and innovation**

Within the CE context, innovation and finance were frequently mentioned by participants as key themes that influenced community success, in terms of achieving their agenda and sharing knowledge within the group. It became clear that finance to sustain the group has become increasingly difficult to obtain and therefore requires a group member with extensive knowledge and experience in sourcing funding avenues. This Section will explore the following two findings:

1) Innovation is driven by the funding made available to the group.
2) Lack of funding can have a negative impact upon group innovation.

4.3.2.1 Innovation is driven by the funding made available to the group

Data from across the communities suggests that innovation occurred when the group had sufficient access to sources of finance. Participant D, a senior lecturer in a higher education setting, highlights this relationship by discussing some recent funding for twenty-two energy communities in 2009.

> And so the big example of that is the Low Carbon Community Challenge which ran I think from 2009 to 2012 where they picked 22 communities and they gave them all a million quid or whatever it was to go and do something really exciting in their local area right. And these groups went out there and did stuff that was really exciting and innovative. But at the time there was funding available, there were grants available and the community energy sector blossomed (Key informant, Participant D, senior lecturer).

The three year period that Participant D discussed shows how funding can stimulate innovation and excitement in the sector. The CE sector is described as having "blossomed", showing the influence that large amounts of funding can have:

> They wanted to do something really interesting and far reaching, but they felt for the grant, in order to get the money and continue to survive they had to kind of tone down those radical objectives right. In order to get the money. They might still have them and actually when they had the money, they might then still act on them to extent but they couldn't talk about them actively when the grant was being evaluated. By contrast, if you go to a more professionalised business type framework which is what we've seen in the last ten years or what seven years, there's no room at all for those radical objectives to come out (Key informant, Participant D, senior lecturer).

Here Participant D identified the extent to which energy communities value the funding they receive. Despite the nature of these communities and the enthusiasm they have to pursue radical objectives, it is clear that the requirements of the funding encourage community groups to pursue a safer and less innovative agenda. Nevertheless, energy communities are innovating with their objectives and this funding allows communities to share knowledge both internally and externally.

Similarly, community one alluded to the availability of funding and described how funding plays a key role in allowing the group to conduct a feasibility study. Participant 1A stated that:

> We applied for something called the Rural Community Energy Fund. RCEF. And they have given us a grant of about thirty-four grand to do a feasibility study into a project that would install a very modern new technology type of wind turbine which we talked about when you were last here (Participant 1A).

This description of how much funding the group received and where it came from, shows how important the source of the funding is to the group. Although the group pre-planned to conduct a feasibility study on a new technology, this would not have been achievable without the funding that was granted to them.

To conclude, communities are known to show proficiency in innovating and creating new ideas for their group agenda. However, it is the funding that is made available to them that allows the community to proceed with their agenda and share the knowledge both within the group and externally.

4.3.2.2 Lack of funding can have a negative impact upon group innovation

In contrast to funding being a catalyst for innovation, some of those interviewed expressed the opposite view, where having a lack of access to funding could harm the community's ability to innovate. Participant 1B, for example, discussed how this prevents energy communities from making a bigger impact on their wider communities or upscaling their operations:

> The thing is with community energy, you'll know this better than I do, there are so many barriers put in front of communities trying to do this, whether it's feed in tariffs, or if you go to a bigger scale, you then need to pay the energy companies considerable amounts of money in order to do that. This is one of the things I do feel quite strongly about, as we were having our chat beforehand. I think in the UK, we're very good at certain things and innovative thought and engineering, we're very good at. This is a whole sector that if the government incentivised or reduced the barriers to people doing things like this, it's like in the village here, we've got people who run around in cars on cooking oil from fishmongers or fish and chip shops. I know it's a silly example, but there are people out there who have got inquisitive minds and it's not a function of age, and they can turn their mind to engineering. Then why can't those things on small scale initially be produced over here with the patents and all the design things that we do have advantages for and are small scale, and of course, if we do need to produce them elsewhere, that will happen (Participant 1B).

This detailed and complex statement highlights the frustration of the group and their lack of innovative thinking when requiring more funding for the group. Participant 1B discussed how important incentivisation is from a government level and how there are many people in the community that have "inquisitive minds" (Participant 1B). This description shows the group's acknowledgement of a high knowledge level within the community. However, there is a frustration at the lack of funding available and the group seems to feel they are limited in what they can achieve. The example of locals using cooking oil for gas in their cars, shows that the community can be naturally innovative, but may just need funding to display and share these innovations. The lack of funding for the group seems to be demotivating and frustrating, which could discourage innovative ideas and KS within the group.

In addition, Participant 1A implied that the innovative objectives and outward facing nature of the group are not looked upon favourably by funding sources:

> We've also, we've got an eye with that project also to the future to hydrogen. But we've been kind of, we've been advised by RCEF not to try and go too far ahead. But a group of us are very interested in hydrogen. We can see it's coming fast now so we're trying to keep tabs on that (Participant 1A).

Within the energy sector, this is worrying for communities as the funding they are seeking is accompanied by a set of rules by which they must abide. These funding rules seem to be limiting community creativity and innovation. The reason the funder may want to limit the group's innovative activity may be that they want to lower the risk of their investment and ensure that the money is being used on projects that they know will have a higher success rate. The ability of the energy group in community one to seek and react to external trends is made clear, but funding sources are limiting their ability to engage in activities that will enable them to respond.

In conclusion, the funding made available to energy communities can have both a positive and negative effect on innovation and creativity. The acquisition of funding for a community can allow them to operate projects on their agenda in an effective and efficient manner. However, a lack of funding or funding that comes with a set of rules can discourage the members of a community and frustrate them in the process of carrying out the group agenda. In many cases, funding may be crucial for the sharing of knowledge between communities. For example, knowledge of opportunities with hydrogen projects in community one may not be shared with other groups because of the set of rules imposed by the funder.

4.3.3 **Awareness of the group**

The final key influencer on the KS ability of the group is the ability of the energy community to identify trends both inside and outside of the group. This was discussed by participants across the different case studies, when thinking about the needs and wants of their surrounding communities. This Section highlights two key areas for discussion: first, how the group searches for trends that are important to the wider community; and second, how the groups readily able to share knowledge within the group, but struggle to emulate this externally.

4.3.3.1 Needs of the community

When discussing KS activity with participants, the key global trends in the sector were highlighted by key informants, whilst the importance of these trends was also emphasized. Participant A, a director of estates who has energy community experience, considered the importance of tackling carbon emissions in an aggressive manner:

> But on the latest people and planet, we've had a separate review, the comment that I liked… their exact words were "we were being very aggressive in reducing our carbon emissions". That's a big compliment to make because we had been very aggressive (Key informant, Participant A, director of estates).

This shows how important this aggressive approach is to the institution and the wider community. Participant A seems to have identified some important wants and needs of the community.

Each case behaved in an outward facing manner and actively attempted to find and respond to wider energy trends that would impact on their communities. In community one, the group leader recognised the group's need to scan the wider environment for trends that may influence both the group and the wider community, as Participant 1A stated:

> We've also, we've got an eye with that project also to the future to hydrogen. But we've been kind of, we've been advised by RCEF not to try and go too far ahead. But a group of us are very interested in hydrogen. We can see it's coming fast now so we're trying to keep tabs on that (Participant 1A).

This recognition of hydrogen as a future energy trend shows that the group is looking to receive knowledge from other groups and organisations in this space. Furthermore, it seems that more than one member of the group is interested in this trend. The notion that many participants within community one are interested in hydrogen, shows how the group's mutual interests may allow KS to take place in a more effective manner. Without this mutual interest, members may find it difficult to share knowledge with those who do not have similar interest and are not willing to receive this knowledge.

The group in community two is similarly interesting, with the group holding community meetings to discuss trends and the actions of government, as Participant 2A explained:

> We had community meetings, we got people together, we talked about what it was all about, why it was important to retrofit your house and save energy and all the rest of it and it was really hard work for the people involved. I mean it's a no-brainer really, I mean obviously not everyone can afford solid wall insulation and all the rest of it and of course that didn't work out anyway because they hadn't gone, I mean it was Labour, Ed Miliband actually that came up with the Green Deal, by the time it was kind of put into operation it was the Coalition Government, it was Ed Davies, a LibDem, who was Secretary of State for Energy (Participant 2A).

The indication is that the group placed a high level of importance upon spotting and responding to trends and the actions of wider stakeholders. This level of importance is emphasized by the way that the group sets up meetings and group discussions on insulation and government schemes such as the "Green deal". This finding suggests that wider trends and schemes have a trickle-down effect, perhaps

acting as a stimulus for KS and discussion around potential CE projects. Finally, discussion with members from the group in community three suggested that they too were interested in wider energy trends and showed the group's intention to look for these and respond effectively, as Participant 3D explained:

> I think everyone is motivated by the big issue, the big challenge, namely climate change and then they take that further by seeing how they can use their funding or their knowledge to start to do things, make things happen by way of, in this instance, a solar farm, but it could be other things, as you know from the Harbury Energy, but essentially, that's a starting point; the awareness of the challenge that we've got, formidable challenge that we've got (Participant 3D).

Group members in community three seem to be motivated by the "big challenge" and this has contributed to the bonding of the group. In addition, the value of the group's knowledge and how each group member plans to use it is emphasized, but also described as a "starting point" in helping to amass the group's "formidable challenge". The description of the groups knowledge as a starting point implies that there is still a large amount of knowledge to be received on the wider issues that influence the group. This statement suggests that the individuals within the group have a thirst for new knowledge from outside of the group.

In conclusion, participants from all three communities have shown an eagerness to seek and obtain knowledge from external but influential stakeholders in the energy sector. In the examples shown, these mainly include activity from other groups and the government. The motives for participant engagement are shown to strongly contribute towards helping communities seek and identify energy trends, but it is the identification of these trends that gives the communities a reason to meet and share knowledge.

4.3.3.2 Sharing knowledge with other communities

This Section illustrates the outward facing nature of the three communities by exploring how they collaborate and communicate with other similar energy communities. It became increasingly clear that each community encouraged KS groups that shared similar objectives. Within the first community, the ambition and outward facing nature of the group was expressed by the group leader's enthusiasm for creating a region wide low carbon community network, as Participant 1A explained:

> The beginning of last year we started to create what we hoped would be a Warwickshire wide network of low carbon communities like ours. Because we knew what we were doing. We knew that over at (name of community), they were doing something or other. And they've got some pretty good projects going there and that's quite a vibrant group (Participant 1A).

The outward facing nature of the group seems to come to fruition once the group leader is satisfied that the group has a high collective knowledge level on the relevant topics. Participant 1A justified the

group's actions and their pursuit of KS partners by stating that "we knew what we were doing". This also implies that having a higher knowledge level and experience within the CE sector gives members of the energy community a higher confidence level when attempting to share knowledge. In addition, this participant related to the other group's objectives and culture by describing them as a group that have "pretty good" and "vibrant" projects, indicate that such a vibrant culture could be desirable for KS.

Similarly, community two display their enthusiasm for collaboration and KS with other groups. In this example, Participant 2D explored how collaborations can help an energy community with sharing knowledge across different geographical locations and with different types of people:

> So examples of how collaboration can add value are for example, things like being able to reach different geographies, different ethnicities, have multi-skills. So for example you are not just in the area of mental health, but you understand mental health in elderly people (Participant 2D).

This comment indicates that collaboration has a distinct relationship with adding value to the group. In particular, this value is described as reaching different locations, ethnicities of people and therefore different skillsets. The example re-enforces the notion that there is a specific profile and type of person that gets involved in energy communities. The acknowledgement elderly people may be key benefactors when collaborating, shows how contextual KS in this context can be.

The data from the third community suggested signs of an outward facing nature, but looked to engage in more than collaboration with other communities. Participants seemed to acknowledge their challenges, describing them as problems and looked for collaboration and mergers as potential solutions to these problems, as Participant 3B revealed:

> We need to consider being taken over by an organisation, another, I mean a bigger more dynamic co-op really. We need to find someone to merge with. I mean because, I think I may have said at that meeting, it's interesting that South Staffs Community Energy are in a way showing similar problems to ours in that they sent a note round to members saying we've got to find ourselves a new Chair and no one's come forward at the moment. So they are in a similar position to ourselves. So maybe they'll be looking for a merger as well (Participant 3B).

When referring to the group's need for merger, Participant 3B also related the community position to that of another of a similar size. This shows community three has a clear outward facing nature and uses other communities with similar objectives as benchmarks for performance. In this case, the acknowledgement of the groups struggles has lead Participant 3B to believe that the community needs more than collaboration to achieve success, implying that the KS may not provide the solution that scale, and group size potentially can.

To conclude, all three energy communities have an outward facing nature that allows them to use other energy communities as KS companions, as well as comparisons and benchmarks for performance. It became clear that the case studies seek other communities that have similar group objectives but have access to other geographical locations and knowledge sets. For example, Participant 2D recognised the benefit of collaborating with other groups containing people with different ethnicities and multiple skills.

4.4 STAGE OF THE COMMUNITY JOURNEY

The following Section will explore the idea that each energy community experiences phases of community maturity based on the progress they have made since their inception. The exploration of this theme is particularly significant in showing what drives KS across the majority of the participants that were interviewed. Firstly, the role of membership will be explored, showing how the profile and expertise level of members changes over time. Within this theme, the stages of "initiation" and "development" are identified as key phases of the community journey. Next, the networking of the communities will be considered as an "interaction" phase. This will be followed by the exploration of trust as a "socialization" phase. Finally, the size of the group is explored, and the "analysis" and "reformation" phases of community maturity are identified.

4.4.1 **Membership**

Throughout the explored data, the theme of membership became a key consideration when exploring the KS activity within each group. Membership within each community group appeared to follow a similar pattern, where motivations for engagement and eagerness to take action were prevalent, regardless of the maturity stage of the group.

4.4.1.1 Action and "initiation"

The first phase of the community journey is considered to involve having an eagerness to set up the group and start the membership. Key informant Participant G stated that:

> It starts with a bit of enthusiasm and then you get people who feel obliged to go because it's a friend of a friend type thing, but they're hard to run and they're always run by volunteers. Whilst that is maintained, there have been good examples of successful village purchase of pubs for example and turn them in to utility buildings where now it's the pub, the post office, that type of thing (Key informant, Participant G, managing partner).

These comments indicate that the proactiveness of the group is partly about honouring long-lasting friendships and that group members feel obliged to support people they know. This demonstrates a level of reciprocity, where members feel obliged to recognise the positive actions of others by responding with positive actions of their own. Based on this, it seems that action is taken by members because they have a certain level of pre-existing trust with those around them, mainly because they are long-standing and well known friends.

Within community one, the group leader demonstrated how their interest, rather than their expertise or knowledge, has guided them to taking action within their local community, as Participant 1A describes:

> So when it became clear that we really needed to do something about climate change and not just talk about it which we've been doing almost as long as I've been involved in environmental

> action and nothing's changed. So about ten years ago I just decided right I'm fed up with talking about it let's do something (Participant 1A).

Although this participant's understanding of the energy sector is based on research and interest, they felt that their commitment to taking action was the primary tool needed to initiate the energy community. Importantly, there is no mention of any knowledge level that should be required to take action and start the energy community.

Since the group's conception, this participant has developed their knowledge over time, by converting their interest and "talking" into community action and activity. This is an example of explicit sharing and receiving of knowledge, in which an individual can create new knowledge for themselves. Participant 1A is showing that regardless of their knowledge level, new tacit knowledge levels can be created within the community context if a group member has the enthusiasm to act.

Similarly, in community two, Participant 2A showed how enthusiasm and a high engagement level with the group has allowed her to take action and develop new knowledge levels.

> I mean (name of participant) and I meet regularly because I kind of fell into the position of helping him with the Annual Report and the VAT Return, dreaded VAT Return, simply because he needed help. We did get a trainee accountant helping us, we advertised through the Birmingham, what's it called, it's the organisation at the top of Digbeth, they've got an office at the top of Digbeth, Council for Voluntary Services, Birmingham Council for Voluntary Services (Participant 2A).

This willingness of individuals to get involved in activities in which they have limited experience, shows how the culture and attitude of the group encourages action regardless of knowledge level. In this instance, Participant 2A is supporting another member with the finances of the group, where neither have high levels of knowledge.

Meanwhile, from the community group in community three, Participant 3A suggests that only one or two of the group members possess technical energy knowledge:

> Other sides, but one of our board is, describes himself as a solar nut and he just goes, he, he's technical, he's got the technical side (Participant 3A).

The description of another group member as a "solar nut" and "technical" shows the groups acknowledgement of high level knowledge, but also indicates that most of the group lack this high level technical knowledge. In this group, one or two members hold the technical knowledge, whilst the other participants use their enthusiasm and actions to implement the groups agenda. This group's experience and the fact it has existed over a long time period, shows that collective technical knowledge among all members is not necessary for the group to be successful.

In conclusion, the existence of energy communities shows that not all group members have high levels of energy specific knowledge. However, it is their engagement and readiness to take action on the group agenda that allows these groups to complete tasks and ultimately to survive. Participants also suggested that a small number of group members have a higher level of energy expertise, signifying that this is something the wider group actively acknowledges. It became clear that it is necessary for a small number of group members to develop higher level technical knowledge which would then support the group's operation. However, this knowledge seems to reside within the individual and is highly tacit in nature, so it is important that this knowledge is extracted and shared with the group. The initial membership and acting in the community could be described as a phase of "initiation".

4.4.1.2 The community "development" phase

During the discussions with all three communities, it became clear that each group progressed their journey through stages of development and maturity. Participants described how these stages seemed to significantly influence the KS within each group.

Key informants alluded to the importance of time and group maturity in the development and sharing of knowledge within these kinds of groups. However, as Participant A explains, this can require changing a group's focus, which can be difficult to achieve.

> Our philosophy here, which has taken me 12 years to change the culture, especially with electricity, what we try to do… so our focus now is to generate as much as we can on campus, because that will mean that we're only pulling so much off the network which is failing anyway (Key informant, Participant A, director of estates).

The recognition that an energy related focus for a community can take a significant amount of time to develop shows that there may be various stages of development that the group needs to engage in to achieve this focus. The first of these stages is highlighted by Participant 1B, who shares community one's desire to recruit younger members who are not retired:

> A big thing that we need to change is the age profile. When I've been, it's predominantly retired people. You'll get different profiles of people at the start, but it's normally retired people and of a certain type. They're caring, nice people. We need a few people that aren't as nice and aren't possibly as caring and maybe a few more risk takers involved who will push things about (Participant 1B).

The above notion that a younger profile of person will "push things about" shows that the group members may be remaining in their "comfort zone" and that more innovative and radical ideas are needed. Participant 1B acknowledged that the group was conceived with a core group of older retired people, but that it now needs to develop the knowledge and expertise of the group by recruiting younger people. This is significant because it highlights that the group has been through an initiation stage

involving older members, which is followed by a recruitment and development stage where the group looks to share and receive new knowledge by recruiting a different profile of member.

Similarly, community two shows that the conception of the group was bounded by a core set of motivations and values, but participants also acknowledged their openness to receiving new members with different types and levels of knowledge, as Participant 2B articulates:

> Well, anybody can get involved but if you're not environmentally minded in the first place or if you don't have some background knowledge it's just a steep learning curve. Anybody can get involved (Participant 2B).

The development of the individual's knowledge when joining the group is described by Participant 2B as a "steep learning curve", showing that new members who join will undoubtably receive some of the shared knowledge within the group. This development in the individual's knowledge also highlights how the KS influences the group's collective learning and development. When new members join, their knowledge improves over time, adding to the collective depth to the group's knowledge base. This could be described as a development phase, which occurs as a result of the group recruiting new members.

Finally, Participant 3D shows the progress and impact that the group in community three has had on the surrounding community:

> That equates to, at least, globally reducing carbon emissions by 50%. Some would say that it's actually… we should be going well beyond that but we're on the background where the emissions are globally rising. So, that really is our starting point, to engage and this has engaged us with a very wide range of organisations. Over the years, we've run conferences, exhibitions, seminars, workshops and so on, to help effect that vision (Participant 3D).

Notably, this individual described the group's collective starting point and their acknowledgement of the global carbon emission challenge. The events they describe seem to heavily reflect the group's KS vision and ambition to tackle carbon emission targets. Like communities one and two, a clear development of the group has taken place from conception to present, with the group acquiring the personnel and resources to manage these events.

In conclusion, all three communities have shown how the group has transitioned from "initiation" to a "development" phase by widely contributing to various aspects of the wider community agenda. The transition is supported by the group becoming involved in a range of community activities that deepen their connections with the community. Furthermore, this transition seems to be associated with recruiting younger members with different expertise levels, predominantly to inspire innovation and new ways of thinking. This approach seems to be a deliberate attempt to support KS, as the group expects younger members to bring new knowledge.

4.4.1.3 Recruiting members with the same interests

Considering the emergence of a "development" phase of community maturity, it became clear that each community experienced a period of recruitment within this phase. Each energy community adhered to a common selection criterion, that new members should share similar interests with the existing group. In community one, there was evidence that this collective shared interest involved every member believing that they can make a difference. As the leader of community one, Participant 1A, explained:

> I needed technical information because I'm not very technical and I needed people to work with a common view and a common shared interest where we felt we could really make a difference. So that's how it all started (Participant 1A).

In failing to mention the knowledge levels she is seeking, this participant seems to prioritise common interest over the knowledge and expertise of participants. In the "development" phase of community maturity, it seems that shared values and common interests are conditions that underpin this phase of development. Communities one and two indicated that shared interests are the main requisite factor for the group. Participant 1C states that:

> Yeah I've been involved in (name of initiative) from its inception. As I say, the group was really started on the back of an interest of mainly retired people who have got more time to have an interest in energy saving measures (Participant 1C).

Similarly, Participant 2A explains that:

> Well, I think I got involved almost through my daughter, I mean she was the one that sort of got me thinking about sustainability generally and being more aware of recycling and renewables and stuff like that. When I retired from the university, which was 2010… (Participant 2A).

Adding to the notion that community members are interested in energy saving measures, both communities seem to gain involvement from older people who are often retired and have more time to dedicate to the group. However, in some cases it seems that their interest has been piqued by younger members who are more interested in energy and sustainability. Participant 2A received knowledge from her daughter that generated a personal interest in energy, but only following retirement, that brought with it the time to pursue these interests. Notably, the participant's interests were a result of significant involvement with a younger family member, with the age profile of the type of individual that the community is now looking to recruit.

In conclusion, each of the energy communities seeks to recruit new members who have the common interest of making a difference. During the conception of the group, participants emphasized this issue as one that is more important than adding a new members expert knowledge to the group. In other

words, having an interest in sustainability and energy is the deciding factor when considering the addition of new members to the group, regardless of the knowledge level or experience.

4.4.2 Networking and "socialization"

The openness of each group and their styles of networking is a recurring theme throughout the data. The KS activity within each community indicates that different methods of sharing were preferred based on the profile of the group, their previous experiences, and who they wanted to network and share knowledge with. The theme of networking will be considered as the first part of the "socialization" phase of community maturity.

4.4.2.1 Communication methods

When discussing methods of KS, it became clear that the communication method used by each group varied based on their objective and past experiences. For example, if sharing knowledge within the group, members used methods that were familiar to them as a result of their previous work experience. It also became clear that energy communities prioritised KS and networking in person over any technological or remote sharing methods. Key informant and Participant I noted that this is because the sense of interaction and engagement gained when sharing knowledge this way.

> I just feel I get a better sense of interaction and engagement that way rather than the phone or an email. You don't always get your questions answered that you want to in emails. 'cause you can spend half your time toing and froing with an email whereas with engagement, at least with meeting the person you're getting, you can get into a discussion, just address, just like that. Another thing to remember is people don't always get on together anyway. People have fall outs. You're always going to have fall outs. Because we see the world very differently (Key informant, Participant I, sustainability manager).

A clear distinction is made here between KS in person and via technology, as indicated between the comments about sharing by email. These comments suggest that a preference for face-to-face KS exists because it reduces misinterpretation. However, Participant I also recognises that people "see the world very differently", which could affect the KS process if members create disagreements.

Within community one, Participant 1A showed how the group engages its current and new members via a word-of-mouth approach to KS.

> Otherwise I don't know, word-of-mouth I suppose, or people express an interest. We've got some people who said they were interested so I said well why don't you just come along (Participant 1A).

This approach shows that making an initial approach to a group member is a route to getting involved, with the group then inviting prospective members to join discussion and KS activity in person. In other

words, for the KS transaction to occur, both parties must accept each other's presence in the discussion. Participant 1C described a different approach in which this group recruits new members, where the openness of the group is communicated to the wider community via social media and community news articles.

> Obviously the community energy group engaged the public and the residents of (name of location) of what we were going to do and we fed back on the results and we tried to change behaviours. There's been articles, sort of social media. There was a good take up in terms of percentage of people, the solar panels, the very early higher fit rate (Participant 1C).

Notably, Participant 1C connects the group's KS activity to changing community behaviours, describing how the solar energy programme was a catalyst for a large percentage of the wider community to get involved. In this instance, this may have been because the more technical and energy specific knowledge had been codified and documented in a way that was easy to understand for the wider community. The use of articles and social media may have helped the group articulate the benefits of solar energy, leading to a change in behaviour. Participant 1D offered insights into how the provision of information materials written on a monthly basis by the group leader supported this process:

> I mean, (name of participant) writes an article for (name of magazine) and (name of community) every month and there's an article from here every month on the library and the (name of magazine) and this and that… the (name of community) and, you know… it all goes on (Participant 1D).

The dedication shown by the group leader to regularly produce these articles is appreciated by Participant 1C. The form of regular communication and openness between the group and the wider community seems to occur in a more traditional manner, meeting the needs of its target recipients. In this case, the older generation tend to read more village articles, as opposed to the younger generation of people, who are more likely to notice such communications on social media.

In comparison to community one, Participant 2B showed that community two has similar levels of openness but will only schedule group meetings around the community agenda:

> Yes. So, (name of community), we do socialise, we might go for a curry once or twice a year but it's not the same, I mean with (name of community) it's more of a, you do campaigning and then some people socialise and because the meetings are every Monday there's more opportunity to bond whereas (name of community) meetings are once a month if there's lots of stuff going on. If it's a quiet period or we think, there's nothing happening it might be every two months (Participant 2B).

The group meetings occur monthly, with their timing sometimes changing depending on how busy key members of the group are. The meetings are linked to "socialising", showing that a more informal and

personal type of group openness. These meetings are also compared to other similar energy focused groups, showing how the group benchmarks its culture against others.

Participant 3B described a more formal and structured approach to the group, referring in this quote to the role of emails and formal community websites.

> Yeah I mean I would say that our main way of communicating is emails. I mean I think we are moving towards having a Facebook presence and we were lucky that in the past (name of participant) was able to get the website set up and we've now got someone who can administer it. That was the lack of someone with the skills was a problem in the past" (Participant 3B).

This description of emails shows how the group opts to use a more structured and simplistic method of communication. The formality shown through the use of emails may relate to the religious nature of the group, where members feel more comfortable expressing their words in detail and in writing. Although a social media and website presence is acknowledged, Participant 3B describes how these are outsourced as the group lacks the knowledge and experience of managing these forms of openness and communication. This could mean that during the "initiation" and "development" phase of maturity, the community failed to recruit members with this specific expertise and the same community values.

In conclusion, the three communities use various KS methods to generate between group members and with the surrounding community. Despite some similarities in these methods, there were also differences depending on the agenda of the group and the profile of members. For example, communities one and three prefer to share group successes and communications via magazines, written articles and emails, showing a more formal approach their KS method. In comparison, community two often meet and share knowledge in social settings, preferring to share knowledge informally.

4.4.2.2 Networking

Despite having preferred communication methods, the interviews showed that each group relied on face-to-face communication to some extent, and that this was dependent on the stage of the group's journey. For example, although the group in community three often communicate via email, they also engage in face-to-face communication when appropriate. This is a form of communication that is easily constructed by the group, as members have established friendships outside of the group over long time periods.

The importance of this communication is espoused by key informant Participant I, who discussed how this method can help to build trust:

> And you have the idea, and this is verified by my own research, you have to meet face-to-face, you have to build those personal relationships. Zoom calls and Skype are all very well intermittently but it's not going to build relationships like meeting someone even informally. And quite often they say that partnership working, and knowledge and sharing can really

> happen informally, you know, having a pint in a bar after a main meeting. Talking informally to somebody you get to know them personally, who they are, that's when you can really open up and really share and develop trust between people to share knowledge and create bonds, bonding (Key informant, Participant I, sustainability manager).

This informal and in person nature of communication shows how meeting someone in person can help develop a mutual sense of trust and understanding. There is a suggestion that meeting someone online does not create the level of mutual bond that meeting someone face-to-face would. This is perhaps because the level of intensity and investment in conversation may be higher when meeting face-to-face. In addition, there may be more commitment and effort involved in travelling to meet someone. The two less tangible concepts seem to be evaded via online communication and may be key to facilitating the KS process.

Participant I's comments seem to be reflected in evidence from community one of the group attempting to communicate and share knowledge with the wider community via large group meetings and village events. Participant 1D explained how the event engaged around 70 people from the local community:

> One of the key projects, of course, is solar panels on the school and the LED lighting that's been put in the school. Those are not just interesting projects; they are really functional and provide a huge welfare benefit. Anyway, we then organised a meeting that we had in the village hall, probably in April this year, and the lady from (name of location) came and at the end of the meeting, we said, because we had speakers in and blah, blah, blah, there were about 60, 70 people (Key informant, Participant I, Sustainability manager).

This same participant previously discussed the important role of the group's monthly magazine in sharing knowledge during the earlier stage of the group's journey. In other words, whilst the group may use formal and explicit methods of sharing to generate interest in their agenda they opt to share the detailed knowledge in a more informal and face-to-face setting. Even so, Participant 1D goes on to acknowledge the developing role of online communications, even though there may be some barriers to using this channel:

> You don't necessarily need to actually physically get them together, that's what I was doing there, I was giving all our village… because this went out to every village in (name of location) and to the towns, I was giving people ideas from others that they could copy, or a contact so they could talk to them. So that was, I found out, you can use the internet now, but in those days it was still relatively new, certainly for villages, you didn't have a good connection, if you'd got a connection at all (Participant 1D).

The attempt to introduce online communications as an alternative to face-to-face communication shows how the community is attempting to reach more people using methods that they are not as familiar with.

Similarly, the interviews from community two show signals that they too prefer a more informal and physical form of communication. Participant 2B describes the group's preference to meet in a local pub and socialize informally, as friends rather than colleagues.

> I think there's a group of ten people around this table at the meeting, three or four of us, maybe five, will go to the pub and that's really important… So, that's really important because it grows the bond between the people involved. The people involved, if they go to the pub together they become friends. So, for example, I've gone on holiday with people from (name of community), to Germany, to Portugal, some other places. Never with a plane though, we always go by train because it's (name of community), so like sleeper trains, that kind of thing (Participant 2B)

The relationship between meeting informally and strengthening the bond between members seems to occur not just in community two, but also in other similar communities. This may suggest that the informal nature of communications suits the type of person that engages within these communities as they feel capable of achieving the group objectives when relaxed and able to consider their colleagues as friends.

Finally, participants from community also preferred physical meetings in community locations such as pubs. Participant 3A described how she considers other members of the group as her friends, whilst being eager to meet them in an urban pub location:

> I rang some friends of mine…And we met in a pub in the middle of (name of location)…And, and slowly had conversations, we held a seminar which was very well attended and we took the decision to set up as a community benefits society (Participant 3A)

The informal communication that occurred in an informal manner seemed to help produce the tangible outcome of meeting the groups objectives. In this instance, the community benefit society was set up as a result of discussions between those who have communicated informally over a lengthy period of time.

To conclude, networking within the group and with the surrounding community often occurs in a face-to-face and informal manner, but also alongside other forms of more formal communication. Depending on the relationship between the group members, it may take time to engage newer members in more physical and social forms of communication in community buildings such as pubs. In the three communities explored, it is clear that each group has been established for a long time period and therefore engage in regular and more social forms of communication. It has appeared that communication is a necessary condition for KS, but KS may not always occur if the form of communication does not suit the type of people within the community.

4.4.3 **Trust**

Shown throughout the exploration of each community journey, trust is a concept that has become a reoccurring theme throughout the discussion. The KS within each case seems to require high levels of trust due to the setting and method of transfer being used by each group. In most instances, all three communities have used forms of physical and informal communication methods, mostly in social settings such as pubs. This Section will explore the concept of trust and be decribed as the "analysis" phase of community maturity.

4.4.3.1 Socialising informally

Trust in these communities seems important in how they operate and share knowledge. The levels of trust within each case varied depending on the number of social interactions undertaken and the relationships between the members of each group. It quickly became clear that socialising informally and regularly in social settings such as pubs helped build high levels of trust between members. Participant I was one of the key informants who specifically mentioned the role of trust in the knowledge development process.

> But the reality is how do you know what you're transferring is good practice for example. Have you actually looked at all the implications of knowledge transfer. Whereas you're not going to get that from a Google, you're not going to get that from reading someone else's climate change strategy. What works is actually meeting that person and developing a relationship with them and building trust with whoever wrote the strategy or delivering the strategy to allow for knowledge development (Key informant, Participant I, sustainability manager).

This quote suggests that sharing of knowledge is therefore best accomplished when face-to-face interactions take place. According to Participant I, this is because the knowledge receiver can build a relationship with the knowledge sender and develop their understanding of the knowledge. This may involve asking further questions to clarify the sent knowledge. However, this knowledge development phase seems to rely on high levels of trust, a concept that harder to establish when searching for knowledge online.

Trust is a concept that is also considered by Participant J, who described it as a lubricant for the relationship between the knowledge expert and those who are receiving the knowledge within the group:

> Some people are willing to invest a lot of time, some are not. So, as long as there is trust in the community, as long as they can say we have one person who's an expert in our community, who can understand the business person so we know that we are not going to get scammed, we trust the champion (Key informant, Participant J, Research fellow).

Participant J's statement shows the importance of each energy community having an expert to champion the knowledge and project high levels of trust within the group. This relationship will however depend

on the group's development phase, as many energy communities may have such a knowledgeable expert in the field, or there may not be the trusted relationship needed between the expert and the remainder of the group. These trust levels could potentially improve over time and with experience of successful projects.

Participant 2A showed how the group in community two has a mutual understanding with both investors and the wider community. Participant 2A discusses these issues in relation to the finances of the energy community:

> I think we're very open with them and we've established a position of mutual trust. They understand that we're not trying to make money out of this, that we're trying to give them a decent rate of interest and four percent is still a decent rate of interest (Participant 2A).

Due to the members' motives for engagement, the investors and wider community have a more informal relationship with the group, as the energy community are not looking to solely make profit. The culture of the group is to operate ethically and make a reasonable return on investment, but also to contribute to the community. As such, the trust levels between the group and the wider community seem to be higher and of an informal nature. As participants from this group have previously identified, everyone involved in the group is volunteering and this may contribute to establishing higher levels of trust.

In conclusion, the informal nature of the group is enhanced by face-to-face physical interactions, which in turn seems to project high levels of trust. This relationship however seems to be reciprocal, where trust between members allows for more competent KS and face-to-face interactions, as members are more likely to meet and socialise with friends and group members that they trust. The development of trust in this phase of community maturity not only influences KS, but also seems to allow participants to reflect upon their establishment of trust. This could be described as an "analysis" phase, where participants reflect upon trust levels within the group and then decide to share their knowledge.

4.4.4 **Size of the group**

Throughout the KS discussions within each community, the size of each energy community became increasingly relevant when considering the groups objectives. Although each community made their own attempts to recruit new members, this would only see success if newer members displayed similar levels of enthusiasm and engagement with key energy issues in the community. It became progressively apparent that there is an optimum number of participants required for useful and effective KS, and that KS would decline if too many members were involved in the core decision making within each energy community. The adjustments made by communities are described as the "reformation" phase of maturity, where communities seek the optimum number of group members for KS and pursue recruitment or reduce their group size accordingly.

4.4.4.1 Optimum group size

For the three energy communities in this research, the maximum number of participants involved in the KS process was usually twelve participants. However, this group size was used when the group intended to make decisions that directly influenced the community agenda. A second phase of KS was also regularly conducted, where the group's knowledge would be shared with a larger number of the wider community. This phase would often involve sharing knowledge with those who were not part of the energy community, but part of a community with different objectives. Participant 1C displayed how community one involves an initial number of 12 key directors, but gets involved in sharing knowledge with specific wider committees based on specific tasks:

> There's about 12 members actually on the committee. I mean we obviously co-opt extra people in when we work with a particular community group. So, if we say we're working with another group, we've got some money for the Scouts we obviously work with the Scout group. If we're working with the church, it's obviously with the church committee (Participant 1C).

This participant provided examples of the local Scouts group and various churches as recipients of knowledge in the KS process. However, the main committee within the group comprises of twelve key members. This indicates that there may be different phases of KS. Participant 1D shared this notion, providing an example of a recent LED lighting project that initially involved the core members of the group, but then around sixty to seventy wider community members in the village hall thereafter:

> One of the key projects, of course, is solar panels on the school and the LED lighting that's been put in the school. Those are not just interesting projects; they are really functional and provide a huge welfare benefit. Anyway, we then organised a meeting that we had in the village hall, probably in April this year, and the lady from (name of location) came and at the end of the meeting, we said, because we had speakers in and blah, blah, blah, there were about 60, 70 people (Participant 1D).

Participant 1D showed how important the group's agenda can be and the number of participants involved in the described project. Due to the large number of participants involved in the village meeting, there may be a need for the energy community to be decisive and to ensure that they excel in KS activity. The second stage of KS activity is clarified by stating that this engagement occurred at a specific event in the community village hall. Importantly, this activity occurred in a local setting where a large number of recipients could engage in more of an informal KS setting.

Participant 2B describes similar tendencies within community two:

> (name of community) is a community benefit society, which basically means that we have a membership, the members are also the owners, so there will be, you can fact check this but

> there's like seven or eight directors, they are elected by our members and they serve three year terms (Participant 2B).

The description of "seven or eight" by Participant 2B shows how the group democratically elects a core number of decision makers, who presumably will also be central to KS, for a specific time period. The structure of the group involves a large number of wider members that have a direct influence upon who is re-elected, suggesting that the group wants to engage in KS, but that this will be limited to a maximum number of core members. The reason for having a small number of core group members is explained by Participant 2C:

> To be frank, we don't really have a cash system so I think that's not very practical. So people can pay a pound, yes, and join, okay a notional pound anyway because they want to and they support our aims. There isn't much point in recruiting 100,000 members and putting energy into that, I don't think it would achieve anything very substantial would it? (Participant 2C).

This participant placed emphasis and importance upon supporting the group's aims and achievement as a justification for having a lower number of core group members. This suggests that there is a focus on recruiting quality members for the community and not just a high quantity. Recruiting a large number of members with different interests and values could damage the way that the group operates, influencing trust and communications. Finally, Participant 3C shows the struggle that the group in community three faced when recruiting a core group of "elite" members:

> And when it actually comes to it it's a particular group, possibly what looks like a bit of an elite group, who want to do this. And the people will be reluctant or just not understanding and I think that was the case at several churches that we approached (Participant 3C).

Participant 3C acknowledged that a small number of people understand energy issues and are therefore considered as core members of the group, providing they obtain a high level of interest in participating. When using the word "elite", they seem to be suggesting that members with these qualities are few and far between, showing the challenges that many of these energy communities face.

Considering the range of evidence presented throughout this Section, there is evidence of an optimum number of group members being required for successful and meaningful KS. Within the explored communities, it is suggested that between five and twelve members are needed, who have interests that align with the group's agenda. Communities one and two seem to purposely elect this number of participants, whereas community three apparently suffer from engagement issues, yet share the same view. Whether forced or by choice, it seems that energy communities have greater confidence in meeting group objectives when sharing knowledge within a smaller group. Futher phases of KS with a wider and larger group are also evident within communities one and two, but these phases are specifically targetted at committees and communities that are relevant to the group objectives. In

conclusion, the “reformation” phase of community maturity is considered as the stage where the community identifies the ideal number of participants to support the groups effective operation.

4.5 SUMMARY

In summary, the discussion of findings has highlighted the importance of three key themes within the explored data that relate to the three research questions. These were identified as power within knowledge networks, enablers of KS and the stages of the community journey.

Firstly, power was discussed (Section 4.2) and considered in relation to the structure of the group (Section 4.2.1). It was shown that energy communities structure their group based on the skills and experience of their members and the objectives that they choose to pursue. Power was also shown to have a relationship with knowledge ownership (Section 4.2.2). Section 4.2.2.1 discussed the skills and experience of group members and how these contributed to their participation. Although knowledge levels throughout communities varied, all levels of knowledge seemed to have potential to be valued by members (Section 4.2.2.2). In addition, the leader of the energy community was seen to not always possess the most expertise within the group, which showed that the relationship between power and knowledge within energy communities is particularly complex. Finally, Section 4.2.3 discussed the chosen agenda of each community. This discussion highlighted the nature of group discussion and community openness (Section 4.2.3.1), the decision-making power within communities (Section 4.2.3.2) and the danger of a founder’s syndrome occurring within energy communities (Section 4.2.3.3).

Section 4.3 discussed the enablers of knowledge sharing, identifying these enablers as openness and friendship (Section 4.3.1), finance and innovation (Section 4.3.2) and the awareness of each group (Section 4.3.3). Section 4.3.1 showed how energy communities used their friendships to create a culture that enhance knowledge sharing, while also using their openness to recruit new members. Section 4.3.2 identified finance as being a key driver of innovation within each community, showing that a lack of funding can also have a negative impact upon innovation. The final Sub Section (Section 4.3.3) displayed how energy communities were aware of other similar groups and the needs of their surrounding local communities.

Finally, Section 4.4 presented the themes associated with stages in a community journey. Section 4.4.1 discussed membership and the role that the recruitment of members had in initiating the development of the community. Section 4.4.2 discussed the role of networking and communication methods in the socialization process that communities experience. Following this, Section 4.4.3 showed how energy communities would socialize informally, contributing to the development of trust between members within energy communities. The size of the group concluded the community journey (Section 4.4.4), where it was shown that an optimum group size exists and that communities would reduce or increase their membership to allow for the best possible knowledge sharing experience.

5 DISCUSSION: THE JOURNEY OF KNOWLEDGE WITHIN ENERGY COMMUNITIES

5.1 INTRODUCTION

The purpose of this Chapter is to provide a critical discussion of the key findings that were highlighted in Chapter 4. This discussion will be theoretically informed by the literature that was discussed in Chapter 2. This Chapter offers a deeper exploration of the themes and how the explored findings contribute to answering the identified research questions within this thesis.

This Chapter will be presented in the following manner. Section 5.2 will explore and compare the key findings in this research with the existing literature presented in Chapter 2. In addition, this Section also alludes to the contributions made by this research. Section 5.3 will clearly outline the original contributions made by this research. Section 5.4 will conclude the Chapter by highlighting the reflections and conclusions of this research.

5.2 THE NATURE OF KNOWLEDGE SHARED WITHIN ENERGY COMMUNITIES

5.2.1.1 Introduction on the nature of knowledge shared

This Section will address the research gap that was identified by the first research question (RQ1) in Chapter 2; **what is the nature of knowledge being shared within energy communities?** The concept of power emerged as a key theme throughout the findings, primarily because of its clear influence on three areas of the knowledge sharing process within the communities. Specifically, the structure of the community, knowledge ownership and the discussion of the community agenda were all impacted by power relationships. The different types of knowledge that were identified in Section 2.3.3, were also shown to exist within energy communities.

5.2.1.2 Power and the structure of a community

Throughout the findings, it became evident that no specific community structure was employed within the three communities explored. Community one demonstrated that the group were prepared to accept and recruit members who displayed a clear interest in their agenda and activities. This showed a collective openness to receiving and sharing new knowledge. Despite the acceptance of new knowledge and ideas, community one also continued to encourage the group leader to make group defining decisions and continue in their role, irrespective of whether or not this individual wanted to do so. This provided an indication of the balance of power within the group, where the leader accepted the view of the majority, despite having freedom as an individual to fulfil a different role. The definition of power that was provided by Roberts (2006, p. 626), alluded to the completion of a task, whether by "influence, force or control". In the case of community one, this influence is evident in the leader of the group being heavily encouraged by other members to continue making decisions as group leader.

The balance of power within the communities also proved to be dependent upon the skills and experience that each community obtained. For example, in community two, individuals would volunteer their support for specific activities, like accounting. This volunteering and acceptance of a new role within the group seemed to define the community structure, where those who volunteered their time acquired greater influence over the group's finances and the decisions made. In addition, the range of activites that members offered support on would display different kinds of project specific knowledge. Examples of these are shown in Table 19 below:

Table 19: Subject specific categories of knowledge

Categories of knowledge
Energy specific knowledge (For example, knowledge about solar PV)
Finance knowledge
Leadership knowledge
Recruitment and membership knowledge

The categories of knowledge were also displayed throughout the findings, where each community discussed projects such as the installation of solar PV on community libraries and involvement in tasks such as preparing the community accounts.

Applying Crozier & Friedberg's (1977) "analyse strategique" framework to the power relationships within community two, it is clear that participants were aware of the power gain that can be attained by volunteering additional time to support the projects. Despite the impression that participants may be volunteering their time for the wider benefit of the group, the ulterior motive of contributing their time to benefit their own interests is also evident. This was acknowledged by Bourdon et al. (2015, p.13), who stated that one of the underlying acknowledgements of the "analyse strategique" framework was that actors would act within their own interests and exploit "zones of uncertainty". These zones were identified as opportunity zones for participants to increase their power and authority of the community. Returning to community two, work that required a deeper knowledge level was outsourced, showing that the community possessed an ability to "know what they don't know". Bolisani & Bratianu (2018) referred to this in their "known/unknown matrix", describing groups that obtained this nature of knowledge as having a high awareness level.

Finally, the structure of the communities also seemed to be framed by the groups' objectives, where community members would ensure that members all had similar interests. For example in community three, members accepted newcomers on the condition that financial interest was not their primary motive for engagement. This community approach to the group's structure and bounding seemed to provide a clear structure and expectancy within the group, where this form of reciprocity was expected

from all of those involved. As such, the non-financial focus of the communities provided a unique power dynamic between those involved, where other factors such as the regularity of meetings and the focus of the groups agenda had more influence on the power held by each member. Considering Crozier & Friedberg's (1977) "analyse strategique" framework, the clear group structure and expectancy within community three may have resulted in a reduced "zone of uncertainty" and allowed participants understand their role and power position within the group.

5.2.1.3 The relationship between power and knowledge ownership

The consideration of knowledge ownership within the various communities showed that power had an influence upon the role of each group member. Power also seemed to be dependent upon how effectively the individuals were able to share their tacit knowledge. The findings displayed the acceptance of participation within the group, regardless of the individual's knowledge level. However, those who were able to reflect upon previous community experiences seemed to obtain a higher power level within the community.

The data from both the key informant interviews and the community cases made it clear that energy communities attract "a certain type of person", implying that the knowledge obtained by communities is therefore niche and context specific. The ability shown by participants when transferring tacit knowledge into explicit knowledge seemed to result in a higher degree of respect and power level, showing a potential relationship between a participant's knowledge level and power within the group. This relationship was also alluded to by Foucault (1979, p.27).

The relationship between power and knowledge ownership was further emphasized by the leader of each community, whose ability it was to provide solutions and fulfil the group agenda that would lead to high trust, respect, and power levels. Notably, it was not the tacit and specific knowledge about energy itself that led to this attainment of power. This re-affirms the notion that an individual's ability to turn embodied knowledge into encoded knowledge is an influential factor within community power dynamics. De Jong & Ferguson-Hessler (1996) noted that non-automated knowledge occurs when a beginner faces a conscious and step by step process of accessing knowledge. This process is apparently occurring within energy communities when knowledge is shared, and participants advance their level of power within the group.

Arnstein's (1969) ladder of citizen participation showed that different levels of power could be obtained by participants who engaged in participation at various levels. This process was evident within the energy communities, where the pursuit of higher levels of knowledge resulted in higher levels of participation and therefore power. Based on the relationship between the power attained and the knowledge ownership, it is possible to relate the nature of knowledge shared to each power level in the ladder (Table 20).

Table 20: Participation, power and the nature of knowledge shared

Participation level	Power level	Nature of the knowledge shared	Awareness level
Citizen control	Citizen control – high power level	Encoded knowledge	I know what I don't know
Delegation	Citizen control – high power level	Encoded knowledge	I know what I don't know
Partnership	Citizen control – high power level	Encoded knowledge	I know what I don't know
Placation	Tokenism – medium power level	Embrained knowledge	"Knowing"/I know what I know
Consultation	Tokenism – medium power level	Embrained knowledge	"Knowing"/I know what I know
Informing	Tokenism – medium power level	Embrained knowledge	"Knowing"/I know what I know
Therapy	Non-participation – low power level	Embodied knowledge	I don't know what I don't know
Manipulation	Non-participation – low power level	Embodied knowledge	I don't know what I don't know

During the manipulation and therapy stages of participation, energy community members may be new to the group and in the process of learning about the roles and responsibilities of those in the community. The level of participation is extremely low, and a low level of power is therefore obtained. The nature of knowledge being shared at this stage is highly tacit and resides within the individual. Within the tokenism stage, participants within the group become more involved by informing, consulting and engaging in placation. The power level that the individual obtains at the tokenism stage is higher within the energy community, as the participant shares their embrained knowledge when consulting and informing those around them. The embrained knowledge being shared also resides within the individual but is made more explicit for others within the community to understand. The final level of power that exists within the energy community is a high level that is consistent with the citizen control stage of participation. This level of power is obtained by the individual when they increase their participation, control the group agenda and delegate tasks to others within the community. At this stage, encoded knowledge is shared to raise the collective level of knowledge within the group. Lam & Holloway (2000) implied that encoded knowledge is still tacit in nature, but is shared collectively. Although tacit

knowledge is notoriously difficult to share, the position of power obtained by the particpcant may contribute to a more effective level of sharing.

The transition in the nature of knowledge through the various participation and power stages, shows how the nature of knowledge changes depending on the power obtained by the participant. Lam & Holloway (2000, p.492) indicated that obtaining embrained knowledge would show a level of "understanding" and "knowing" on behalf of the individual. Based on this, it has become clear that energy communities also obtain a level of "knowing" throughout the participation and power stages. The final nature of knowledge that Lam & Holloway (2000) refer to as embedded knowledge, could exist at each stage of the power process. This is because "knowing" is not always obvious to others and tacit knowledge takes time to be extracted, shared, and documented within a group. As Polanyi (1966, p.4) states, "we know more than we can tell" and it would be unwise to assume the knowledge level of a newer group participant.

5.2.1.4 Community agendas

The findings show that each community obtained an agenda that was influenced by the power relationships within the group and subsequently affected how each community operated. This relationship was revealed in the democratic nature of each community, the location of the decision-making power and the degree to which there was "founders' syndrome".

There were some signs that communities were operating in an autocratic manner, where the leader of the group made decisions and members were apparently reluctant to come forward and share their knowledge. However, members appeared to be slowly becoming more engaged in group discussion and presenting ideas to the remainder of the group. This emphasized the journey that the community was on, where it would take time for members to share their ideas and influence the community agenda. Wenger (1998b) presented a similar understanding of CoPs, showing how members engaged in different phases of group invovlement depending on stage of development of the CoP.

The recognition that community one had three ideas that were "in embryonic stages" (Participant 1A) also revealed how the group would form their agenda based on sharing and discussion of ideas. Participant involvement in each community typically involved those who lived in the local area, with the community agenda formed based on the priorities of the surrounding community. A similar situation often occurs in commercial organisations, but in this case stakeholders are concerned with meeting customer needs instead of those of the community. The meeting of the stakeholder needs within energy communities shows a flow of knowledge from outsiders into the group. Gebert et al., (2003) similarly noted that CKM concerns the flow of knowledge about, from and for the consumer. Lesser and Storck (2005, p. 831) identified a CoP as a "group whose members regularly engage in sharing and learning, based on their common interests"; a situation that was evident within community one, where members had mutual interests as residents in their local community. Wenger (1998, p.125) also noted that

"mutually defining identities" were an indicator of the existence of a CoP, where a level of mutual engagement and sense of belonging would be present within a group. The presentation of ideas from members based on their identity as local residents indicates that a community focused CoP may have been in the early stages of existence.

In communities two and three, participants were also willing to engage in group discussions and play an equal role in highlighting the priorities of the community. One individual explained how the community agenda and objective may be ambitious and "lumpy", but regular group meetings and discussions allowed members to discuss the agenda. The consistency of these discussions may have helped the community extract complex and tacit knowledge from certain individuals over time. These regular discussions also reveal the extent to which the community is democratic and whether the power dynamic in the group resides within or beyond one individual. Similarly, in community three, one participant noted that the agenda of the group was driven by a "group effort". The open and democratic nature of community discussions in all three communities shows the existence of a willingness to share knowledge from participants and a power dynamic diluted by regular discussion within each community. This suggests that participants may be struggling to capitalize on "zones of uncertainty" and act in their own interests because of the open, regular discussions and the way knowledge is being shared at this "embryonic stage" of the group agenda.

The concept of trust was also referred to when discussing group decision making and the agenda of various communities. There was evidence that those involved in the decision making of the group had all invested reasonable sums of money. Because of this financial investment, there seemed to be an implied trust level between members, where those in the group felt comfortable in socialising and engaging in informal communication. This was noted by one participant, who described the depth of the relationships between members who socialised informally and became friends. Despite the deep and personal relationships within community two, participants expressed the relevance of community infrastructure and the importance of the group's agenda to the surrounding community was still important. It became clear that trust and relationships both within the group and with the surrounding community were reliant upon the successful completion of impactful community projects that would "send a message" to all of those involved. Successful and impactful work seemed to reinforce the trust between members within the community.

Based on Barney & Hansen's (1994, p. 176) notion that "trust is the mutual confidence that no party to an exchange will exploit another's vulnerabilities", it is clear that energy communities possess a level of collective trust that is built from completing projects and communicating with the wider community. In addition, the investments that are made within the community may be the "vulnerability" that each member discloses and the completion of a project on the agenda may reinforce the trust within the group. Mcinerney & Mohr (2007, p. 70) considered trust as the "basic environmental factor for KS"

and similarly, trust may play a part in lubricating the knowledge shared in the completion of various projects within energy communities.

Finally, the emergence of a "founders' syndrome" within energy communities was acknowledged by several participants. Participants discussed the perception that energy communities are known as democratic entities, yet often comprise a culture that is far more autocratic and relies on individuals to make decisions and influence the activity of others within the group. These individuals were described as "elites" (Participant D). Community one displayed signs that one individual obtained the highest level of power within the group, mainly because of their ability to "bash on regardless" (Participant 1A) and also because of the acceptance amongst other participants. Participant 1D relayed this acceptance by stating that the group leader would make decisions because they "knew people" and "had the drive" (Participant 1D). Similarly, community three indicated that the group leader wielded a higher level of power than other participants by talking for large majorities of group meetings. It became clear that the KS opportunities for others within the group were somewhat limited due to the power and level of constraint inflicted by the group leader. Both power and constraint are shown in the "analyse strategique" framework (Crozier & Friedberg, 1977) to have influence upon the zone of uncertainty and the aim of obtaining control of a situation.

5.2.1.5 Summary of the nature of knowledge shared

The nature of knowledge shared within communities seems to vary depending on the participation level of individuals and the power dynamic that exists within the group. This was shown in the way that the explored communities engaged in group discussions, made decisions, and communicated.

Firstly, the structure of an energy community was shown to be associated with the engagement level of each individual group member. Those who engaged in shared activities apparently attained a level of power that influenced the way in which the community operated. However, it is important to remember that each community is voluntary by nature and that each member has a shared ownership of the company. In this case, the communities were structured as CICs. As a result of this member involvement, community leaders seemed to structure the community in a way that was beneficial to everyone in the group. This may have been done to avoid "zones of uncertainty" and to show the group that the power is shared amongst members. Despite this, power was also discussed by participants in relation to the knowledge ownership of certain group members. It became clear that those who obtained higher knowledge levels seemed to wield higher levels of power within the group. Although members discussed the shared and democratic nature of group discussions, those with higher knowledge levels appeared to command higher levels of respect and decision-making power. Decisions were influenced by those who were expert on certain topics and by other members relinquishing their decision-making power to group leaders and experts.

Considering these findings, the more a member participated, the more knowledge they would receive and share. The process of acquiring knowledge subsequently then increases a member's power within the group. Group leaders were praised for showing high levels of engagement and determination in getting things done and making fast decisions. Ideas within the communities were discussed at "embryonic stages", but then acted upon by the group leader, often in a decisive and unyielding manner. Throughout this process of member engagement and power attainment, the nature of knowledge being shared transitioned from being tacit and embodied, to explicit and encoded.

5.3 FACTORS THAT INFLUENCE KNOWLEDGE SHARING

5.3.1.1 Introduction on the factors that influence knowledge sharing

This Section will focus on addressing the second research question (RQ2) identified in Section 2.8; **what are the factors that influence KS within energy communities?** Throughout this discussion, several influencers will be highlighted as significant in affecting the KS process within energy communities. These factors include openness and friendship, finance and innovation, group awareness, membership, networking, trust and the size of the energy community. Although some of these factors were highlighted in the literature review, factors such as friendship and the size of a community, were found to be particularly important within the context of this research.

5.3.2 Factors with high influence

This Section will discuss the most influential factors that affected KS. The power dynamic, group openness and friendship, finance, awareness and group size were all particularly relevant to energy communities, although these may be less applicable to the general KS literature that focuses on organisations.

5.3.2.1 Power dynamic

Section 5.2 discussed the importance of the power dynamic within energy communities and how it influenced the knowledge shared amongst group members. The power obtained by group members was shown to be a consequence of participation levels rather than necessarily due to knowledge or expertise. In addition, although power often meant that energy communities were able to complete tasks efficiently and decisively, this power could restrict the ability of some members to contribute to group discussions. This might have led to a significant loss in tacit knowledge extracted from individuals. Section 5.2 therefore acknowledged that the power dynamic within the group and the power of individuals could have a significant effect upon the nature of knowledge being shared.

5.3.2.2 Openness and friendship

The findings identified openness and friendship between members as particularly important for the sharing of knowledge. This finding is particularly significant, firstly, because it alludes to the nature and culture of the community; and secondly, because it is not specifically identified within the KM literature as a significant factor on knowledge shared.

In the first instance, it became clear that friendships could contribute to creating a culture of KS. This was seen when participants in communities one and two described how the groups would socialise regularly and felt comfortable doing so because of friendships build on shared experiences and community work. One participant described having existing friendships within the community that were started in 1970. As a result of these friendships, the three communities seemed to operate with an informal and friendly culture. The informal and friendly culture was also shown by the extent to which group members allowed the researcher to become immersed in the activities of the communities, such

as attending various group meetings and AGM's (see Table 16), which was an important enabler of the subsequent data collection. This finding is in line with Wenger, McDermott and Snyder (2002), who state that informal CoPs tend to meet when convenient and require less structuring than more formal groups. Such was the case in the three explored communities, where there were expressed preferences for meeting irregularly and at local community buildings such as pubs.

As a result of this informal culture underpinned by friendships, a degree of openness was displayed in each community. This openness was displayed in the nature of the group discussions and by each community welcoming the engagement of a younger demographic. Participant 1B noted that the average collective age of community one was significantly higher than what the group had aimed for, whilst Participant 1D praised the engagement of younger people due to their tendency to "bring new ideas". The realisation from group leaders that a younger age demographic could contribute to the energy communities shows how the openness of energy communities allows them to achieve mutual engagement, joint enterprise and shared repertoire. Wenger (1998, p.125) identified indicators one and seven (Table 4, Section 2.4.5) as sustaining mutual relationships and knowing what others know, what they can do, and how they can contribute to an enterprise. There is evidence of these indicators here, as energy community leaders seemed to be shrewdly using their friendly and openness to receive ideas for newer and younger members. This shrewdness could be a characteristic of this age demographic, as Gardner & Cennamo (2008) stated that baby boomers are known to prioritise relationship building.

Finally, the openness of each community supported successful communication between those within the group and wider stakeholders. The openness of energy communities could be viewed as one of many "bridges" for potential KS. This could be seen through communities hosting events such as workshops, conferences and exhibitions in order to engage with wider stakeholders. Participants noted that energy communities structure their agenda to match the needs of the surrounding community. It became clear that hosting events and engaging with wider stakeholders allowed these energy communities to understand these needs and structure their agendas accordingly. A similar process is evident in commercial organisations, as the previously discussed CKM models (see Chapter 2) identifies customer facing characteristics and the tendency to align aspects of knowledge with processes. In a similar way, energy communities seem to use processes such as events to become community facing. Furthermore, the openness of these energy communities could also be likened to the early phases of a CoP. Wenger (1998b) identified *potential* and *coalsecing* as the first two initial stages of CoP development, in which CoPs would make initial contact with others who have similar interests and then discuss the shared goals that would form the basis of their community relationship. These stages were also apparently occurring within energy communities, where openness allowed the group to host events and exhibitions.

In summary, the openness and friendship of energy communities seems to have influenced the interaction of group members with those outside the group who are part of the wider community. This

high level of friendship and openness may be a distinctive feature within energy communities due to the voluntary nature of the group, how members initiate their involvement and the collective age of members.

5.3.2.3 Finance and innovation

The findings suggest that a relationship between innovation and finance existed within the energy communities. Firstly, the key informant interviews suggested that energy communities have generally seen moderate levels of success due to funding being made available for projects. However, community interviews insinuated that this funding may not be available for these communities all the time. Although the energy communities displayed high levels of innovation and were proficient in generating ideas, participants were frustrated that they could only act upon their ideas if they had the necessary finance. As such, despite their capability to innovate, finance was a barrier when attempting to achieve more. Community one provided the example of driving cars using cooking oil for fuel as an example of such small scale innovation.

Reviewing Scarso, Bolisani and Salvador's (2009, p.434) pillars of a CoP, suggests that the funding of an energy community might align with the economic remit of a CoP, as it involves the effective allocation of resources to specific projects. Resource allocation may support the group in establishishing mechanisms for reviewing the costs and benefits of potential agendas. The review of the community agenda using available finance could allow members to recruit appropriate experts, take more time in making their decisions and focus on innovating on a larger scale.

In summary, all three energy communities acknowledged the role of finance and innovation in enhancing the KS activity within each group. The attainment of appropriate levels of finance influenced the ideas and the scale of the innovations that energy communities were able to act upon. A lack of finance could discourage innovative ideas, with energy communities frustrated at only being able to implement small scale initiatives. Despite the establishment of finance as a key influencer for KS and innovation, energy communities also found ways to innovate on small budgets. The example of sustianable fuel solutions in community one shows that finance may not be necessary when creating viable CE projects.

5.3.2.4 Awareness of the group

The awareness shown by the energy communities was relevant when considering how knowledge was being shared both internally and externally. Community one showed their understanding of current trends and the needs of their surrounding community, as they acknowledged the potential role that hydrogen could play within the energy sector. One participant described the group's willingness to think of local responses and solutions to the wider community's needs by initiating a community wide network of similar energy communities. This showed a high level of awareness from the group and displayed their willingness to share knowledge with other communities in the same space. Similarly,

community two recognised the importance of collaboration with other groups in the pursuit of obtaining "multi-skills" (Participant 2D). This implied that communication with other groups in the CE sector could support KS and the development of tacit knowledge between different communities. Finally, community three recognised the need to scale their operation and were acutely aware of merger opportunities with other similar energy communities. One participant described the operational problems that a similar energy community was experiencing, showing the group's awareness of other communities in the same sector. The high levels of awareness displayed by all three communities provided them with the opportunity to communicate and subsequently share knowledge.

This awareness may align with indicator eight, mutually defining identities, within Wenger's (1998, p.125) CoP indicators. Energy communities have shown that they understand their own identity and the identity of others, by recognising potential collaboration opportunities and other communities with similar objectives. Furthermore, the awareness shown indicates that these communities may be categorizing themselves as a certain type of community and actively considering how their group activities compare with similar communities. Hogg & Abrams (1988) stated that social identity comprises both self-categorization and social comparison, and has the potential to influence an individual's self-esteem. Levels of self-esteem within the group could potentially be raised by benchmarking the communities' activities against the performance of other groups. Participant 1A displayed self-esteem when confidently stating that the group "knew what they were doing".

In summary, the awareness shown by energy communities has the potential to influence the knowledge shared both internally and externally. The recognition of other similar communities shows that group members actively evaluate the activities of other groups and consider their own agendas in relation to both performance and the potential for scalability. The levels of awareness shown may provide group members with self-esteem and confidence when considering their own activities and social identities.

5.3.2.5 Size of the group

The number of participants involved in an energy community was widely discussed by participants. They made it clear that the size of the group was important because the number of members could have an influence upon the way in which the group operated.

Community two acknowledged the disadvantage that gaining too many members could have upon the group's operations and processes. There was a fear that decision making might become more difficult as more members joined the group. One community three participant described the members as "elite", which implied that each had a clear and inherent value that is perceived by others within the group. Although CoP group sizes are not often considered to influence KS within CoPs, this may arise in the energy community context because participants focus on making decisive and quick decisions that are informed by a small number of proficient energy experts.

The interest around group size witnessed in all three energy communities may suggest a concern about their social capital. Baker (1990) indicated that social capital concerns the structure of relationships, whilst Nahapiet and Ghoshal (1998, p. 251) described the factors that support the structuring of these relationships. These were identified as network ties, network configuration and appropriable organization. In considering community size, members are able to structure their group in accordance with the knowledge and skills that are available and required. Having a relatively low number of members may contribute to the creation of easily defined roles and responsibilities.

In summary, the size of an energy community has been discussed as an influential factor upon the KS activity within an energy community. This discussion has shown that smaller group size may allow members to reflect upon their social capital and organize the knowledge in their group via effective and concise decision making. Participants acknowledged that this may not be as achievable with a larger group size. The acknowledgement of group sizes by participants may also be unique to the energy community setting, as it has not been identified as a key influential factor in other contexts.

5.3.3 Factors with moderate influence

This Section will discuss the factors that influence KS within energy communities, with reference to the literature on KS and CoPs in other contexts. Within the findings Chapter (Chapter 4), membership, networking and trust were all identified as key themes. This discussion recognises these themes and explore the influential factors on the KS process.

The theme of membership became prevalent when participants discussed the inception of the group and how new members were recruited. A criterion that had to be met by new members of communities one and two who wanted to join the group, was to have similar interests to those who were already involved. Accordingly, it became clear that the recruitment of members with the same interests could be influential when sharing knowledge, as recruiting those with different interests might distort the focus of the group and discourage the willingness of others when sharing knowledge. Although willingness to learn was more important than existing levels of knowledge, the importance of common interests is already known within the CoP literature. Thus Wenger and Synder (2000, p. 139) define a CoP as "groups of people informally bound together by shared expertise and passion for a joint enterprise". This definition shows that similar interests have potential to influence the KS activities within CoPs.

Similarly, the networking that energy communities engaged in was highlighted as a potential influence upon the KS process. Each energy community displayed preferred methods of communication, which seemed to lead to effective KS. This could be explained by each energy community having analysed the existing knowledge base of the group and then selecting a suitable communication method. For example, community two had a preference to meet informally and face-to-face, organising meetings every Monday. Socialising informally was considered to create a "bond" between members. Similarly, community one held regular informal meetings to discuss the group agenda yet managed all external

communications via magazines and more formal methods of communication. One participant authored a monthly magazine that informed the wider community. This suggested the community felt comfortable communicating internally on an informal basis but thought that those who were external to the group should be informed more formally. The importance of networking and communications in the KS process was described by Ipe (2003) as opportunities to share knowledge. Ipe (2003) showed that the structure of work teams, training programs and technology could provide channels of opportunity for those who wished to share knowledge. Within the energy communities, these channels were seen to be informal and tailored to the strengths of the collective group.

Finally, all three energy communities considered trust as crucial to the day-to-day operation of each group. For this reason, trust should be considered as a key influencer upon the knowledge shared in each community. The findings revealed the importance of members being able to meet regularly and face-to-face, as this was seen to support the process of relationship building and openness between members. This openness was helped by a mutual understanding of the terms of engagement amongst members, where the motive for engagement was not purely financial. The clarity displayed by energy communities during the group's inception could therefore help build the levels of trust shown between them. Barney & Hansen (1994, p. 176) described trust as "the mutual confidence that no party to an exchange will exploit another's vulnerabilities". In the case of energy communities, members had shared motives for engagement, helping to reduce any members' financial concerns. This may have contributed to the early development of trust and the foundations of friendships within the group. In addition, Shaw (1997) suggested that trust could be developed by using creative ways to share and present information. The different methods of regular communication chosen by each community indicates that trust was also formed through transparently sharing information. For example, the creation of a community magazine by community one contributes to the development of trust between members, as they have confidence that all relevant information is openly accessible.

In summary, the development of trust within the three communities may influence KS by providing members of the group with confidence that their vulnerabilities are not going to be exploited. The regular presentation and sharing of information helps build confidence in those who are engaging in KS and enable decision to be made with clarity. The combination of confidence and trusting the knowledge sharer helps participants to feel more comfortable when receiving knowledge.

5.3.3.1 Summary of the factors the influence the knowledge shared

Section 5.3 has synthesized and explored the factors considered to influence KS within energy communities. Section 5.3.2 identified factors that might be considered distinctive to energy communities, whilst Section 5.3.3 explored factors from the literature review (Chapter 2) that were seen as influential within the energy community context.

Openness and friendship, finance and innovation and the awareness of an energy community were shown to be distinctive in this context. Friendships that existed prior to the formation of the energy community often led to developing an informal and relaxed culture within each community, which subsequently allowed members to share knowledge with comfort. This may be a factor that is particular to energy communities, as pre-exisitng friendships are not commonly observed within organisations. The available finance to each energy community was shown to both drive and hinder potential innovation, but did not stop group leaders from small innovations that required little to no finance. These innovations were used as a template for others within the group to observe and learn from. The importance of finance that supports the functioning of energy communities is acknowledged in the literature (Seyfang et al., 2013). The awareness of each community was also shown to influence KS, as energy communities were mindful of the needs of their surounding communities and other similar groups operating with the same objectives. Energy communities therefore adapted their communications to suit the needs of the surrounding community and other similar groups. In addition, the power dynamic (explored in Section 5.2) and the size of the energy community were found to be influential, as they contributed towards the nature of the knowledge being shared and the participants who were involved in sharing this knowledge. These factors became particularly important, as they would influence the nature of the knowledge being shared as the community developed over time.

Finally, membership, networking and trust were all factors that underpinned the process of sharing knowledge. These discussions align with the findings, where all three factors were considered as influential at different stages of community maturity. Membership was shown to be particularly important, as the recruitment of new members to the group could negatively influence the willingness of existing members to share knowledge. It was shown that the recruitment of members with aligning motivations could be particularly important for knowledge sharing and the dynamic of the group. Furthermore, networking was also shown to influence the knowledge sharing activity of a community. Communities displayed the use of different types of communication, yet all members seemed to prefer an informal and relaxed approach to engaging with these methods. This relaxed and informal approach seemed to be underpinned by a "bond" that existed between members within each community. Lastly, trust was shown as an influential factor that was developed by regular community meetings and the groups acknowledgement of the terms of engagement. These terms of engagement seemed to be non-financial, which may have contributed to the susbstantial development of trust levels within each community.

5.4 INFLUENCE OF COMMUNITY MATURITY UPON THE KNOWLEDGE SHARING PROCESS

5.4.1.1 Introduction of community maturity phases

This Section will address the third research question identified in Section 2.8; **how is knowledge shared within energy communities?** This discussion will show how knowledge in its various forms plays a role in a project's lifecycle, using a project example from energy community one to illustrate this process. In addition, the findings Section identified key themes that described an energy community's journey when engaging in the day-to-day activities and sharing knowledge. The four themes were membership, networking, trust, and the size of the group. It became evident that these themes represented community maturity stages, with an energy community functioning differently at the following different stages of progression: initiation; development; socialization; analysis; and reformation. The following discussion synthesizes these findings, drawing on the community and organisational literatures to show how these phases of maturity are distinctive in the energy community context.

5.4.1.2 Stages of the project lifecycle: the case of energy community one

Section 4.1.1 presented the biographies of the energy communities studied in this research, while Section 4.1.1.4 displayed the stages that energy communities go through during a project. The stages shown are specific to energy community one and the project it undertook to install solar PV upon the village library and cafe. Figure 29 considers the duration and evolution of each stage throughout the project. The identification of funding opportunities and the reflection on group roles and responsibilities are two stages in the project lifecycle that continue over time. Table 21 provides a further explanation of each of these stages of the project lifecycle and how knowledge is shared within them.

Figure 29: Stages of the project lifecycle

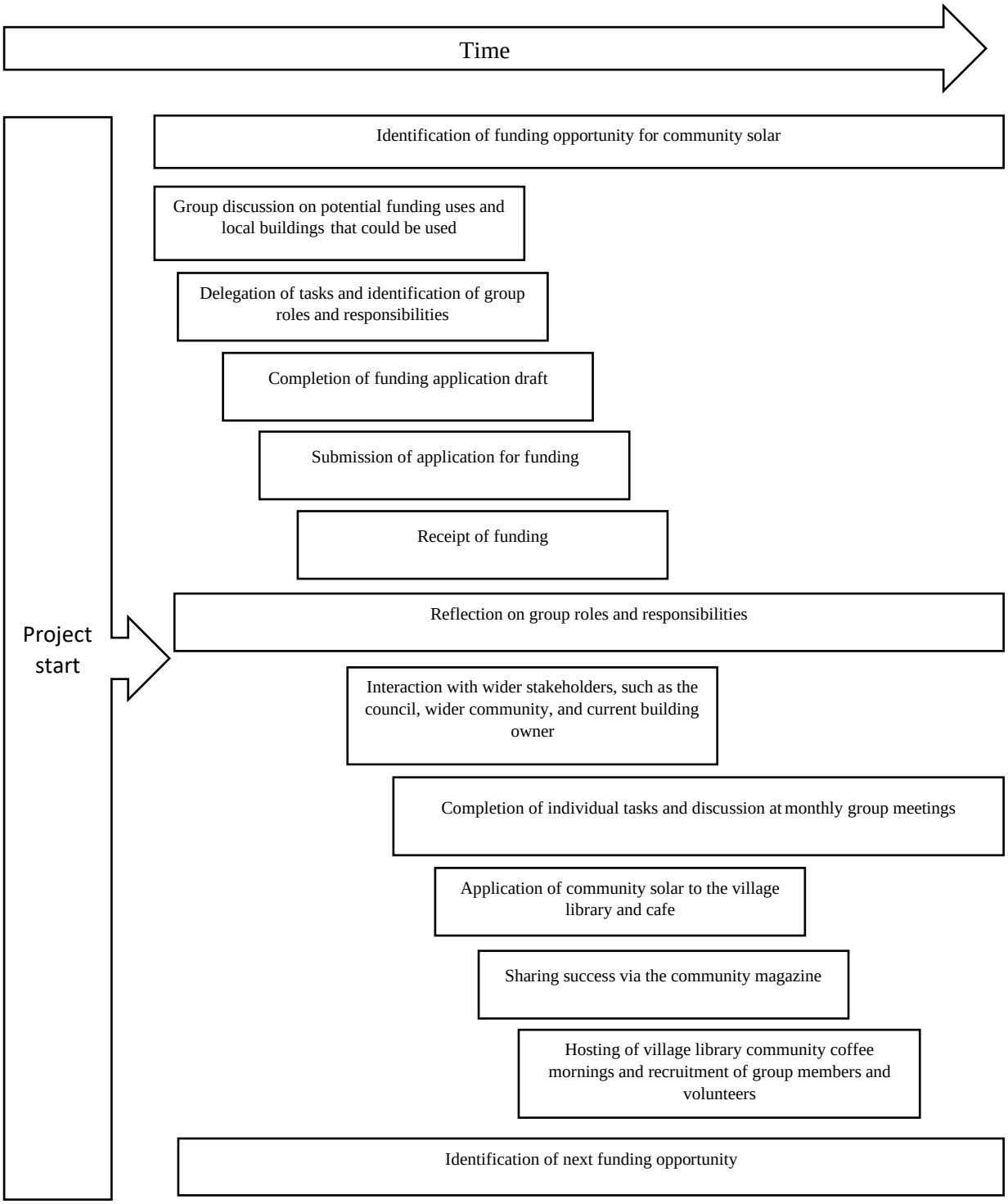


Table 21: Project lifecycle description

Stage of project	Knowledge sharing description
Identification of funding opportunity for community solar	Initial research using embodied and tacit knowledge of where to seek funding is used to identify opportunities. This research occurs at the start of a project but is ongoing as new opportunities can arise at any time.
Group discussion on potential funding uses and local buildings that could be used	The embodied and tacit knowing of funding opportunities and local buildings is shared with the wider group via discussion and various group meetings. This stage occurs after a potential funding source has been identified but is completed before tasks and responsibilities are delegated.
Delegation of tasks and identification of group roles and responsibilities	Shared knowledge becomes embrained via note taking, the construction of detailed emails and group discussions. Notes are shared within the group and roles and individual responsibilities are assigned. This stage occurs after local buildings have been identified for inclusion, but before the funding application is completed.
Completion of funding application draft	Funding applications are completed by the group, where tacit knowledge is further codified and group members "learn by doing". Group members use their assigned roles and responsibilities to progress the application, so it is ready for submission.
Submission of funding application	Funding applications are submitted by the group leader, where the process is completed with the help of the group.
Receipt of funding	Applications are accepted and the energy community receives funds.
Reflection on group roles and responsibilities	Knowledge becomes encoded and explicit when the group discuss individual strengths, weaknesses and review their current performance in existing roles. This is completed via extensive group discussion during meetings in the village library and café. The reflection on group roles and responsibilities occurs throughout the project lifecycle and allows the group members to monitor their performance and ensure they are sharing knowledge effectively.
Interaction with wider stakeholders, such as the council, wider community and current building owner	Knowledge becomes even more encoded and explicit when group members use their reflections to support their interaction with wider stakeholders. These interactions occur as soon as the application for funding is submitted, so that the group can involve the relevant stakeholders before the funding arrives.

Completion of individual tasks and discussion at group meetings once a month	The completion of individual tasks using encoded knowledge that has been received from other group members, is used to develop individual and tacit knowledge. Over time, this becomes embedded knowledge as individuals become more competent at their individual tasks and share their new knowledge with the energy community. This stage occurs once individual roles and responsibilities are decided and continues throughout the duration of the project lifecycle.
Application of community solar to the village library and cafe	Knowledge becomes even more embedded within the individual and the energy community when solar PV is installed on the agreed building. In this case, the library café receives a solar PV installation in the village. This occurs after the funding has been received and whilst the relevant stakeholders are still being consulted.
Sharing success via the community magazine	Knowledge is encoded further when the progress and success of a completed project is shared via the community magazine. This magazine is sent to each household within the constituency every three months. In the case of this solar PV project, the success story is shared after installation and in the next available magazine.
Host library coffee mornings and recruitment of group members and volunteers to run café	Successes and upcoming opportunities are discussed with current and newer members who have joined after viewing the community magazine. This stage occurs for the rest of the duration of the project lifecycle and supports the identification of new funding opportunities. Potential collaborations with other buildings and new stakeholders could also be identified.
Identification of next funding opportunity	Use of embedded individual and collective knowledge to seek new funding opportunities that are viable for the group. This brings the stages of the project to a close and the process is repeated.

5.4.1.3 "Initiation"

The theme of membership was highlighted within the findings as important when initiating the start-up of an energy community. For this reason, the first stage of community maturity is described as the "initiation" stage.

At the beginning of the community journey, participants described the leaders of the initiative as being enthusiastic and having a certain level of determination. It became clear that high levels of knowledge on topics such as energy and other niche areas of expertise were not needed to initiate the start of the community journey. As a result, close friends and colleagues of those who started the journey felt obliged to contribute, especially when it became apparent that no expertise was needed to get involved. This shows the high levels of reciprocity can are involved when energy communities are in the early stages of formation. Ben-Ari & Enosh's (2013, p. 426) notion that reciprocity arises when contributing as a matter of common interest, concern, social phemomenon or personal matter, appears applicable to the energy community context. One participant showed reciprocity when engaging in tasks such as VAT returns and annual reports, having had no prior experience and only the willingness to "fall into the position" (Participant 2A) of helping the group. This indicates that energy communities can be considered as CoPs because of the mutual interests of the members involved. The mutual interests and enthusiasm of those who initiate the development of energy communities aligns with Lesser and Everest's (2001) claim that CoPs are initiated to create a specific output would seem to be appropriate in this context. In comparison, Brown and Duguid's (2001) idea that participants come together to fulfil mutually beneficial needs, may not be applicable in this context.

Wenger (1998b) identified the first stage of a CoP as the "potential" stage, which is concerned with individuals making initial contact with others who have a similar agenda and objectives. In energy communities, there is evidence that the initiation phase of community maturity may occur before the "potential" stage, with initiation involving the formation of the community structure. However, the initiation phase may still exhibit similar features, as initial communication with other potential members does occur during this time. Nevertheless, energy communities have displayed levels of reciprocity, which involve feelings of duty and obligation from newer members to participate and respect existing friendships within the group.

In summary, the initation phase of community maturity is where the community journey begins, with members joining the group amongst close friends and colleagues. The involvements during this stage include: making the decision to take action and legally form the energy community; and communicating with friends, family and colleagues with similar interests who may be interested in becoming members. This stage is a vital basis for KS as it highlights the mutual interests of the group, therefore establishing the CoP.

5.4.1.4 "Development"

The consideration of membership as a key theme within the findings revealed the transition that founding energy community members embarked upon once the initial formalities had been recognised. This transition was referred to as the "development" phase in the findings. These findings showed that members aimed to recruit more participants and increase the scale of their operation, mainly in the pursuit of new ideas and innovation. In all three communities, the founding members were estimated at aged forty and above, perhaps because this age group had the time and money to commit to the group. However, these founding members also recognised they required the perspective of younger participants and those who had different areas of knowledge and levels of experience. One participant noted that founding members were predominantly retired and that energy communities needed "risk takers". Kyles (2005) remarked that generation Y is particularly comfortable with technology and work-life balance, which may contribute to their innovativeness. Accordingly, energy communities recognise that a wide-ranging age differential across the group may result in increased levels of innovation and ideas. Furthermore, energy communities recognised their collective age in the early stages of community formation. This shows that they may be understanding their social identity. Hogg & Abrams (1988) noted that social identity comprises two components: self-categorization and social comparison, both of which are evident in energy communities, which self-categorize as retired and actively compare their ability to innovate and generate ideas to a younger social group. Both Chung & Koo (2012) and Schutte & Barkhuizen (2015) recognised the concept of social identity as one that contributes to the effective sharing of knowledge in different contexts.

The importance of recruitment within energy communities was also evident in the collective group knowledge journey alluded to by various group members. A community one participant described how a lack of initial technical knowledge could have prevented the group's inception of the group, whilst another from community two acknowledge that anyone could join, regardless of existing knowledge or expertise. This indicates the importance that energy communities attribute to those who are willing to participate and share their knowledge. The collective journey that members experience and an inevitable "steep learning curve" (Participant 2B) for those who had no prior experience was acknowledged. Despite the community appreciation for all types of knowledge, energy communities preferred to recruit members with similar interests. Those who wanted to make a difference to their wider communities and shared interests in sustainability were viewed as valuable recruitments.

Considering the development phase of energy communities and their approach to recruitment, the explored characteristics align with indicators 9 and 14 within Wenger's (1998, p.125) key indicators of a CoP. Both indicators offer insight into how energy communities recognise their knowledge gaps, their target recruits and what interests they prefer energy community members to share. Indicator 9 displays a shared repertoire between members, which was shown by communities one and two when identifying the need to recruit younger group members for the purpose of developing ideas and to provide an

innovative perspective. Indicator 14 was displayed when energy communities announced their preference for recruiting members with interests in sustainability, which showed a level of mutual engagement and collective agreement. Considering Wenger's (1998b) stages of a CoP, the development phase of community maturity could be considered as a prerequisite for the "coalescing" stage. Wenger's (1998b) described the coalescing stage as involving members of a group discussing shared goals and defining the ongoing group objectives. This above discussion, however, indicates a development phase that is more concerned with the recruitment of appropriate members that have the potential to add value to the group, based on their interests and expertise, and recognising the knowledge and expertise of founding group members to identify knowledge gaps. These two areas of development may allow energy communities to enter the equivalent of a coalescing phase with the confidence that they have the necessary expertise to achieve their ambitions and group objectives.

In summary, the development phase of community maturity is a phase that plays a crucial role in helping energy community members form the foundations of their community and KS activity. This phase has been shown as particularly important because it is when energy community members engage in discussions about the knowledge gaps and the profile of required members to fill the identified gap. This may be crucial for KS in these communities as identifying a member who is a poor fit for the group may not yield the required knowledge.

5.4.1.5 "Socialization"

The findings showed how the energy communities used various communication methods to communicate internally and network with those who were external to the group. This phase of community maturity is discussed as the "socialization" phase, where energy communities often met informally and then chose their preferred method of communication and KS.

All three energy communities preferred to meet and discuss their community agendas in person and at various local community businesses. For communities two and three this involved meeting regularly at local pubs within the community, whilst community one preferred to meet at the village library. The style of these meetings was informal, helping to support the sharing of knowledge. As Participant I specifically highlighted:

> Talking informally to somebody you get to know them personally, who they are, that's when you can really open up and really share and develop trust between people to share knowledge and create bonds.

Those interviewed in communities two and three also discussed friendship as a factor that influenced the informality of communications at different meetings. It became clear that the relationship between members had often lasted longer than the existence of the energy community, resulting in smoother communications and quicker engagement in KS. Referring to Wenger's (1998, p.125) indicators of a CoP, these characteristics are in alignment with indicators 1 and 4. There was an absence of what

Wenger (1998) described as “preambles” (indicator 4), where discussions and informal meetings between group members seemed to be relaxed in nature.

Despite this informality, participants also suggested that their informal communications would lead to a more formal method of communication. One key informant participant made the observation that using email as a form of communication made it easier for group members to ask questions and receive clear and concise answers. Community three acknowledged the role that sending emails formulating their thoughts and ideas had in sharing knowledge with the group. The documentation and sharing of these ideas in this way shows how the community transitioned their informal socialization into more formal methods of KS. In comparison, community one also documented their thoughts and ideas, but shared them more formally via the production of a community magazine. The creation of the community magazine was undertaken by the group leader, who compiled and documented information that was then shared both internally and externally. Summaries of the knowledge shared in the magazine was also shared on social media by the community group leader. Finally, community two preferred to meet informally and then engage in campaigning activities as a group. This process involved less formal documentation of knowledge, but higher levels of direct engagement with fellow group members and external community members.

Nonaka’s (1991) SECI model of KS, and creation helps shed light on the mechanisms and processes that are occurring at this stage of community maturity. The informal meetings between members in each community show how energy communities socialize and discuss their tacit knowledge. Members within energy communities then receive this knowledge via various relaxed and informal discussions and then document it using emails, social media and community magazines. This process aligns with the socialization to externalization phase of Nonaka’s (1991) SECI model of KS. Community two, seemed also to include the next phases in the model of combination and internalization in their sharing, as they would take meeting notes but “learn by doing” and campaign in the wider community.

In summary, the socialization phase of community maturity reveals the transition that the energy communities make when converting the groups’ collective tacit knowledge into a more codified and explicit nature of knowledge. The socialization phase involved communities engaging informally in more social and relaxed settings in the first instance, mainly to reignite existing friendships and discuss group ideas. This placed the foundations for extracting the tacit knowledge within the group and was formalised when communications were carried out via methods that included email and community magazines. The process of KS occurred throughout the whole socialization process and the communication methods seemed effective in allowing members within the group to receive the knowledge.

5.4.1.6 "Analysis"

The "analysis" stage of community maturity was highlighted within the findings as a stage that involves the review of community progress. It became apparent that communities would review their own progress and identify the stage of the journey that they were experiencing. This became apparent because participants began to discuss the concept of trust with the researcher, after they had engaged in various informal discussions in social settings, such as pubs and community buildings. Participant I discussed trust by highlighting the importance of meeting fellow group members in person by comparing the acquisition of knowledge to the gathering of what may be described as information:

> You're not going to get that from a Google, you're not going to get that from reading someone else's climate change strategy. What works is actually meeting that person and developing a relationship with them and building trust (Participant I).

This statement indicates a clear distinction between what the participant considers as knowledge and information. They suggest that engaging in discussion when meeting in person allows a level of trust to be established between participants, which may then contribute towards effective KS. Participant I therefore relates to knowledge as a concept, that is part of a transaction between participants, unlike the use of websites such as Google which are used purely to obtain information. This notion aligns with Davenport & Prusak's (1998, p.5) definition of knowledge as a:

> mix of framed experiences, values, contextual information, and expert insight that provides a framework for evaluating and incorporating new experiences and information.

This evidence suggests that within the energy community setting, knowledge concerns the experiences and insight gained by the individuals within that setting. These experiences do not seem particularly easy to extract and require levels of trust between the sender and receiver of knowledge.

Another participant referred to the importance of trust in the process and describing the trust that group members had in those with specific expertise and knowledge. The development of trust seemed to be supported by the accepted view that the collective motive of the group was to pursue meaningful community objectives. The fact that only a small annual rate of financial return was expected was also important, as having a singular collective motive and pursuit of profit alone may have resulted in a more ambiguous development of trust. Mishra (2012, p. 5) identified trust as a concept where one party is vulnerable, in the belief that another party is competent, open, concerned and reliable. This definition seems to fit what was apparent within the energy communities, as participants seemed to invest time and money into the community, based on the understanding that all of those in the group were pursuing impactful and meaningful objectives. The importance of trust at this stage of the community maturity process suggest the analysis phase could be the equivalent of the dispersed stage of a CoP (Wenger, 1998b). According to Wenger (1998b), this stage occurs when participants feel comfortable in meeting less regularly and have trust in the knowledge that they have received from others members. As a result

of this trust, the transition from being a more active CoP to becoming a dispersed CoP is made smoother as knowledge becomes more tacit over time (Wenger, 1998b).

In summary, the analysis phase of community maturity allows energy communities to consider the trust levels that are present between individuals within the group and decide whether they are happy to share their knowledge and then become a more detached group. Such a level of detachment for an energy community can only occur when the collective group are satisfied that suitable levels of trust between members exist. High levels of trust are shown when group members acknowledge the role of others in the development of their own tacit knowledge. Nevertheless, the analysis phase of community maturity highlights the transition of the group from meeting in person and engaging in group discussions, to developing tacit knowledge and becoming a more dispersed community.

5.4.1.7 "Reformation"

The number of people involved in the leadership of an energy community was an influential factor when considering KS within energy communities. Aligned with this, the findings identify a reformation stage of community maturity, where participants would reflect upon the processes within the group and adjust their group size accordingly. It became clear that the pursuit of an optimum number of group members would allow the group to operate smoothly and therefore engage in more productive levels of KS.

In all three energy communities, the membership was between five and twelve, indicating that there is an optimum number of preferred group members. The acceptance and comfort that group members showed when discussing the group size indicated their confidence in the scale and make of the groups. Despite members in community three being described by one participant as "elite", these members nonetheless were perceived as adding value. In comparison to communities two and three, community one showed their interest in maintaining a group size below twelve, but also described their willingness to engage with a higher number of members depending on the project or task. Participant 1C used the example of the local church committee as a group that would be welcomed into the energy community when sharing knowledge on particular projects. The levels of willingness shown by community one when increasing the size of the group suggested that they enjoyed relaying the stories of their projects and sharing knowledge with wider stakeholders.

The reformation stage of community maturity can be considered against the final stage of Wenger's (1998b) CoP framework. When compared, the two stages have marginally different characteristics. Reformation has been shown to involve the re-sizing of an energy community and is a process where group members reflect on the trust levels within the community. If levels of trust are shown to be relatively high and reciprocated within the group, then KS is viewed as an easier process. In contrast to the reformation stage of community maturity, the memorable stage of a CoP focuses on the storytelling of the group and ensuring that the community obtains a legacy that is remembered. Although there were

aspects of storytelling shown within community one, the reformation stage should be considered as one that would occur prior to the stages of storytelling and building a legacy.

5.4.1.8 Summary of community maturity phases

Section 5.4 has synthesized and discussed the journey that energy communities embark upon when sharing knowledge. This journey is shown to comprise of five different stages: initiation; development; socialization; analysis; and reformation. The discussion of each stage shows that much alignment with the CoP literature and the different stages that occur within a CoP. However, each community maturity phase also has distinct charateristics and tendencies which distinguish the phases in the community ending context from current understanding of CoPs. More specifically, factors such as trust and the size of the energy community are shown as crucial at different stages of maturity. These factors make contributions towards the process of KS, with participants continually reflecting on their collective dynamic and considering whether they should engage in KS. As each energy community progressed through the maturity phases over time, the knowledge is shown to transition from being individual and tacit, to collective and explicit.

5.5 AMENDMENT OF CONCEPTUAL FRAMEWORK

The discussions presented in Sections 5.2, 5.3 and 5.4 have synthesized the findings and provided the researcher with a deeper understanding of the KS process within energy communities. Section 2.9 summarised the literature review by presenting a conceptual framework for the research. The included concepts were used to underpin the methodology and to guide the choice of research method. Figure 30 revisits the proposed conceptual framework from Section 2.9, whilst Figure 31 proposes an amended version of the framework that is informed by the research findings.

Figure 30: Previous conceptual framework

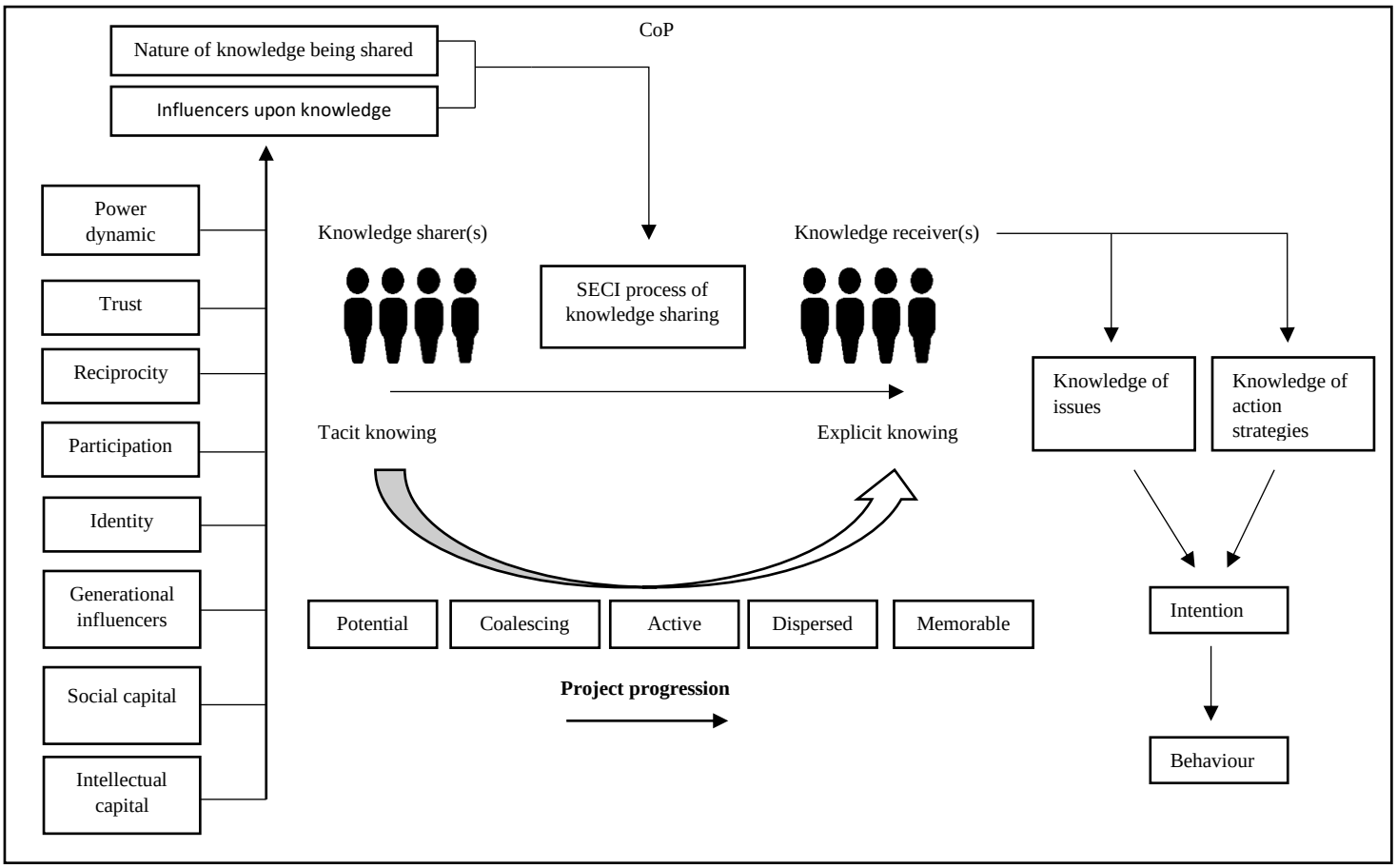


Figure 31: Amended conceptual framework

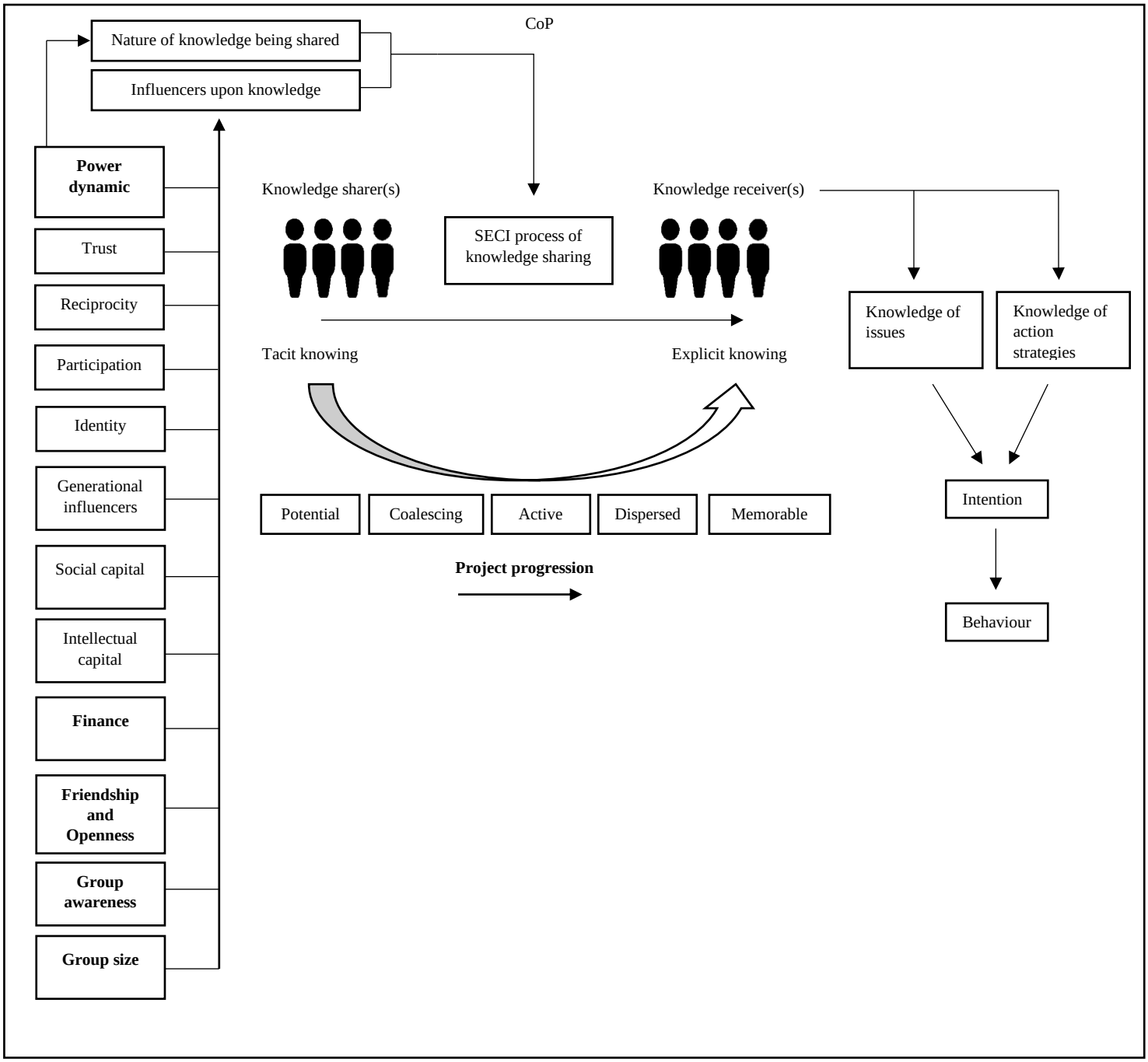


Figure 31 includes five new factors (in bold) that influence KS that have been added to the framework. These factors have been considered in detail within both the findings and the discussion chapters. The power dynamic within each community was discussed within Section 4.2 of the findings, indicating the existance of a relationship between power and the nature of the knowledge being shared. Not only was this discussed in relation to the types and nature of knowledge, but it was also acknowledged as a factor that influences KS and contributes to the development of each community maturity phase. In addition, energy communities' friendship and openness, finance and awareness of other communities were

highlighted as key themes in the findings and discussed as influencers of KS in Section 4.3. These findings build upon work by Nahapiet & Ghoshal (1998), who suggested that informal and face-to-face communication could help to create high levels of trust and friendship. The recognition of finance and innovation also aligns with Khilji et al's (2020) work that recognised the importance of innovation in the KS process. The importance of community group size as a factor that influences KS appears distinctive to the way that energy communities share knowledge, which shows that conducting KS research in new contexts is both valuable and important. This notion aligns with the views of Wang & Noe (2009), who discussed the need for KS research in new and under researched contexts. The contributory influence of intellectual capital, social capital, generational influences, identity, participation, reciprocity and trust are also recognised within the framework, although these seem less influential, as it was finance, friendship and openness, group size and group awareness that framed the findings and discussion. Despite this, the existence of factors such as trust show that the findings align with Sibte & Abidi's (2007) work on KS, which displays a model for knowledge sharing in healthcare; and Jeon et al's (2011) notion that intrinsic and extrinsic motivation influence attitudes towards KS. Thus, in energy communities, extrinsic motivation is revealed through the reciprocity, social capital and intellectual capital that are seen, whilst intrinsic motivation is reflected in members of identity within an energy community.

Figure 31 also shows that these influencers and the nature of knowledge being shared both directly impact upon the process of KS. This issue was explored within Section 5.4, where the process of KS within energy communities was shown to exist during five different maturity phases. Across the five identified stages, the transition of knowledge from the sharer to the receiver is shown. In addition, the stages also consider time and the nature of the knowledge being shared. The knowledge being shared transitions from tacit knowledge during the "initiation" phase, to explicit knowledge during the "analysis" and "reformation" stages.

5.6 SUMMARY

To conclude, this discussion has synthesized the findings in Chapter 4 and presented a deeper exploration of the nature of knowledge shared within energy communities (Section 5.2), the factors that influence knowledge sharing (Section 5.3) and the stages of community maturity (Section 5.4).

Firstly, the nature of knowledge shared within energy communities was shown to be influenced by the power dynamic and structure of a community. Power was then identified as a concept that could have a relationship with the knowledge that group members owned. Table 20 provided an overview of the relationship between participation, power and the nature of the knowledge shared within energy communities. Table 20 also showed that the more a member participated, the more knowledge they

would receive and share. The process of acquiring knowledge would also subsequently increase a member's power within the group. Embedded, encoded, embrained and embodied knowledge were all described as knowledge forms that would exist at different stages of participation and knowledge sharing. In addition to these forms, categories of knowledge were also identified as subject specific types that participants would refer to when discussing their involvement in a specific project. Examples were shown as energy specific knowledge, finance knowledge, leadership knowledge and recruitment knowledge.

Section 5.3 critically discussed the factors that influence knowledge sharing within energy communities. These factors were categorized into factors that had high influence on knowledge sharing (Section 5.3.2) and factors with medium influence on knowledge sharing (Section 5.3.3). Power dynamic, openness and friendship, finance and innovation, the awareness of the group and the size of the group were all discussed as factors with high influence. These factors were used as themes to structure the findings and emerged as frequent topics of discussion within the data. Membership, networking and trust were identified as factors with medium influence, as they were discussed less frequently, but were still acknowledged to have influence upon knowledge sharing activity. Finally, Section 5.4 discussed the five community maturity stages that were identified in the findings. These stages were discussed as a journey they energy communities experience when sharing knowledge. The journey was shown to include stages of initiation, development, socialization, analysis, and reformation.Throughout these stages, the nature of knowledge would change from being individual and tacit, to collective and explicit. As this process occurred, the factors that influence the knowledge sharing (discussed in Section 5.3) would also influence knowledge sharing at various stages. For example, trust was shown as a concept that would be considered by group members when entering the reformation stage.

The discussion of Sections 5.2, 5.3 and 5.4 provide this research with a deeper exploration of the possible answers to the three identified research questions. The succeeding Chapter will present a number of conclusions, contributions and reflections based on this discussion.

6 CONCLUSION, CONTRIBUTIONS AND REFLECTIONS

6.1 INTRODUCTION

This Chapter provides several conclusions, contributions, and reflections on the study. Section 6.2 discusses the previously identified research aim. Section 6.3 addresses the three research questions that have been explored throughout this research. Sections 6.3.1 and 6.3.2 provide the conceptual and theoretical contributions of this research. Following this, Section 6.3.3 outlines several practical implications that arise from this research. Section 6.4 identifies the limitations of this research and provides some recommendations for future research directions. Finally, Section 6.5 offers some concluding remarks.

6.2 ADDRESSING THE RESEARCH AIM

In response to the current and timely issue of achieving Net Zero Carbon emissions by 2050, this research aimed to explore the knowledge shared and managed within energy communities. The range of discussed literature in Chapter 2 reviewed the theories and research concerning both KM and communities.

Using the methodology that was discussed in Chapter 3, this study shows that knowledge could have a critical role to play in the scaling of energy communities across the UK. More specifically, the insights gained into the nature of knowledge being shared, factors that influence KS and the process of how knowledge is shared will provide future researchers with a framework for conducting further research in this space.

6.3 ADDRESSING THE RESEARCH QUESTIONS

The following two Sections will address the three research questions that were set out to inform the overarching research aim within this study. Addressing RQ1 and RQ2 has enabled conceptual contributions to the literature to be made in relation to the nature of the knowledge shared within energy communities, and the factors that influence the sharing of this knowledge. Answering RQ3 has led to a theoretical contribution that is linked to what is known about the stages of a CoP in this context. This is described in terms of stages of community maturity.

6.3.1 Conceptual contributions

6.3.1.1 The nature of knowledge being shared within energy communities

The first research question focuses on building a better understanding of the nature of knowledge being shared within energy communities. The nature of this knowledge was shown to be important because it could allow energy communities to understand more about the knowledge that they are trying to extract and share with each other.

Firstly, this research has used the KM literature to identify the different types of knowledge that could exist within energy communities. The interviews with participants in each community have revealed that different types of knowledge do exist and that these depend on the structure of the group, the group agenda and the knowledge ownership of each participant. It became apparent that sharing knowledge within this context is complex and consists of a process where a member engages in various stages of participation and socialization with other members. Based on this evidence, it is far too simplistic to state that there is just one encompassing knowledge nature within energy communities. As such, it is prudent to suggest that the pattern of these knowledge sharing types varies across different communities.

The use of Lam & Holloway's (2000) dimensions of knowledge helps to provide clarity on the forms of knowledge being shared within energy communities. As an energy community is formed and structured, embodied and tacit knowledge resides within the individuals in the group. This may include a community member's specific knowledge on preparing funding bids, managing finances or understanding how solar panels are installed on buildings. The epistemological dimensions of this knowledge then changes as the community groups form their agenda, decide upon their group structure, and explore the expertise and knowledge held by different members. This maturity process allows an individual's knowledge to become more explicit and other members to become aware of "who holds what knowledge". This is what Lam & Holloway (2000) refer to as embrained knowledge. For example, within community two, one participant was able to use their experience and interests to support the financial management of the group. The nature of knowledge then can become encoded and collective as it is shared across the group, with others able to access knowledge that is new to them through group meetings, informal and social gatherings, and documentation on specific topics. Community three showed that this form of knowledge exists within energy communities, as the group assigned a specific minute taker and speaker on the agenda of the meetings. This also showed how shared knowledge from the meetings were being documented and recorded.

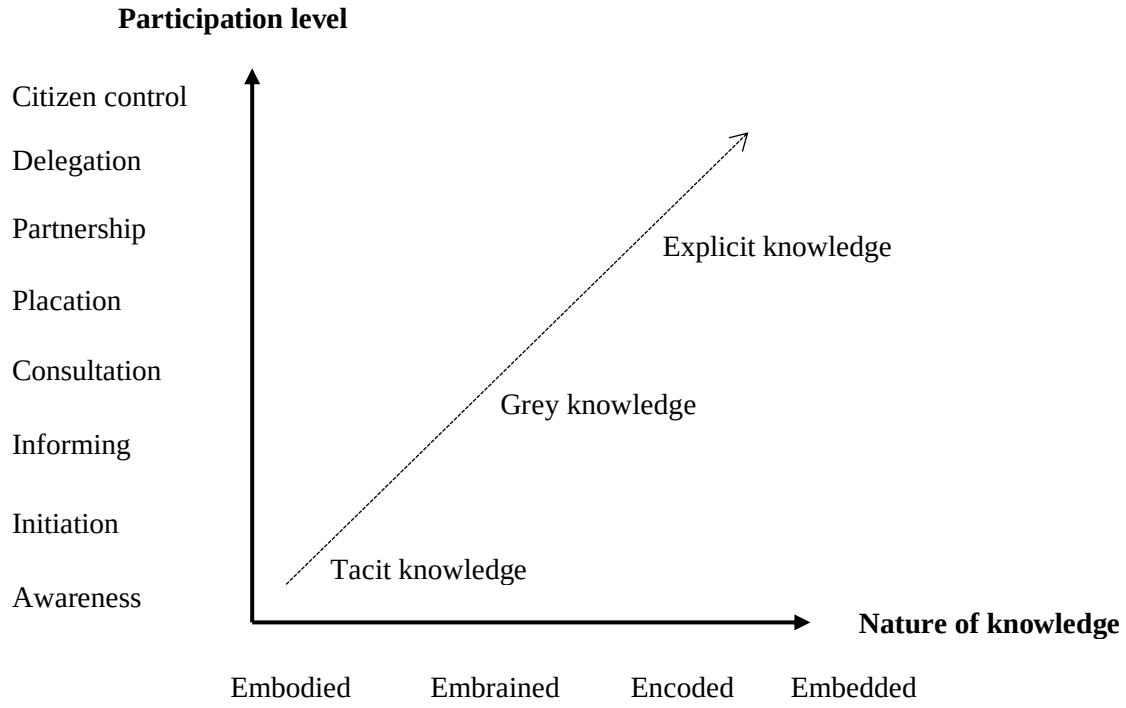
Finally, the nature of knowledge being shared within the group was shown to become embedded and tacit at a collective level, when the whole group developed a deep and rooted understanding of energy related knowledge. This was also shown in communities two and three, when participants expressed their experiences of the communities by drawing on "pooled skills". Table 22 provides an overview of the nature of knowledge being shared within energy communities.

Table 22: Overview of the nature of knowledge shared within energy communities

Nature of knowledge being shared	Epistemological dimension	Ontological dimension	Energy community related example
Embedded	Tacit	Collective	Knowing and collective understanding of how to install solar PV
Encoded	Explicit	Collective	Documenting and sharing the knowledge so that the collective group understands the basics of solar PV installations
Embrained	Explicit	Individual	Recognition from others about an individual's specific knowledge on solar PV
Embodied	Tacit	Individual	Prior knowledge about installation of solar PV

This research also shows that the nature of knowledge being shared may vary based on (1) the participation levels of participants within the community and (2) each participant's level of power and their subsequent role in decision making. The structure of energy communities, knowledge ownership and community agendas were all highlighted as areas that helped to explain the nature of knowledge being shared at different stages of member participation. Figure 32 builds upon Table 22 by displaying the perceived relationship between participation level and the nature of the knowledge shared.

Figure 32: Relationship between participation and the nature of knowledge shared within energy communities



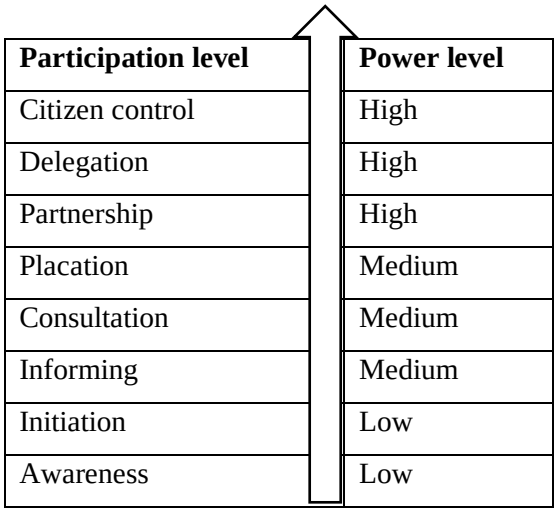
As shown above, the nature of the knowledge shared within these energy communities is mapped against the participation level of participants using Arnstein's (1969) ladder of participation. This Figure shows the transition of knowledge as it is shared within the communities. In essence, the more an individual participated with the group, the more explicit and collective their knowledge became. During the sharing process, grey knowledge resembles "something in between" tacit and explicit knowledge, which aligns with how Li, Liu and Zhou's (2018, p.890) conceptualise knowledge. In this instance, grey knowledge may be embrained or encoded in nature and appears in energy communities when participants begin to inform, consult, and use their knowledge.

Despite the clear steps shown in Arnstein's (1969) ladder of participation, not all of the presented levels are always relevant to an energy community. Figure 33 shows a reframed participation ladder, where the therapy and manipulation steps have been replaced with awareness and initiation. This new labelling symbolizes a more accurate representation of the phases of engagement that an energy community member will experience. One participant discussed how they became aware of energy related activities due to the interests of close family and friends. This interest then led into an initiation phase of joining the group and socializing with fellow group members. Many of the rewards and benefits of engagement in energy community work have been shown to be non-financial, such as friendship and feelings of

contribution and achievement. Therapy and manipulation do not seem relevant phases for this energy community context, as members are voluntary rather than forced to join.

In addition to this contribution focused on member participation and knowledge shared, it was observed that a member's power status significantly increased if they increased their participation level and shared more knowledge. This notion was seen to be true in all three communities, with the community leaders exhibiting the highest participation levels in comparison to others within the group. Figure 33 displays the relationship between participation and obtained power level within these energy communities.

Figure 33: Influence of participation level on obtained power



Participation level	Power level
Citizen control	High
Delegation	High
Partnership	High
Placation	Medium
Consultation	Medium
Informing	Medium
Initiation	Low
Awareness	Low

As shown, as members increased their participation within the community, their power level rose. Citizen control, delegation and partnership all commanded the highest power level. Within these energy communities, the leaders of each group obtained these highest levels of power. This power was displayed through leaders delegating tasks such as minute taking, whilst also "bashing on" with the group agenda regardless of the readiness of the rest of the group. The influence of an individual's power level on the nature of the knowledge shared is significant, as it became apparent that power could also have a negative effect upon those who wanted to share knowledge but were unable to do so. This was seen predominantly in community three, where participants acknowledged the leader's tendencies to overshadow the thoughts of others and talk for lengthy amounts of time during meetings. The high-power level of this leader may have therefore been suppressing the transition of knowledge from tacit and individual to being more explicit and collective within the group.

In summary, RQ1 has provided the platform for two empirical and contextual contributions to knowledge. The first contribution concerns the different types of knowledge that exist within energy communities and their tacit or explicit nature. The second contribution then maps the types of knowledge against participation, showing that as members increased their participation, the sharing of knowledge enabled the change from individual and embodied knowledge to embedded and collective knowledge. Finally, the findings relating to RQ1 evidence the role of power in the frequency and the nature of the knowledge being shared within these energy communities. Having a high participation rate within energy communities is shown to often result in an acquisition of power over other participants within the group. This was not always beneficial for KS, as the opportunities for others to share knowledge within the group could become restricted.

6.3.1.2 Factors that influence KS within energy communities

The second research question was focused on exploring the factors that influence the KS process within energy communities. These factors were identified in Sections 4.3 and 4.4, showing how they enabled KS and contributed to the various stages of community maturity. Whilst some of these factors have already been acknowledged within the community literature, others appear distinctive to the energy community setting. In addition, some factors seemed to be more influential than others in the KS process. Table 23 provides a summary of the factors that influence KS within energy communities.

Table 23: Factors that influence knowledge sharing within energy communities

High influence factors	**Factors with medium influence**
Power dynamic	Membership
Openness and friendship	Networking
Finance and innovation	Trust
Group awareness	
Size of the group	

The five factors considered highly influential were prominent during participant interviews, being referred to by various participants in different energy communities. The power dynamic within an energy community was shown to have a relationship with knowledge ownership and to play a key role in structuring the community and the agenda that the community engaged in. The findings support Foucault's (1979, p.27) notion that there is no power relationship without the existence of knowledge and vice versa. However, this research extends this idea by highlighting the relationship between power, participation and its influence over the structure and the agenda of an energy community. The openness and friendship displayed within the communities was explained by the existence of friendships prior to the community being established or a member joining it. These friendships contributed to creating an informal and relaxed culture that encouraged KS between members. These findings therefore align with

the existing research that considers culture as a key influencer upon KS activity (De Long & Fahey, 2000; Leonard-Barton, 1997; Pan & Scarbrough, 1999; Jarvenpaa & Staples, 2001).

The financing the energy communities and their consequent ability to innovate was also influential when sharing knowledge. The findings and discussion showed that energy communities were able to innovate and create ideas but relied on having the necessary finance in place to organise their resources and continue developing the scale of their impact. For example, community one lacked this finance, which deterred the group from pursuing several innovations. The findings reinforces the importance of finance in allowing groups to function effectively, which aligns with Scarso, Bolisani and Salvador's (2009, p.434) notion that the economics of a CoP are a core pillar for successful group operation. This research shows that the finance available to an energy community could indeed influence operating effectiveness and potentially the extent to which knowledge is shared.

The awareness shown by all three energy communities demonstrated that participants sought oppportunities to share knowledge with the wider community and other energy communities which engaged in similar activities. Energy communities would benchmark their performance and agenda against these other groups and look for community acquisition opportunities with larger communities. These findings further show how a community's awareness of external stakeholders would allow them to communicate with other groups and potentially identify opportunities to share knowledge as a consequence. In displaying these characteristics and aligned with indicator eight of Wenger's (1998, p. 125) checklist, energy communities were showing they can be considered as a CoP. In addition, these findings support Ipe's (2003) view that sharing knowledge relies on having the will to look for opportunities to do so. Finally, the size of the group should also be considered as a key contribution to existing knowledge about the factors that influence KS. Adjusting the size of the group was shown to be vital for energy communities, as it allowed participants to define their roles and responsibilities and communicate with each other regularly and effectively. These findings extend Nahapiet and Ghoshal's (1998, p. 251) notion that the effective structuring of relationships and face-to-face communications helps to create trust and friendships. Energy communities developed their friendships during the community maturity stages by communicating regularly, informally and effectively. This regular communciation was supported by the low number of members and clearly defined member roles.

This study also highlights three influential factors that have already been shown within the KS and CoP literature. Membership was shown as influential, due to its role in facilitating the initiation and development of the energy communities. Energy communities were shown to recruit members with similar interests, regardless of their pre-existing knowledge level. These findings reinforce the view that energy communities should be considered as CoPs, where the group is formed by members with mutual interests. As Wenger and Synder (2000, p. 139) stated, a CoP is defined as "groups of people informally bound together by shared expertise and passion for a joint enterprise". In addition, energy communities

were acutely aware of the collective age of the community, which resulted in various recruitment drives and in attracting younger members with innovative ideas.

Finally, the networking activity of the communities involved the adoption of various communication methods. These provide an insight into the way that energy communities prefer to facilitate their KS activity. Energy communities favoured informal communication methods, as shown by participants who met regularly in local pubs to not only socialise but also to discuss the energy community agenda. Formal methods of communication were then used to document conversations and contribute to KS. These methods included emails, campaigning, and the creation of community magazines. These more formal methods of communication are also seen in other types of organisation (Fielding, 2006), but the informality of the networking that was seen within these energy communities seems to be a distinctive feature of communication in this setting.

As a result of friendship and informal methods of networking, trust was also shown to influence the KS process. Participants displayed high levels of trust when socialising informally and discussing group operations in informal settings. Trust was also displayed between members, by allowing group leaders to make quick and decisive decisions. The high trust levels of each community seemed to be underpinned by friendship and the acknowledgement that members were not involved solely for financial gain. In addition, the regular documentation and presentation of information gave members confidence in the agenda and the competence of those around them. These findings align with Shaw's (1997) notion that trust can be developed by using creative ways to share and present information. These findings also align with previously conducted research that show trust to be crucial in supporting KS (Walker et al., 2010, Kuo, 2013; Swift & Hwang, 2013).

In summary, the findings that answer RQ2 contribute by presenting eight different factors that influence KS within energy communities. These factors are considered as being influential and highly influential depending on how often participants discussed each factor.

6.3.2 Theoretical contributions

6.3.2.1 How knowledge is shared within energy communities

The third research question was framed to explore the way in which an energy community operates and the processes that may be involved in supporting KS. Section 5.4 identified, synthesized and discussed the various energy community maturity phases that the three communities experienced. These phases also provided a basis for exploring and comparing the existing literature surrounding CoPs, KS and organisations. It became clear that the identified community maturity phases could be benchmarked and compared against Wenger's (1998b) stages of a CoP. Based on this, this Section will explain theoretical contributions to knowledge that involve firstly, identifying the various energy community maturity phases; and secondly, benchmarking these phases against the existing CoP literature. In doing so, the

distinctiveness of the energy community setting is revealed and a framework highlighting the process of sharing knowledge over time is developed. These contributions to knowledge are important because they (1) provide theoretical understanding of how knowledge is used within energy communities, which strengthens the basis for future exploration and (2) provide knowledge that energy communities can use to practically improve their working practices and support the sharing of knowledge.

After exploring each maturity phase, the uniqueness of the energy context became more apparent. Table 24 compares the identified energy community phases with Wenger's (1998b) stages of a CoP.

Table 24: Comparison of energy community stages

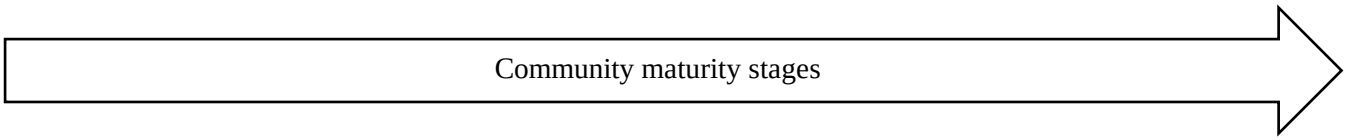
Stage of CoP	Description	Phase of community maturity	Description
Potential	Contacting those who have a similar personal agenda and aligning interests	**Initiation**	Starting the energy community by initiating the legal formation of the group and contacting friends, family, and former colleagues
Coalescing	Discussion of shared goals and creation of group objectives	**Development**	Recognition of existing knowledge and subsequent knowledge gaps within the group Recruitment of members that fill the identified knowledge gaps and obtain similar interests and expertise
Active	Creation of practices and processes that support the operations of the group	**Socialization**	Meeting informally and choosing preferred communication method Subsequent codification of shared knowledge
Dispersed	Acknowledgement of sufficient collective tacit knowledge that supports reduced levels of long-term group interaction	**Analysis**	Group reflection on processes and analysis of trust between members Supports the transition to becoming a more dispersed group
Memorable	Preservation of the group via storytelling and building a legacy	**Reformation**	Use of trust analysis and process analysis to re-size the group Optimum group size supports the development of tacit knowledge

The overview of community maturity phases shown in Table 24 provides a clear description of each stage and reveals the ways in which energy communities are distinctly different from the CoP stages that have previously been identified. The identified maturity stages present a unique theoretical contribution within this context, where the transition from individual and tacit knowing to collective and explicit knowledge is shown via a clear process that communities experience and engage in. This contribution is particularly important because it provides energy communities with a set of stages that

they can use to analyse and to review their processes. The stages may also increase their awareness of the sorts of activities they can expect to engage in during the knowledge sharing process.

During the community maturity phases, the nature of knowledge changes, as participants increases their level of engagement. The relationship between participation and nature of knowledge was discussed in Section 6.3.1.1 (RQ1). The transition in the nature of knowledge shared during the maturity phases was indicated in Section 5.4, as the processes underpinning the KS were described and linked to a more explicit and codified form of knowing. Table 25 provides an overview of each maturity phase and the nature of the knowledge being shared, the participation level of members, the power dynamic within the group, the size of the group and the trust levels between members.

Table 25: Overview of community maturity stages



	Initiation	**Development**	**Socialization**	**Analysis**	**Reformation**
Nature of knowledge being shared	Embodied	Embodied	Embrained	Encoded	Embedded
Participation levels of members	Low	Medium	High	Medium	Medium
Power dynamic within the group	Autocratic	Dispersed	Democratic	Dispersed	Autocratic
Size of the group	Small	Small	High	Very high	Optimum
Trust levels between members	Low	Medium	High	Very high	High
Type of knowledge being shared	Both tacit and explicit forms of knowledge are shared during initiation, as energy communities bring prior project knowledge with them into the start of new projects.	Knowledge becomes more explicit as members increase their participation, trust levels and begin to recruit new members.	Tacit and explicit knowledge is used and shared by members as they engage in regular group discussion and informal project meetings.	A combination of tacit and explicit knowledge is shared as an energy community reflects upon its processes.	Explicit knowledge is shared and contributes to the development of tacit knowledge as the group adjusts the community size to an optimal level.

Table 25 adds to the contribution shown in Table 24 by providing a more detailed description of the explored concepts and their relationship with each maturity phase. Table 25 is developed from Figures 32 and 33, to show the participation levels of group members and types of knowledge being shared during each maturity phase. These types of knowledge are a combination of tacit and explicit knowledge, where there is a shift from tacit to explicit knowledge as the latter becomes more prominent over time. Figure 32 also emphasizes this point and recognizes that "grey knowledge" exists as the nature of the knowledge being shared changes.

Within the initiation stage, participants would begin to involve themselves in the group formation but show a low engagement level. At this stage, the size of the group was shown to be small, and the nature of the knowledge within the group was embodied in nature. This could be explained by the fact that trust levels are likely to be low when members first begin to meet other community participants.

The development stage of maturity required a slightly higher level of engagement from members, as they sought to recruit new members and fill existing knowledge gaps within the group. The power dynamic changed from being autocratic and led by the group leader during initiation, to being more dispersed during the development phase. This change in power dynamic occurred as other group members participated in the recruitment process and contributed to the development of collective goals and objectives. It seems likely that trust levels at the development stage of maturity would increase as members create shared objectives. Socialization was shown to occur when the participation levels of members were at their highest. Participants would meet regularly at informal settings such as pubs and libraries, with the purpose of both socializing and discussing ongoing energy projects. The nature of knowledge being shared at this stage became embrained as participants engaged in discussion and shared their knowledge and experiences. Within the socialization phase, the power dynamic between members was more democratic, perhaps because formal decision making was less likely to occur when participants shared knowledge informally in a social setting. The trust exhibited by participants, may be significant at this stage due to this informality.

The analysis stage is associated with a medium level of participation, with members taking time to analyse group processes and document the shared knowledge within the group. The analysis of the knowledge received by each member allowed each community to review both the size of the group and the trust levels that had been obtained. The nature of the knowledge shared at this stage was subsequently encoded, as it was documented following extensive informal discussion at the socialization phase. The power dynamic within the group was dispersed, as participants were sufficiently informed to make their own decisions about who they could trust, who they could share knowledge with and what knowledge gaps remained within the community.

Finally, the reformation stage is associated with re-shaping the energy community so that it attains the optimum number of group members for successful operation and KS. This phase follows the analysis

stage, as communities reflect upon their operation, consider the group size, and try to improve their processes. In addition, knowledge at this stage becomes embedded and collective due to the completion of projects and the successful sharing of knowledge in the socialization phase. Participants may use their received knowledge within the group operation and create new knowledge by considering their own unique experiences. This kind of process is highlighted within the internalization stage of Nonaka and Takeuchi's (1996, p.69) SECI model of KS and creation. The reformation stage of maturity may reduce levels of trust from the analysis phase, as members may no longer be needed within the core of the group, creating potential collective trust issues. In addition, participants may identify individuals within the group as untrustworthy, resulting in a reduced amount of shared knowledge. The power dynamic that exists within the group may be particularly autocratic at this stage, as group leaders influence decisions on group sizes and participant roles.

In summary, this Section has provided a concise and original contribution to knowledge by answering **RQ3: How is knowledge shared within energy communities?** This research shows that knowledge is shared as energy communities experience a journey of maturity over time. These phases were identified as initiation, development, socialization, analysis and reformation. The phases of community maturity were presented and compared to Wenger's (1998b) existing stages of CoPs, showing both similarities and differences at each stage. The latter consideration of the nature of knowledge shared, power, participation, trust and group size at each stage provides a unique and original means of considering stages of maturity within the energy setting. These considerations help us understand the impact that some of the influences upon KS may have upon the process.

6.3.3 Practical implications

The discussed findings have several practical implications that could help community energy groups to improve their working practices and impact, which also could have wider implications for community energy at a national level.

The nature of knowledge that is shared within energy communities was shown to vary based on (1) the participation levels of participants within the community and (2) each participant's level of power and their subsequent role in decision making. As such, communities should consider the participation level of each member and make attempts to ensure that no member of the group feels excluded or disinclined to participate. Low levels of member participation could make it more difficult to extract and share knowledge that could be vital in ensuring effective working within these communities. For example, a disengaged member that participates rarely may have valuable specific knowledge about a technical issue, such solar installations, or a business skill relevant to the attainment of community project funding. Failure to extract this knowledge by the group might negatively influence the longevity and long term impact a community can make.

In addition, energy communities should consider the power dynamic within their group and make attempts to avoid problems associated with "founders' syndrome". This dynamic is seen in communities where one person takes sole control of the group's decision making. Although this research shows that high levels of participation are beneficial for extracting and encoding tacit knowledge, an imbalance in member participation across the group can result in a counterproductive imbalance in power. A consequence can be that community members may not get the opportunity or feel empowered to share their knowledge. Practically, the likelihood of this situation can be reduced if communities regularly analyse and review the knowledge sharing culture that exists within the group. The stages of community maturity could be used to support such analysis, by providing clear stages that group members can refer to during the knowledge sharing process. For example, monthly and annual knowledge sharing reviews in line with each maturity stage could be established, at which contributions made by each group member could be identified. Such information could help identify areas of specific knowledge among certain members, while identifying potential to encourage knowledge sharing among others. The regular reviewing of the nature of knowledge shared will allow energy communities to increase their efficiency in extracting and encoding knowledge.

The consideration of factors that influence knowledge sharing could also be crucial to improving effective working within energy communities. This research has highlighted several important factors that are particularly applicable within this setting. Influential factors such as the power dynamic, openness and friendship, level of finance and innovation, group awareness and the size of the group should be regularly reviewed by each community. For example, the monthly review of community size and friendships within the group may encourage the timely recruitment of new members to ensure the sustainability of the group and that projects are well supported. Practically, the regular addition or loss of members may change the dynamics, culture, decision making processes and effectiveness of the group and its ability to deliver different projects. However, such changes within each community could, over time, improve how effectively the community operates.

The discussed implications could also have impact on a national scale. Improvements in knowledge sharing processes within energy communities could increase member awareness and acknowledgement of other similar communities. From a national perspective, this could be crucial in providing the opportunity for energy community collaboration, knowledge sharing between communities, and a more collective approach to reducing carbon emissions within the energy sector. In addition, as energy communities were found to occasionally collaborate with other similar groups via organisations such as CEE at annual climate change and energy related events, there is potential to disseminate information about energy community maturity stages via these events for use nationally by other communities.

6.3.4 Policy implications

The findings presented in this research lead to a number of policy implications that could be considered by the UK government. The adoption of the following recommended policies would support the management of knowledge within energy communities and therefore allow communities to mobilize their efforts and potentially increase their impacts.

Firstly, this study contributes to the debate around the scalability of community energy. 'Scalability' can be considered to refer to increasing either the size or number of community energy projects. However, scalability may be an unhelpful term because it implies that increasing community energy is likely to be achieved by increasing the size of energy communities. The findings of this study have shown that there is an optimum size for an energy community to operate effectively. As such, the UK government and researchers should consider whether supporting replication of this optimum energy community size may be a better policy approach to increasing the impact of community energy on the energy system. Such policy could therefore support replicating the activities and successes of high-performing community energy groups across the UK.

More funding for energy communities should also be made available for a wider range of communities, such as those that are more rural. This kind of support could be vital for engaging a wider demographic in community energy, a factor that is crucial to effective scaling up. Energy communities tend to exist in areas that are relatively affluent and urban (Seyfang et al., 2013, p.981). To achieve the kind of scaling up needed to meet carbon reduction targets, the participation of people from more rural and less affluent locations is important. The knowledge available and needed in these types of location may be different to that seen in other energy communities. For example, people from more rural areas may have knowledge of the most suitable and cost-effective locations to set up solar farms in their region. Policy calls for more funding in these areas are also currently being made by organisations such as CEE (CEE, 2021).

The findings make readily apparent the need for a range of knowledge within energy communities. Policy that makes funding available to support knowledge specific roles within organisations such as CEE could be used to support the development of a knowledge infrastructure to which energy communities could refer. Energy communities could be supported to collaborate in this initiative, leading to the collection and storage of knowledge from a range of communities could be used to support future community growth and emerging groups. For example, a newly formed community energy group in rural Scotland might then be able to access an online knowledge hub containing tutorials, example projects, community formation templates and a list of knowledge specific contacts that could support their formation. The stages of community maturity could be presented in these resources as a framework against which a community could benchmark and review their knowledge sharing activity.

Finally, this research has highlighted the need for energy communities to encourage participation in their groups from a younger demographic. Currently, energy communities are apparently heavily made up of members aged forty and older, which can limit the generation of ideas and innovations within groups. Policy that supports younger people to take time out of their workplaces to contribute to their local community energy group would be helpful. In doing so, communities may benefit from an influx of new project ideas and benefit from local contacts that may not have previously participated. Policy that encourages the sharing of knowledge from a younger demographic could increase the rate at which communities are able to scale their operations and therefore support greater impact.

In summary, policies that provide communities with both time and funding could support the process of sharing knowledge within and between communities on a national scale. More specifically, a knowledge specific policy that supports the (1) the development of a community energy knowledge hub and (2) knowledge specific job roles within organisations such as CEE could be vital to capturing and sharing the knowledge that energy communities need to effectively mobilize.

6.4 LIMITATIONS AND FUTURE RESEARCH

Despite the significance and originality of the contributions discussed in this research, there are several limitations that should be acknowledged. Firstly, the researcher was limited in the amount of time that could be allocated to approaching energy communities and collecting the data. The time available to gather the primary data was around six months. Access to energy communities proved particularly difficult, as these groups were wary of newcomers who were not looking to become regular members. The researcher therefore had to take the time to immerse themselves within the community and to become a member, attending several meetings in order to develop the necessary level of trust with each group. Once interviews within energy communities were arranged, the researcher had to travel to different locations for them to be conducted. The limited time available meant that the researcher only had time to approach three energy communities and to conduct a limited number of interviews within these communities. The collection of a larger sample of data across more communities could have further supported the depth of the study. Secondly, the limitations discussed in the data collection part of the thesis had an influence on the generalisability of this research. The limited number of communities that were explored means that the results of this study can only be generalised to make assumptions about energy communities with similar characteristics.

Finally, the cross-sectional case study method that was used only provides a snapshot of the knowledge sharing that occurs within energy communities. Due to the limited amount of time available to the researcher, this was deemed the most effective method for exploring the scope and nature of knowledge sharing in this context. However, this kind of data is limited by the fact it captures knowledge sharing and members' perceptions about the scope and nature of knowledge share at a particular point in time. As such, having longer for data collection may have allowed the researcher to employ a longitudinal

method of enquiry, which would have allowed a more detailed mapping of how and what knowledge was shared over a longer time period.

Future studies that seek to enhance the current understanding of knowledge sharing within energy communities should use the findings of this research as a basis for understanding whether similar findings emerge from (1) a larger sample of energy communities and (2) energy communities with different characteristics. For example, future studies could explore energy communities with different agendas and that that are located in different areas of the UK. These areas are important to the research agenda because a broader and more generalisable understanding of knowledge sharing could contribute to improving effective working and UK wide collaboration in this space. For example, future research could explore whether the proposed community stages of maturity exist in communities that are solely focused upon wind power, or whether they exist in communities in Scotland or Wales. If not, alternative approaches to sharing and managing knowledge might need to be considered in communities with different characteristics. The use of formal methods of communication were regularly used within the studied energy communities, practices which are also used within corporate organisations (Fielding, 2006). During the knowledge sharing process, a combination of the social communication among members seemed to operate alongside more formal and corporate methods of communication. The deeper understanding that has been gained about this process could provide energy communities with ideas about how best to combine these methods and dynamics to extract and share knowledge more effectively. Comparative studies looking at knowledge sharing in community energy groups in other parts of the world could also add new insights into the KS process by these sorts of communities.

Theoretically, future studies could provide a more detailed understanding of the relationship between the maturity stages an energy community experiences and knowledge sharing. Using a process map of stages with performance indicators could support energy communities in reviewing their processes and enhancing their knowledge sharing practices. In addition, the use of a wider sample of communities could reveal different types of knowledge that is used and shared, and offer insight into other influential factors that affect the knowledge sharing process. These gaps in knowledge could be further explored through both qualitative and exploratory studies. Similar to the work presented by Jeon et al. (2011), the factors that influence knowledge sharing within energy communities identified here, could be quantitatively assessed across a larger and more structured sample.

To conclude, considering the study's limitations has identified the potential for further research to understand the influence that effective knowledge sharing and management can have within energy communities. However, these limitations also identify the ways in which future studies could further build knowledge in this area. Future qualitative studies could map out each maturity stage in more detail and consider key performance indicators, while quantitative research could validate the factors that influence knowledge sharing within these stages.

6.5 METHODOLOGICAL REFLECTION

Reflecting upon the methods used within this research and how the data was collected, as is often the case, alternative methods could have been used to address the research questions. Although the researcher was justified in using an exploratory approach, the deep relationships developed within the explored energy communities could have allowed a deeper and longer study to be conducted. For example, an ethnographic study that involved observing members in the communities could have yielded interesting findings. Nardi (1997) considered the ethnographic approach as one that requires the researcher to form close relationships with participants, and in doing so, to live a similar life to those being observed. This type of ethnographic study involving a high level of immersion in community practices might have highlighted more nuanced or different themes to those uncovered using the interpretative semi-structured interview method.

In addition, focus groups that bring together community members to discuss views on knowledge sharing activities and practices, might have provided an alternate perspective on the focal constructs. On more than one occasion, the researcher was able when attending community meetings to engage in group discussions with all the participants present. These opportunities arose spontaneously, as the researcher attempted to immerse themselves in each community and develop a relationship with each participant. If conducting similar studies in the future, there could the opportunity to arrange recorded discussions involving multiple participants, which might offer further insights into the understanding of power relationships and member participation.

Despite these methodological reflections, the chosen methodology enabled the required exploration of knowledge sharing within each energy community and allowed this researcher to answer the three identified RQs.

6.6 CONCLUDING REMARKS

The journey that has resulted in the completion of this PhD has not only allowed me to develop my interests in energy and sustainability, but also to produce some interesting and meaningful contributions. Attaining these contributions, however, came with a series of challenges and learning experiences along the way. I found that I was able to overcome the various challenges by constantly reflecting on on my development and by reviewing my progress with my supervisors every two weeks. This short concluding section provides an overview of this reflection.

At the beginning of my journey, I found it difficult to transition from my previous work environment into academia. Having worked in operations and finance for a regional brewery, my academic writing initially lacked the development needed to start writing effectively about the knowledge and community literature. After attending several academic writing workshops and receiving feedback on my writing, I worked hard to improve my sentence structuring and use of vocabulary. Despite improvements over

the three years, I feel that my academic style of writing needs to continue to evolve and this is something I look to carry on improving post PhD.

After the completion of the literature review, I quickly identified the method that I wanted to use in the research. I am particularly interested in qualitative data and answering "how" and "why" questions. When viewing a set of data, I always want to know more about the explanation behind the data and the factors that influenced it. This led me to want to know more about knowledge and how knowledge is shared and managed within energy communities. Using a quantitative approach would not have provided the depth of exploration I needed about community participants and their experiences. Having decided to use semi-structured interviews, I then struggled to gain access to key informants and community energy groups. Energy communities are particularly difficult to access because they tend to consist of very close friends and former colleagues who live within a specific georgraphical location. As an outsider, it was difficult to prove to each group that I had a genuine interest in energy communities and that my research could offer them findings that would be of interest or valuable to their operations. After attending numerous energy and sustainability conferences, I managed to network with several energy community leaders, enabling me to gain access to three communities in the West Midlands. From this point onwards, I was able to arrange semi-structured interviews with members and immerse myself in each group by attending regular meetings. The data collection was particularly enjoyable as I consider myself as someone who has a wide-ranging interest in people and how they live their lives. I also enjoyed the process of developing trusting relationships with each community and being able to attend their regular meetings.

Despite having a positive data collection period, the arrival of the COVID-19 pandemic made it difficult to continue with my research at the same pace. The closure of the Coventry University campus and the government imposed national lockdowns meant that several conferences were cancelled and stopped me from having face-to-face meetings with my supervisors to discuss my work. As such, I met with my supervisors fortnightly, using Microsoft Teams and Zoom. The transcription of my interviews and analysis of the data that I had collected was then conducted from home, where it was not easy to work and stay motivated. I feel that the PhD has been a very lonely process as a result, which seems to be the case for others even during normal circumstances. The removal of social interaction with fellow PhD students made it particularly difficult to discuss the PhD process with others and to reflect upon my progression. During the national lockdowns in 2020 and 2021, I began to exercise daily and ensure that I spent time outside of the house. This played a pivotal role in ensuring that I stayed motivated, healthy and depression free during the process.

After transcribing and analysing the collected data, I spent several months discussing the themes of my research with my supervisors and producing a draft that allowed the data that I had collected to tell a clear story. I also found this to be challenging because of my eagerness to quickly interpret the data and

discuss the findings. My supervisors urged me to be patient and to take a significant amount of time when writing up the findings. This helped me to stand back from the data and discover the underlying story. Following the completion of the findings chapter, I spent the final months of my PhD considering the discussion and contributions that should be made. Continually disussing this with my supervisors and my family has helped me to refine these contributions and understand why this research is so important.

Overall, I feel that my PhD journey has been challenging but also particularly enjoyable and rewarding. I have thoroughly enjoyed designing and delivering a project with the purpose of making an important contribution to this significant and topical subject. In particular, I have learned that completing such a long term and demanding project cannot solely be supported by motivation. There were times that I lacked the motivation to continue and it was through discipline and consistency that I was able to continue my journey to completion. I will therefore be taking these lessons forward with me in life.

7 APPENDICES

Appendix 1: The UK's Ten-Point Sustainability Plan

The following ten points outline the UK's strategy to tackle climate change (Sharma, 2020, p.12-13).

1. **Nuclear power**

   Nuclear power provides a reliable source of low carbon electricity. We are pursuing large-scale nuclear, whilst also looking to the future of nuclear power in the UK through further investment in Small Modular Reactors and Advanced Modular Reactors.

2. **Green public transport, cycling and walking**

   We will accelerate the transition to more active and sustainable transport by investing in rail and bus services, and in measures to help pedestrians and cyclists. We will fund thousands of zero emission buses and give our towns and cities cycle lanes worthy of Holland.

3. **Offshore wind**

   By 2030 we plan to quadruple our offshore wind capacity so as to generate more power than all our homes use today, backing new innovations to make the most of this proven technology and investing to bring new jobs and growth to our ports and coastal regions.

4. **Hydrogen**

   Working with industry the UK is aiming for 5GW of low carbon hydrogen production capacity by 2030. We are also pioneering hydrogen heating trials, starting with a Hydrogen Neighbourhood and scaling up to a potential Hydrogen Town before the end of this decade.

5. **Jet zero and green ships**

   By taking immediate steps to drive the uptake of sustainable aviation fuels, investments in R&D to develop zero emission aircraft and developing the infrastructure of the future at our airports and seaports, we will make the UK the home of green ships and planes.

6. **Protecting our natural environment**

   We will safeguard our cherished landscapes, restore habitats for wildlife in order to combat biodiversity loss and adapt to climate change, all whilst creating green jobs.

7. **Greener buildings**

   Making our buildings more energy efficient and moving away from fossil fuel boilers will help make people's homes warm and comfortable, whilst keeping bills low. We will go with the grain of behaviour, and set a clear path that sees the gradual move away from fossil fuel boilers

over the next fifteen years as individuals replace their appliances and are offered a lower carbon, more efficient alternative, supporting 50,000 jobs.

8. **Zero emission vehicles**

   From 2030 we will end the sale of new petrol and diesel cars and vans, 10 years earlier than planned, and provide a £2.8 billion package of measures to support industry and consumers to make the switch to cleaner vehicles.

9. **Carbon capture, usage and storage (CCUS)**

   Our ambition is to capture 10Mt of carbon dioxide a year by 2030 - the equivalent of four million cars' worth of annual emissions. We will invest up to £1 billion to support the establishment of CCUS in four industrial clusters, creating "Super Places" in areas such as the North East, the Humber, North West, Scotland and Wales. We will bring forward details in 2021 of a revenue mechanism to bring through private sector investment into industrial carbon capture and hydrogen projects via our new business models to support these projects.

10. **Green finance and innovation**

    We have committed to raising total R&D investment to 2.4 per cent of GDP by 2027 and in July 2020 published the *UK Research and Development Roadmap*. The next phase of green innovation will help bring down the cost of the net zero transition, nurture the development of better products and new business models, and influence consumer behaviour.

Appendix 2: Hunter's (1953, p.5) hypothesis on power structure

1. Power is exercised as a necessary function in social relationships.
2. The exercise of power is limited and directed by the formulation of and extension of social policy within a framework of socially sanctioned authority.
3. In a given power unit (organization) a smaller number of individuals will be found formulating and extending policy than those exercising power.

Corollary 1. All policy makers are "men of power".

Corollary 2. All "men of power" are not, per se, policy makers.

Appendix 3: Participant Information Sheet

Community-based knowledge sharing in a changing energy sector

PARTICIPANT INFORMATION SHEET

You are being invited to take part in research on community-based knowledge sharing. William King, PhD candidate at Coventry University, is leading this research. Before you decide to take part, it is important you understand why the research is being conducted and what it will involve. Please take time to read the following information carefully.

What is the purpose of the study?

The purpose of the study is to examine the nature of knowledge residing within communities and the manner in which it is shared.

Why have I been chosen to take part?

You are invited to participate in this study because you will be able to provide valuable insights on the project's key topics.

What are the benefits of taking part?

By sharing your experiences with us, you will be helping William King and Coventry University to better understand community-based knowledge sharing.

Are there any risks associated with taking part?

This study has been reviewed and approved through Coventry University's formal research ethics procedure. There are no significant risks associated with participation.

Do I have to take part?

No – it is entirely up to you. If you do decide to take part, please keep this Information Sheet and complete the Informed Consent Form to show that you understand your rights in relation to the research, and that you are happy to participate. Please note down your participant number (which is on the Consent Form) and provide this to the lead researcher if you seek to withdraw from the study at a later date. You are free to withdraw your information from the project data set at any time until the data is destroyed on 01/09/2021. You should note that your data may be used in the production of formal research outputs (e.g. journal articles, conference papers, theses and reports) prior to this date and so you are advised to contact the university at the earliest opportunity should you wish to withdraw from the study. To withdraw, please contact the lead researcher (contact details are provided below). Please also contact the Research Support Office at:

E: researchproservices.fbl@coventry.ac.uk

T: +44(0)2477658461

Your request can be dealt with promptly in the event of the lead researcher's absence. You do not need to give a reason. A decision to withdraw, or not to take part, will not affect you in any way.

What will happen if I decide to take part?

You will be asked a number of questions regarding your experiences of community-based knowledge sharing and the energy sector. The interview will take place in a safe environment at a time that is convenient to you. Ideally, we would like to audio record your responses (and will require your consent for this), so the location should be in a fairly quiet area. The interview should take around 1 hour to complete.

Data protection and confidentiality

Your data will be processed in accordance with the General Data Protection Regulation 2016 (GDPR) and the Data Protection Act 2018. All information collected about you will be kept strictly confidential. Unless they are fully anonymised in our records, your data will be referred to by a unique participant number rather than by name. If you consent to being audio recorded, all recordings will be destroyed once they have been transcribed. Your data will only be viewed by the researcher/research team. All electronic data will be stored on a password-protected computer file on the Coventry University One Drive. All paper records will be stored in a locked filing cabinet within the researcher's place of residence. Your consent information will be kept separately from your responses in order to minimise risk in the event of a data breach. The lead researcher will take responsibility for data destruction and all collected data will be destroyed on or before 01.09.2021.

Data protection rights

Coventry University is a Data Controller for the information you provide. You have the right to access information held about you. Your right of access can be exercised in accordance with the General Data Protection Regulation and the Data Protection Act 2018. You also have other rights including rights of correction, erasure, objection, and data portability. For more details, including the right to lodge a complaint with the Information Commissioner's Office, please visit www.ico.org.uk. Questions,

comments and requests about your personal data can also be sent to the University Data Protection Officer - enquiry.ipu@coventry.ac.uk

What will happen with the results of this study?

The results of this study may be summarised in published articles, reports and presentations. Quotes or key findings will always be made anonymous in any formal outputs unless we have your prior and explicit written permission to attribute them to you by name

Making a complaint

If you are unhappy with any aspect of this research, please first contact the lead researcher, Dr Helen Roby at

helen.roby@coventry.ac.uk. If you have concerns and wish to make a formal complaint, please write to

helen.roby@coventry.ac.uk. In your letter please provide information about the research project, specify the name of the researcher and detail the nature of your complaint.

Dr. Helen Roby

Centre for Business in Society, Jaguar Building

Coventry University

Coventry CV1 5FB

Email: helen.roby@coventry.ac.uk

Appendix 4: Participant Consent Form

Participant No.

INFORMED CONSENT FORM:

Community based knowledge sharing

You are invited to take part in this research study for the purpose of collecting data on community based knowledge sharing.

Before you decide to take part, you must **read the accompanying Participant Information Sheet.**

Please do not hesitate to ask questions if anything is unclear or if you would like more information about any aspect of this research. It is important that you feel able to take the necessary time to decide whether or not you wish to take part.

If you are happy to participate, please confirm your consent by circling YES against each of the below statements and then signing and dating the form as participant.

1	**I confirm that I have read and understood the Participant Information Sheet for the above study and have had the opportunity to ask questions**	**YES**	**NO**
2	**I understand my participation is voluntary and that I am free to withdraw my data, without giving a reason, by contacting the lead researcher and the Research Support Office at any time until the date specified in the Participant Information Sheet**	**YES**	**NO**
3	**I have noted down my participant number (top left of this Consent Form) which may be required by the lead researcher if I wish to withdraw from the study**	**YES**	**NO**
4	**I understand that all the information I provide will be held securely and treated confidentially**	**YES**	**NO**
5	**I am happy for the information I provide to be used (anonymously) in academic papers and other formal research outputs**	**YES**	**NO**
6	**I am happy for the interview to be audio recorded**	**YES**	**NO**
7	**I agree to take part in the above study**	**YES**	**NO**

Thank you for your participation in this study. Your help is very much appreciated.

Participant's Name	Date	Signature
Researcher	**Date**	**Signature**

Appendix 5: Key informant checklist

Context

Tell me about your current role

How long have you been working in this role?

How long have you been part of the organisation?

Energy Sector

What do you perceive to be the key trends within the energy market?

How do you think these trends have emerged?

Why do you think these issues are key?

How would you respond to these trends?

Who do you consider to be key stakeholders in the energy sector?

Why are these stakeholders important?

How do stakeholder views vary?

Community

What are your experiences of community energy?

What is your view on community energy?

How do you think community energy can contribute to the energy sector?

How is community energy structured?

How do members get involved in community energy?

Who is part of the group?

Describe the relationship between members of the group.

What do they value?

How are members of this group different from those who work in organisations, councils and government?

What do you feel are the barriers for members who are looking to engage in community energy projects?

Why do you feel these are the barriers?

What do you feel are the motivations for member engagement in community energy?

Why do you think that these are the motivations?

Who do you think are the key players within community energy groups?

Who are the key stakeholders in community energy?

Why are these the key stakeholders?

Knowledge Sharing

What role does a community group's knowledge and expertise play in solving some of the discussed issues?

How does the knowledge and expertise of members differ?

Why do you think this is the case?

How you think expertise and experience amongst members is shared with the rest of the group?

Why?

Appendix 6: Semi-structured interview prompts

Context

Tell me about your current role

How long have you been working in this role?

How long have you been part of the organisation?

Energy Sector

What do you perceive to be the key trends within the energy market?

How do you think these trends have emerged?

Why do you think these trends are key?

How would respond to these trends?

Who do you consider to be key stakeholders in the energy sector?

Why are these stakeholders important?

How do stakeholder views on these trends vary and why?

Community

How does community energy work?

How is the group structured?

How do members get involved in community energy?

Who is part of the group?

Describe the relationship between members of the group.

What do they value?

How are members of this group different from organisations, council and government?

How do you feel the group is progressing?

What things are going well?

What things are not going so well?

Why?

How do others feel about the priorities in the group?

How do your interests align with other members of the group?

How do you approach solving issues and problems as a group?

Who do you approach for advice?

How do you approach asking for advice?

How do you ensure that you have access to all of the resources you need to operate?

How does the size of the group impact the problem-solving process?

Knowledge Sharing

What role does the groups knowledge and expertise play in solving some of the discussed issues?

How does the knowledge and expertise of members differ?

Which members are knowledgeable about which areas?

How do you think expertise and experience amongst members is shared with the rest of the group?

Why?

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