The Role of Scientific Knowledge and Other Knowledge Types in Grassroots Sustainability Initiatives:

An Exploratory Case Study of a
Low Impact Development Eco-village in Wales

By

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Master Thesis

Submitted in partial fulfillment of the requirements for the degree of
Master of Science (M.Sc.) in Environmental Governance

Albert-Ludwigs-Universität Freiburg
Faculty of Forest and Environmental Sciences

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Acknowledgments

I would like to begin by thanking all my friends in the MEG program. I am grateful for each and every one of your different experiences and perspectives, and the many hours we spent discussing, studying, laughing and philosophizing in the past two years. During our time together, I have grown so much and gained an entirely new perspective on life. I would like to thank Prof. Dr. Michael Pregernig for his thorough supervision, helpful feedback and support throughout the entire research process. The commitment and engagement you bring to your supervision is outstanding, and something I know must not be taken for granted. Many thanks also to my second examiner Prof. Mark Roseland, for agreeing to take on this role – via trans-Atlantic request – despite being extremely busy with projects in Canada. A special thank you goes to Prof. Molly Scott Cato. I appreciate your time and feedback, as well as your literature tips which helped me tremendously, particularly in the early stages of this thesis. I would like to express my deep gratitude to all the participants of this study. Without your generous cooperation and honest input this research would literally not have been possible. A special thank you goes to Paul Wimbush for facilitating much of the logistics, and being extremely supportive throughout. Thank you also to Kevin and Su, for allowing me to stay in the farmhouse. I appreciate your generosity so very much, and hope to come back and visit one day. I would also like to thank the kind people at Landmatters, and particularly Sharon, for allowing me to stay with you and dig in your vegetable garden. A great big thank you goes to my family, for supporting me in whatever journey I decide to embark on. Particular thanks to my sister, Adriana, for your feedback and helpful suggestions. And finally, my deepest thanks to David, for being my rock, and supporting and encouraging me particularly during times when I was very frustrated and ready to pull out my hair.

Engaging with this topic, conducting the interviews and writing up this report has been a challenging but greatly enriching experience. I am thankful for finding the right topic, and have come out of this process inspired to make radical sustainability a central part of my life. I have also discovered a hidden passion for building my own low impact reciprocal roofed roundhouse.

Declaration

I, Karolina Rietzler, hereby declare that I have completed this master thesis entitled "The Role of Scientific Knowledge and other Knowledge Types in Grassroots Sustainability Initiatives: A Case Study of a Low Impact Development Eco-village in Wales" independently, using only the sources and materials indicated. All the sources and materials used in this study are cited and acknowledged as appropriate. In addition, I declare that I have not previously submitted any part of this document elsewhere.

Freiburg, March 20, 2012   _____

                                                                                    Karolina Rietzler

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Abstract

The importance of science and scientific knowledge in societal development is well recognized. The past fifty years, despite significant scientific advancements and a twenty-five year global commitment to sustainable development, have born witness to increasing environmental and social deterioration. Thus, there is a need to look critically at the role of science and scientific knowledge in developments towards sustainability. There is also a need to explore the role of alternative knowledge types within this context. An urgent call for more radical efforts to develop sustainably can be found in much of the literature, along with an increase in research on the relationship between civil society, knowledge and the environment. Therefore, this thesis asks about the role of scientific knowledge and other knowledge types in a radical grassroots sustainability initiative – the first low impact development eco-village in Wales. An exploratory case study research, including sixteen face-to-face interviews with participants from four different categories, was conducted. Several theoretical concepts, including transdisciplinarity, 'citizen science', knowledge boundaries, and ideas about grassroots innovations inform the research. The findings identify a great wealth of knowledge amongst the participants, including much alternative knowledge particularly amongst the eco-village residents. Intuition is identified as a novel and unexpected knowledge form important in the case. This study finds that acknowledging and accessing intuition as a valid form of knowledge may be linked to engaging in more radically sustainable behaviour and argues that it deserves serious attention within the mainstream discourse. Insights into the role of science within the initiative, as well as the potential for the project to contribute to mainstream knowledge towards sustainable development, are reported. Suggestions for innovative research approaches aimed at integrating institutional scientific knowledge and knowledge held by the participants of the initiative emerge from this study. It is found that this grassroots initiative facilitates encounters between people with entirely different understandings, and allows for negotiation of meaning within four different 'knowledge dichotomies' relevant to sustainable rural lifestyles. The thesis presents evidence of the importance and value of alternative knowledge types, and argues that more emphasis should be given to the collaboration between local expertise and scientific expertise in the attempt to move towards sustainable and equitable human development.

Keywords: science, knowledge, intuition, alternative knowledge, low impact development, sustainable development, sustainability, quality of life, transdisciplinarity, boundaries, grassroots innovations, local contexts.

List of acronyms

Acronym	Full name
CPRE	Campaign to Protect Rural England
DECC	UK Department of Energy and Climate Change
IEA	International Energy Agency
IUCN	International Union for the Conservation of Nature
IPCC	Intergovernmental Panel on Climate Change
JUDP	Joint Unitary Development Plan
LID	Low impact development
LI	Low impact
SD	Sustainable Development
TAN 6	Technical Advice Note 6
TD	Transdisciplinarity
TR	Transdisciplinary Research
UNCED	United Nations Conference on Environment and Development
UNCTAD	United Nations Conference on Trade and Development
UWE	University of the West of England
WAG	Welsh Assembly Government
WSSD	World Summit on Sustainable Development
WWOOF	World Wide Opportunities on Organic Farms

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1 INTRODUCTION, BACKGROUND AND RESEARCH FOCUS

1.1 Current global state of the environment

Every human and non-human being on this planet depends on the Earth and its resources for survival. Services that intact ecosystems provide include climate regulation, the provision of food and water, disease management, and the prerequisite for spiritual health and fulfillment. At the beginning of the last century, both human numbers and technology did not have the ability to induce radical changes in planetary systems. However, even in 1987 when the Bruntland report entitled "Our Common Future" was written "major, unintended changes" were occurring "in soils, in waters, among plants and animals, and in the relationship among all of these" (Brundtland & Khalid, 1987, para 122). The report stated that the rate of change was outstripping science's ability to assess and advise, and that this was cause for deep concern for people fighting to prioritize these issues on national political agendas (Brundtland & Khalid, 1987). Thus, the claim that our society faces massive challenges, both in terms of environmental quality and social equity, is no novel concept and tends to enjoy widespread acceptance.

The past fifty years have born witness to more rapid human-induced changes to ecosystems than during any comparable period in human history, resulting in a dramatic loss in the diversity of life on planet Earth (Millennium Ecosystem Assessment, 2005). Every day one hears that rapid human population growth places additional pressures on environmental deterioration, the energy crisis and resource shortages (Tang, Karhu, & Hamalainen, 2011). Areas which science has been able to monitor exemplify this deterioration and include the loss or degradation of forty percent of the world's coral reefs and thirty five percent of the world's mangrove area in the past fifty years, as well as a quadrupling of the water behind dams since 1960 and massive conversion of land to cropland – with a tripling of reactive nitrogen in terrestrial systems during the same period (Millennium Ecosystem Assessment, 2005). According to the New Economics Foundation, the world's average per capita footprint – representing the amount of land required to provide for resource consumption and absorption of CO_2 emissions – has been above the sustainable capacity of the planet since the 1980's, mostly due to massive over-consumption in Western countries (New Economics Foundation, 2009). For 2011, September 27th represented 'Earth Overshoot Day' which is "the approximate date our demands on nature for a given year exceeds the planet's ability to replenish" (Global Footprint Network, 2011). The remaining three months of 2011 were then lived in ecological overshoot, finally consuming a projected 135 percent of the resources the Earth created last year. The additional thirty five percent were obtained by "depleting stocks of fish, trees and other resources, and by accumulating waste such as carbon dioxide in the atmosphere and oceans" (Global Footprint Network, 2011). The

prognosis for the future looks grim. A large-scale UN research project states that the degradation experienced by our ecosystems is likely to increase in the first half of this century, adding to the difficulty of achieving the Millennium Development Goals, which address sustainability and equity issues worldwide (Millennium Ecosystem Assessment, 2005).

This section provides an introduction to the current study by first giving an overview of the current state of the environment above (chapter 1.1) and then introducing the concept of sustainable development (chapter 1.2) below. It goes on to discusses the importance of science and knowledge in society and development (chapter 1.3), and finally concludes by summarizing how the previous sections have proven a need and justification for the particular research interest of this study (chapter 1.4).

1.2 Sustainable development

The previous section briefly describes the current state of the environmental crisis we are facing today, and shows that the situation is worsening. This section aims to outline a type of development which has been championed as a solution to the crisis we are in.

Sustainable development (SD) has become a catch phrase for a type of development that does not result in the persistence of the socially and environmentally devastating development so often witnessed to date. There are many different definitions of SD and as many interpretations. The most frequently cited definition is found in the Brundtland Report "Our Common Future" from 1987 which defines SD as development which "meets the needs of the present without compromising the ability of future generations to meet their own needs" (Brundtland & Khalid, 1987, para 27). Within this, three pillars of sustainable development have been defined: the economic, the social and the environmental (Adams, 2006). The concept implies that there are limitations "imposed by the present state of technology and social organization" (Brundtland & Khalid, 1987, para 27) and its definition has a two-fold implication. The first concept rests on earlier work by the Club of Rome and a report entitled "Limits to Growth" published by them in 1972 demonstrating that current patterns of growth could not be sustained into the indefinite future (Meadows, Meadows, & Randers, 1972). The second concept the Brundtland definition of SD highlights is one of meeting needs, not only of the present generations but also of future generations, and especially in relation to the world's very poor (Brundtland & Khalid, 1987). Unfortunately, the Brundtland definition of SD still assumes that the limitations we are facing are not absolute, and that "technology and social organization can be both managed and improved to make way for a new era of economic growth" (Brundtland & Khalid, 1987, para 27). Thus, it does not represent a paradigm of development that sheds the current capitalist obsession with continued growth, and merely emphasizes that there are limits, but ones we most likely will learn to bypass with advances in science and knowledge. See figure 1 for a comparison of the theory and reality of the SD concept by the International Union for the Conservation of Nature (IUCN). In this figure, the nature conservation organization depicts its

view that environmental considerations within SD are currently not emphasized enough, and should receive more attention. It is, however, important to understand that this view is dependent on the organization's aims and objectives, and if this figure had been drawn by an organization with a strong development policy, the social, or economic, circles would most likely have been emphasized more strongly.
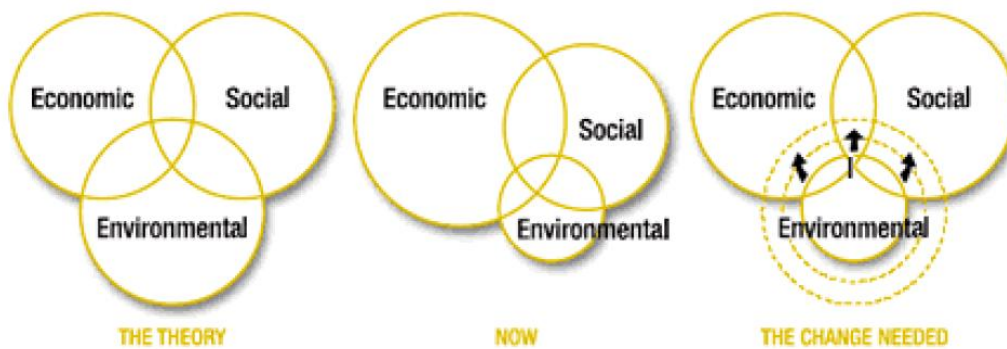
Figure 1: The three pillars of SD. From left to right, the theory, the reality and the change needed to better balance the model. (Source: Adams, 2006)

The confidence in the continued ability of scientific advancement permitting a development strategy relatively close to business-as-usual displayed in the Brundtland report is not shared by many recent accounts. Caldwell (1999) claims that by abandoning a relationship of reciprocity with the environment, and instead attempting to command it and demand too many resources from it, we have broken an ancient covenant with nature. The following excerpt from Caldwell's text "Is Humanity Destined to Self-Destruct?" speaks for a strong inclusion of absolute limits if we are serious about developing sustainably.

> Without a strong and governing principle of limits built into public policy, the ingenuity of humans may impel them to their own demise. Limits hold true for all life-forms, and will ultimately constrain the direction of human development. If the present widespread commitment to a sustainable future is realistic, people and policymakers must act on the axiom that unfettered growth and unrestrained expansion in a finite system lead toward a condition of cul-de-sac, with no further future for humanity (Caldwell, 1999, p. 4).

While Caldwell's message may seem overly pessimistic, it points to the urgency with which we must fundamentally question both the type and direction of future developments. In 1992, 178 nations signed the Rio SD principles and the Agenda 21 Action Plan which resulted from the "Earth Summit" (the United Nations Conference on Environment and Development (UNCED)) held in Rio de Janerio. The commitments made in Rio were then "strongly reaffirmed" at the World Summit on Sustainable Development (WSSD) held in Johannesburg, South Africa in 2002 (United Nations, 2012). Today, twenty years after Rio and shortly before the next United Nations Conference on Sustainable Development (Rio+20) the situation does not inspire hope. Not only have the environmental and social problems not improved, they have worsened. The South Centre, an intergovernmental policy think tank of developing countries, claims that the "global sustainable development situation has deteriorated" and the "environment crisis has

worsened" in the twenty years since Rio (South Centre, 2012), showing the limits of this top-down and capitalist-driven approach to sustainability. The same sentiment was expressed strongly by the secretariat of the United Nations Conference on Trade and Development (UNCTAD), Ulrich Hoffmann (Hoffmann, personal communication, 2011). Particularly if our goal is not only to continue existing, but also to mitigate the extreme poverty and inequality present today, there is an urgent need to go beyond current efforts. We need to be on the lookout for stronger and more radical attempts at developing sustainably – developing *differently* – and we need to look for these on all levels of society, from government-led approaches to community-based initiatives. Pickerill and Maxey claim that "it is time to seriously consider radical solutions to our overlapping environmental and social crises" (Pickerill & Maxey, 2009a, p. 1516).

Although, as the implied criticism in figure 1 shows, one could, and surely should, inspect today's economic logic and the power relations inherent in it when critiquing the lack of results observed in SD efforts so far, this is not the focus of this study and thus beyond its scope. The following quote by Irwin (1995) points to the logic behind the current study, and provides an introduction to the next section by claiming:

> These [SD] questions are inseparable from questions of knowledge and the status of science within competing notions of social progress. There is a danger at present that the international debate over sustainable development will be conducted without a critical account of science itself – and indeed that a global scientific discourse will prevent the expression of more localized understandings and experiences. A particular form of science will 'frame' the issues in a manner which may not be open to other ways of knowing and other ways of living in a sustainable fashion (Irwin, 1995, p. 6-7).

1.3 Importance of science and knowledge in society and development

This section focuses on the challenge expressed in the final quote of the last section (1.2). It represents a more critical examination of science and scientific knowledge, keenly aware of the many environmental and social problems of our time. Despite the recent focus on developing sustainably outlined above, we are confronted with the inability – or unwillingness – of our society and political leaders to address these issues in an adequate manner. It is time we ask ourselves how we got here, and what we can change to improve or mitigate the current devastating situation. Scientific knowledge, and more generally our various 'knowledges' about how the world works and how we can or should interact with it, have a key role to play in this process. Science has long been seen as important if not essential for human development, particularly in the creation of technologies to serve humanity, and in our relationship with the natural environment (Bocking, 2004, p. 3). Scientific inventions permeate our lives. People on opposite sides of the planet can now speak to each other in real time, there is a wealth of knowledge available upon the click of a mouse via the internet, and the knowledge gained through science has even allowed us to replace our organs if they should become defect. However, while scientific insight has provided benefits such as greater efficiency, greater productivity, and the chance for more leisure time, society has also felt its impact in terms of

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unemployment, "the centralization of power" and a "potential loss of freedom and autonomy" (Irwin, 1995, p. 3). When one understands the contribution of science in terms of biotechnology, new methods of manufacturing or satellite broadcasting and nuclear energy, Irwin claims it becomes obvious that "our culture is to a large extent 'framed' by technological development – in the sense that science and technology provide many of the material possibilities for modern existence" (Irwin, 1995, p. 3). In addition, and of relevance to this study, advancements in scientific knowledge and innovation are directly linked to both the large scale environmental destruction and exploitation outlined above (Millennium Ecosystem Assessment, 2005) and to our ability to perceive and monitor these changes. Thus, the role of science in society and development is critical. While, as Irwin (1995) says, the majority of commentators present the role of science and it's innovations as a benefit to society – which it is important to acknowledge and which is visible particularly when looking at the changes in living conditions in the past 150 years – he also points to the other side of this "double edged sword", claiming that:

> despite the claims of certain contemporary scientists that science has brought about the 'kingdom of freedom', it seems that the ambiguities of scientific and technological progress represent an important subtext within our lives and a major challenge for future international development (Irwin, 1995, p. 3-4).

Thus, looking critically at the role both science and scientific knowledge as well as other forms of knowledge play within modern life should not be interpreted as an attack on science and technological development per se, in favour of other knowledge forms. Rather, it should be seen as a possible step towards reforming our relationship to knowledge with the hope of improving our efforts towards finding truly sustainable ways of developing. The remainder of this chapter is therefore dedicated to looking at science and its relationship to society and development more closely through the eyes of several influential thinkers.

The writings of the German sociologist Ulrich Beck provide an important argument in support of examining our understanding of science and knowledge in relation to the environmental issues outlined previously. Beck acknowledges the positive contributions of science but also recognizes the darker side of the developments of modernization. In particular the role assigned to science and knowledge in this process presents, for him, cause for concern. He sees the current ecological crisis as the result of unwanted side-effects of industrial society, and argues that it should not be seen as an 'environmental problem' of our surroundings, or the world outside ourselves, but rather understood as "a profound institutional crisis of industrial society itself" (Beck, Giddens, & Lash, 1994). He argues that whilst in previous times people were concerned with *externally* produced risks, the risks we face today are a result of *internal decision,* and depend on a "simultaneously scientific and social construction" (Beck, 1992, p. 155). He makes three claims about science, stating it is simultaneously (1) one of the *causes,* (2) the *medium of definition* and can also be (3) the potential *source of solutions* to risks of our

time (Beck, 1992). This clearly places science in a position of central importance for the current and future development of society and its relationship to the natural environment. However, he argues that the industrial modernization processes, of which science is a key element, are "blind and deaf to their own threats" and that those threats will in fact "call into question and eventually destroy the foundations of industrial society" itself (Beck, Giddens, & Lash, 1994, p. 6). This self-inflicted obsolescence of the industrial society will occur *automatically;* unwanted and un-noticed, yet compulsory. It makes way for an emerging 'risk society' which he defines as "a developmental phase of modern society in which the social, political, economic and individual risks increasingly tend to escape the institutions for monitoring and protection in industrial society" (Beck, Giddens, & Lash, 1994, p. 5). This means that when the dangers produced by the industrial society begin to dominate both public and private debates the very institutions of industrial society become both the producers and *legitimators* of threats that they are unable to control (Beck, Giddens, & Lash, 1994).

Of relevance to this study is Beck's belief that we are now in a stage of '*reflexive modernization*'. What this means is that we are in a stage past modernity, in which we are forced to engage with the risks and consequences of the processes of modernization and industrial society – which are still ongoing in the risk society. This argument, that we are now at a stage where we must – whether we wish to or not – confront ourselves with the impacts and role of science, explains the choice of focus for this study. Beck outlines an interesting and important contradiction for the role of science and knowledge, which highlights why it is imperative to continue to reflect on it: science is critical and skeptical of the objects it focuses on, but often does not apply this skepticism to itself. In Beck's own words:

> On the one hand, science and thus methodical skepticism are institutionalized in industrial society. On the other hand, this skepticism is (at first) limited to the external, the objects of research, while the foundations and consequences of scientific work remain shielded against internally fomented skepticism. This division of skepticism is [...] unstable in the face of the suspicion of fallibility: the continuity of scientific-technical development runs through a discontinuity in its internal and external relations (Beck, 1992, p. 14, emphasis added).

Three ideas in the excerpt above are of central importance: *methodical skepticism*, *foundations and consequences of scientific work*, and *fallibility*. The strength of science, it's critical and skeptical approach to analyzing and understanding the world around us, is at the same time a weakness since it tends not to be applied to science itself. Thus – particularly if one believes that science, like everything else, is fallible – we must remedy this omission and also focus our critical attention on the very *foundations* and particularly the *consequences of scientific work*. Therefore, reflexive modernisation[1] here means this skepticism is extended to examine the very foundations and hazards of scientific work and science itself. If one assumes that we indeed

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[1] Modernization to Beck means "surges of technological rationalization and changes in work and organization, but beyond that it includes much more: the change in societal characteristics and normal biographies, changes of lifestyle and forms of love, change in the structures of power and influence, [...], in views of reality and *norms of knowledge*" Beck (1992, p. 50) (emphasis added).

now find ourselves within this period of reflexive modernization, then we have no choice but to fundamentally question the institutions that have escorted us to where we are today. Our understanding of the role and form of science and its findings, and on a broader level of knowledge in general, must therefore also be addressed.

Beck's work, but also the contributions of thinkers like Thomas Kuhn[2], who developed the concept of 'paradigms' in science and analysts of science like Alan Irwin[3] who defined the concept of 'citizen science', signal the necessity of critically inspecting scientific knowledge ('facts', theories and ideas) and other non-science knowledge in light of their potential to influence the development and progression of society – both in a positive and negative way. Science is currently still providing the structure in which all debates must take place, and scientific accounts tend to be presented with astonishing certainty. However, as Irwin's examples[4] demonstrate, there is increasing evidence that we have reached a stage where "this particular form of legitimation has worn decidedly thin" and other forms of knowing should be heeded equally (Irwin, 1995, p. 107).

More recent literature also speaks of the increasing skepticism of society towards the previously uncontested idea that "modern science comprises an ever-growing body of unchanging and unchallengeable truth" (Duguid, 2010, p. 244). Progress, representing the core value of Western society and increasingly much of the globe, with its constant innovation, implies essentially constant change and thus the potential for disruption or catastrophe. Caldwell pre-empted this concern claiming that "change has been accelerating faster than our understanding of its ramifications and consequences" (Caldwell, 1999, p. 4). The promise made by science to always keep one step ahead of the potential disruption and thus solve the negative impacts of innovation and progress is becoming subject of increasing skepticism as well (Duguid, 2010). Duguid (2010) sees this loss of faith in scientific knowledge as a symptom of society's decreasing ability to tolerate constant change and views it as resulting first from experiences of the bloodshed during World War 1, then from fear of nuclear disaster in the Cold War, and currently from the fear of a massive ecological collapse.

Having outlined the negative aspects of a science and a knowledge creation that does not reflect on its actions – particularly in relation to the environment and sustainable development – it is imperative to mention that within modern science there exist different understandings of how it should be conducted. Some approaches reflect critically on what problems science should be addressing, are open to and actively seek the inclusion of alternative types of knowledge and aim to counteract the problems mentioned above. For example transdisciplinary

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[2] See Thomas Kuhn's (1975) 'The structure of scientific revolutions'
[3] See Alan Irwin's (1995) 'Citizen Science'
[4] See Chapter 1 and 3 of Irwin (1995).

research (TR), aims to be: a) problem-oriented, b) beyond disciplinarity, c) practice-oriented, d) participatory and e) process oriented (Pohl, 2001, p. 39). It provides an example of an approach to science which acknowledges local or practical knowledge as being equivalent to scientific knowledge and thus incorporates the expertise of scientific knowledge, local knowledge, and jointly generated knowledge (Wiek, 2007, p. 56). Additional approaches to science, such as the concept of "citizen science", call for science to assist the needs and concerns of citizens while also referring to a type of science enacted by the citizens themselves, therefore also considering contextual knowledges that are generated outside of formal scientific institutions (Irwin, 1995). These more 'reflexive' approaches to science, which inspire new hope for the role of science and knowledge in society's progression towards sustainable development, are explored in more detail in the theory chapter (chapter 4) of this thesis. Related to the scientific approach is the level of society on which science focuses. These more alternative approaches, by acknowledging the local and the contextual, also give importance to sustainable development on the grassroots level. Grassroots sustainability projects, by emerging out of real-life problems, often practice an entirely different and more radical kind of sustainable development (Seyfang & Smith, 2007).

In summary, the arguments made through the voices of the authors presented above are not to say that science is 'evil' nor that it is the only cause for the observed development of modern society and the environment. Rather, it should serve to justify that examining science and knowledge skeptically and critically is not only sensible but *imperative* if we wish to gain greater understanding of the influence it has on our actions and thus on our planet, and the potential it presents. Obviously one could write and comment equally on the importance of examining power relations, class and hierarchy issues, political systems, etc. The focus on science and knowledge in terms of their influence on society and thus the environment and (un)sustainability is a conscious choice. In part the choice is justified above, but there are two additional components. The first is that it is impossible to focus on all relevant aspects associated with sustainability within the very limited scope of a master thesis, and therefore decisions and eliminations must be made. The second is that understanding the relationship between what we call 'science' and 'scientific' knowledge, other alternative sources and forms of knowledge and the 'progress' of our society are of particular interest to me, the researcher. I am therefore using this thesis as a chance to explore an area I feel is important but also one which captivates me personally.

1.4 Conclusion of introduction and presentation of research focus

This chapter aspires to lay the foundational context for understanding the current study. It begins by looking at the current global state of the environment and concluds that there is an urgent need to act in order to prevent further degradation and destruction. It goes on to discuss

the concept of SD, outlining its origins and aims, and showing how – after 20 years of 'commitment' to the concept by most nations worldwide – it has not only failed to improve the situation but in fact things are continuing to worsen. This is used to argue that an emphasis on deeper sustainability initiatives is needed. The chapter continues by presenting the importance of science and knowledge to the development of society, by showing how it is at least partially responsible for creating the unsustainable and environmentally damaging development observed today, as well as demonstrating that it has greatly benefited society in the past several hundred years and that new approaches to both science and knowledge – including sustainability projects that emerge from the bottom-up (from citizens themselves) – present new hope for providing solutions to sustainability.

This introduction has thus lain the foundation for introducing the focus of the current study: an examination into the role of science and other knowledge types within a citizen sustainability initiative. Therefore this research asks the following 2 broad research questions:

1. **What is the current role and potential of science and academia in a grassroots sustainability project?**
2. **What other knowledge types or ways of knowing can be identified, and what role do they play?**

The next chapter (chapter 2) provides both the context and case description of the initiative chosen to investigate, and the following chapter (chapter 3) outlines the theoretical framework applied for this research and presents the detailed research questions examined.

2 CONTEXT AND CASE DESCRIPTION

This chapter describes the specific context which allows for the more radical attempt at sustainability analyzed in this study, and then presents the case study chosen to be analyzed. First, the United Kingdom (UK) and Welsh contexts are discussed in terms of provisioning for SD (chapter 2.1). Then a novel grassroots type of SD called low impact development is introduced (chapter 2.2), followed by a discussion about the relationship between LIDs and land use planning in Wales (chapter 2.3). The final two sections are dedicated to introducing the case, focusing first on Lammas, a Welsh cooperative dedicated to supporting LIDs (chapter 2.4) and then on Tir y Gafel, the first LID ecovillage under the cooperative – the first in the entire UK to be given prospective planning permission – and the specific object of this research study (chapter 2.5).

2.1 The UK and Welsh contexts

In the UK, the government developed the first ever SD strategy in 1994. They claim that since this spearheading effort they have "played a lead role in promoting sustainable development at home and overseas" (UK Government - DEFRA, 2011). In 2005 the UK published a revised SD strategy "Securing the Future" and a joint strategic framework was agreed upon between the UK government and the devolved administrations in Scotland, Wales and Northern Ireland. The aim of the new SD strategy is to "give people the opportunity in every community in the country to make a difference locally – or globally" and to come up with "local solutions and actions – on transport, on waste, on energy and on *creating places where people want to live*" (Securing the Future - delivering UK sustainable development strategy, 2005). The UK government's commitment to encouraging innovative and local solutions for where and how *people want to live* as a possible path towards sustainability is critical, and provides a legitimizing foundation for the current deeper sustainability policies of Wales.

Wales has taken its sustainability commitment to the next level. In the intro to the joint SD framework "One Future – Different Paths" (2005) the Welsh First Minister states that:

> Living better but with less impact on the environment of our planet will mean making some hard choices that will call for real powers of political persuasion that will test our leadership to the full. For our children and their children's sake we cannot afford to fail that test (Welsh Assembly Government, 2005).

Although most nations produce documents with impressive statements about their commitment to developing differently and more sustainably, and these should be viewed critically and in connection to the actions that follow these statements, it seems the Welsh Assembly Government (WAG) has continued to show it is taking SD seriously. The Government of Wales Act 2006 puts the promotion of SD at the centre of the Welsh government's work: thereby it is one of 18 out of 30 OECD countries to have constitutional SD provisions (Jacob & Volkery, 2006) making it a *statutory duty* (Welsh Assembly Government, 2009, Davidson, personal communication, 2011, Saltmarsh, 2012). This duty requires Welsh Ministers to make a scheme

setting out how they propose, in the exercise of their functions, to promote sustainable development. In 2009, under section 79 of the Government of Wales Act, the WAG presented its SD scheme 'One Wales: One Planet' which commits to SD being the *central organizing principle* of the WAG and the public sector in Wales. It recognizes that if everyone on Earth lives as people in Wales do, three planets worth of resources would be needed. The long term goal is for Wales to reduce its resource use to consume only its fair share of the Earth's resources – becoming a one planet nation – within the lifetime of a generation (Welsh Assembly Government, 2009). Within the backdrop of this One Planet SD scheme, a policy guidance document on development in the countryside (Technical Advice Note 6) acknowledges a new type of sustainable development (Welsh Assembly Government, 2010). The next section will focus on the unique situation of Low Impact Development, called "One Planet Development" in Wales, and specifically on the County of Pembrokeshire, which is the setting of the eco-village initiative analyzed in this study.

2.2 Low impact development (LID)

Low Impact Development (LID) was first coined by Simon Fairlie[5] in 1996 to refer to "development that through its low impact either enhances or does not significantly diminish environmental quality" (Fairlie, 1996, p. xiv). It has recently been taken up in Welsh policies, under the name of "One Planet Development" (Welsh Assembly Government, 2010) but will continue to be referred to as LID throughout this study as this is the name it is commonly called in Wales[6]. As LID is a "multi-featured and intrinsically integrated form of development" a study on LID suggests that a simple definition cannot capture the meaning of LID (University of the West of England, 2002), and therefore identifies several features of LID, which are presented below (see table 1). Since his original definition in 1996, Simon Fairlie has also re-worked his definition. He now prefers to define LID as 'development which, by virtue of its low or benign environmental impact, may be allowed in locations where conventional development is not permitted' (Fairlie, 2009a). Below, Fairlie explains his new definition, stating:

> I prefer this revised definition because wrapped up in it is the main argument; that low impact buildings need not be bound by the restrictions necessary to protect the countryside from 'conventional' high impact development - a.k.a. suburban sprawl (Fairlie, 2009a, p. 2).

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[5] Simon Fairlie is a LID pioneer, former editor of The Ecologist, current editor of The Land magazine and was interviewed for this study.
[6] It is important to note that the Low Impact Development concept central to this study is completely distinct and separate from the North American idea of storm water management, which is confusingly called by the same name (see for example Bedan, 2009) .

Figure 2: Low impact development - the diversity of approaches. (Photos: Dale and Saville, courtesy of Lammas)

Fairlie makes two additional arguments in favour of LID. Firstly, exceptional policies are needed as conventional home construction in a countryside protected from urban sprawl is becoming too expensive for local residents. Secondly, as we will all soon be forced to live more sustainable low impact lifestyles, pioneers in this area should be encouraged and supported (Fairlie, 2009a, p. 2). See figure 2 for an impression of the variety of building styles associated with LIDs.

Fairlie is referring mainly to subsistence-based development in rural locations where residents draw most of their everyday needs including energy, food and water directly from the site of development where they live. Thus, "LID is usually integrally connected with land management and as much as describing *physical development,* LID also describes a *form of livelihood*" (University of the West of England, 2002). LIDs can be single homes, co-operative communities or larger developments, and can be situated either within or adjacent to local communities, or located in the open countryside (Welsh Assembly Government, 2010). Particularly the provision for allowing LIDs to be located in the open countryside has been a cause for concern amongst critics of LID. As development in the countryside has long been avoided through existing planning policies, concern has been expressed that if LIDs are allowed where other development is not permitted, "such people would be treated differently to others who might also wish to live in the countryside but could not bring themselves within the requirements for LID" (University of the West of England, 2002, p. 30). However, the same study came to the conclusion that as long as these special considerations are justified by serving legitimate aims, and achieved by "proportionate means" this criticism is not likely to present obstacles to the creation of policies for LID (University of the West of England, 2002, p. 30). And indeed the

recent policy does prescribe that if located in the open countryside LIDs must provide for the minimum needs of the inhabitants in terms of income, food, energy and waste assimilation (Welsh Assembly Government, 2010).

The study on LID conducted by the University of the West of England (UWE) makes a strong case for LID being an "*intrinsically sustainable form of development*", concluding that:

> It is clear that LID makes strong contributions to the environmental aspects of sustainability. Its contribution to the social aspects is also significant. LID's contribution to the economic aspects of sustainability is more modest but also positive. What is most striking is that LID makes positive contributions to all three aspects of sustainability together, without trading off against each other (University of the West of England, 2002).

The report also dissolves one of the fears that opponents of LID tend to voice, by finding that there is no evidence to indicate "that residents of LID are an economic burden on society" (University of the West of England, 2002).
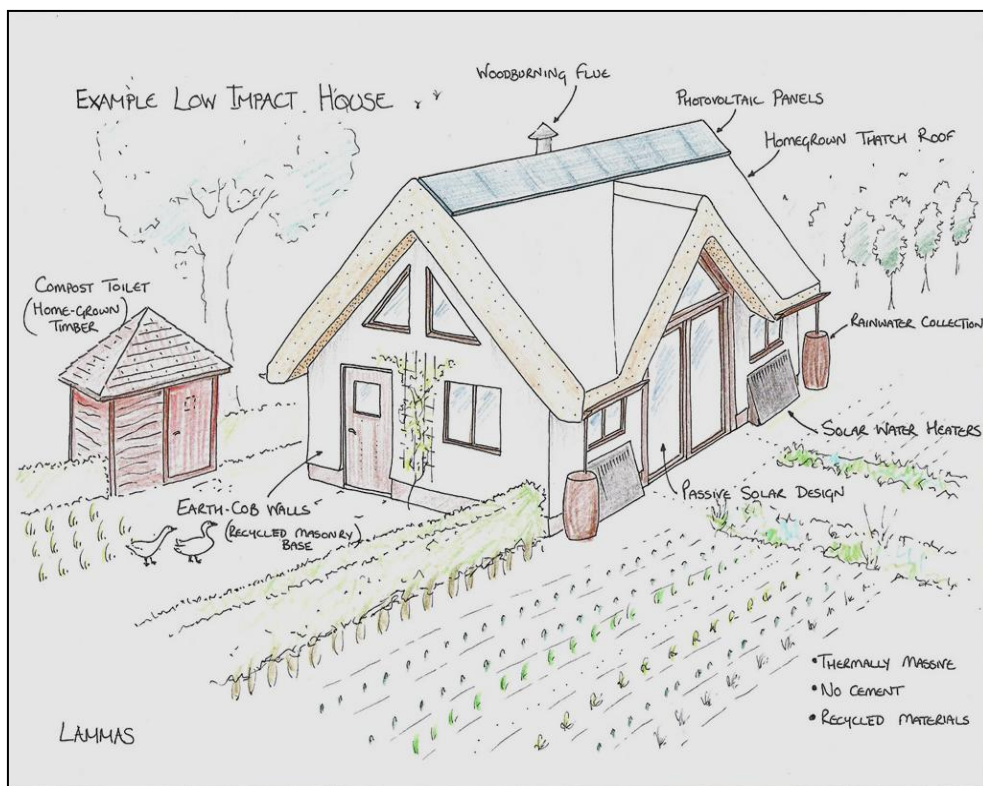
Figure 3: Drawing of one possible model of a low impact home. (Drawing: courtesy of Paul Wimbush)

A main feature of LID is that it involves a high degree of engagement of the developer or occupier with the land and the resources that working the land can provide. This can represent a very responsible approach to the use of the planet's resources (Baker Associates, 2004).

These definitions and descriptions of LID make it clear that it refers to physical as well as social aspects of development, namely where and how people build their dwellings and how they live their lives. See figure 3 for an impression of important features on an example of a LID home.

The theory behind LID is expounded in Fairlie's 2009 edition of "Low Impact Development" and represents a criteria-based environmentally and socially friendly alternative to traditional land

use. Fairlie argues that LID is a contrast to the traditional land use and planning system, which dates back to the Town and Country Planning Act from 1947. This outdated system works by allocating a restricted amount of land for residential and other use, creating a scarcity of developmental land, which leads to escalations in the price of land, monopolization by corporations "massive indebtedness of a large proportion of the population" amongst other problems" (Fairlie, 2009b, p. 4-5). In contrast, LID allows people to build on nearly all types of land under the condition that they conform to agreed environmental criteria. He claims:

> This criteria based method of development control eliminates the artificial prices attached to allocated land, and the monopoly control of such land; in a capitalist economy, it creates an incentive for developers to compete with each other, not by bidding as much as they think they can afford for scarce development sites, but to design projects that will be judged to be more sustainable than those of their rivals. (Fairlie, 2009b, p. 5)

Table 1 lists the main features of LIDs and gives an idea of the type of development and the type of benefits being discussed.

Table 1: The main features of LID

being locally adapted, diverse and unique	increasing public access to open space
being based on renewable resources	generating little traffic
being of an appropriate scale	being linked to sustainable livelihoods
being visually unobtrusive	being co-ordinated by a management plan
enhancing biodiversity	

Source: Maxey (2009, modified)

The picture in figure 4 of one of Tony Wrench's low-impact roundhouses provides a good illustration of several of these characteristics. Particularly obvious is: the modest scale, the natural and unobtrusive aesthetic of the building, the noticeable biodiversity on and around the dwelling, and the uniqueness of the structure, which is built almost completely from renewable, recycled and local resources, and makes use of 100% sustainable and renewable energy (wind and solar).

Figure 4: Tony Wrench's LID 'Den' exemplifies several of the visual features of LID (Photo: Karolina Rietzler)

2.3 The planning system and LIDs

2.3.1 Encouraging trends in Wales

Since the origin of land use planning in the 1940's, the planning system in Wales has placed development in the open countryside under strict control, in order to "prevent the spread of urban areas" and to protect the character of the countryside (Baker Associates, 2004). The planning system, according to the Welsh government "has a key role to play in supporting the delivery of sustainable rural communities" (Welsh Assembly Governmnet, 2010). The focus on preventing development in the countryside, however, remains one of the planning system's main objectives today, and according to a study on LID from 2004, this can in some respects promote greater sustainability (for example through reduced car travel by locating developments near workplaces) and arguments in favour of such development control have partly been strengthened by Wales' stronger emphasis on SD in recent years (Baker Associates, 2004). As presented in section 2.2, however, LID have been shown to present an intrinsically sustainable type of development and very recently Wales has begun acknowledging LID in its planning and SD policies. The 2009 SD scheme, "One Wales: One Planet" provided the foundation for acknowledging LID on a national level. In 2010 the Technical Advice Note 6 (TAN 6) considers LID "potentially an exemplary type of sustainable development" (Welsh Assembly Government, 2010). TAN6 is a milestone policy, and is currently the only national planning policy on LIDs in the entire UK (Kulbicki, 2011).

However, on a local level, Wales developed an understanding of LID earlier than it's break-through national policy in 2009. Pembrokeshire County has had a county-wide LID planning policy since 2006. This policy, called Policy 52 'Low Impact Development Making a Positive Contribution' provides a context for permitting development in the countryside as an exception to normal planning policy. It is part of the Joint Unitary Development Plan (JUDP), a product of the Pembrokeshire County Council and the Pembrokeshire Coast National Park Authority and provides the foundation for the conception and approval of the eco-village studied in this research. This policy is based on studies by Fairlie, Chapter 7[7], and reports by the University of the West England (2002) and Baker Associates (2004). Although planning policy normally strictly controls development in the countryside, these authorities accepted that permission may be granted to exemplars of sustainable living. A main condition for being allowed to live on site is the 'functional need requirement' – meaning that the number of adult residents should be directly related to the functional requirements of the enterprise (Pembrokeshire County Council, 2006, p. 2). Since they argue that *all* buildings in theory should be sustainable, irrespective of the location, they expect such "exemplars" to go *beyond* carrying out low impact activities and

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[7] Chapter 7 is an organization which campaigns for "access to land for all households through environmentally sound planning" and bases its name on Agenda 21, Chapter 7c, on Human Habitation Settlement. See http://www.tlio.org.uk/chapter7/

building sustainable homes. They therefore expect LIDers to "prove that they will provide *positive* benefits, in addition to being low impact" (Pembrokeshire County Council, p. 1).

2.3.2 Planning still a major hurdle for LIDs

Before concluding this section, in which Wales is generally praised for its 'progressive' and forward-looking planning policies – which they no doubt are, compared to many other countries – it would be biased not to admit that the individuals wishing to implement LID projects continue to have a very uneasy relationship with the planning system in Wales (Wrench, 2009). The general apprehension for allowing development in the countryside – based on aforementioned concerns about changing the landscape visually and contributing to urban sprawl – is still present particularly on the local level. A relatively new book on LID explains that whilst this restrictive stance:

> has helped Britain avoid the excesses of suburbia visited on North America, it has not stopped unsustainable roads, houses, supermarkets and other 'developments' from concreting over thousands of acres of our most fertile and bio-diverse land every year since! LID presents a new planning paradigm which places humans as part of the natural world not as an anathema to it. LID demonstrates that humans can create sustainable homes and livelihoods and increase bio-diversity. (Pickerill & Maxey, 2009b, p. 67)

A ranking of the four now existent UK policies addressing LID, comparing how well the LID policy addressed the LID criteria and the government's SD goals, gave Policy 52 the best ranking with a score of 17/18, far above the next highest policy scoring a mere 8/18 (Boyle 2007 in Lewinson, 2008, p. 17). This indicates that Policy 52 is a particularly well researched, well-written and high-quality policy. Although this is commendable, "there are problems resulting from interpretation of criteria and there still appears to be little understanding of the concept of LID or its objectives" even within authorities which have a LID policy (Lewinson, 2008, p. 49). The UWE (2002) research report also came to the conclusion that although LID scores *positively* against the three parameters of sustainability, there is a paradox within Wales whereby this development "of high intrinsic sustainability" is being rejected by a planning system that claims it is centrally concerned with SD (University of the West of England, 2002, p. 83). This system "does not make allowance for production for self-sufficiency nor for the low cost lifestyles favoured by those living off the land in this way" SD (University of the West of England, 2002, p. 83). As a result, the small numbers of pioneers who are engaging in LID are simply moving onto agricultural land without advance planning permission. Inevitably they are discovered, make retrospective applications, and after local refusals, those who endure through the exhausting and expensive planning appeal get awarded planning permission (Dale, 2009, p.16-17). Tony Wrench[8], a pioneer LIDer in Pembrokeshire expresses concern that the planning system provides ready permission for projects that are excessive in their use of

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[8] Tony Wrench has been actively involved in Lammas since its beginning, although he does not reside there. He has been a major figure in the development of Policy 52 in Pembrokeshire, and won the first ever planning appeal under this policy. He also participated in this study.

resources and greenhouse gas emissions (e.g. new roads, new parking lots, new estates) while responding to LID with great suspicion and setting up massive hurdles for applicants to jump through. To end with words from his book:

> If [...] I want to build a house with no cement, with no mains connections, built from natural materials and in harmony with nature, I have to jump through a ludicrous series of hoops and hurdles to prove that this house and its occupants will make a positive economic, social, and environmental contribution. This might seem perfectly natural to you, dear reader, used as you are to our topsy turvy system on the road to collapse. To me, though [...] this is yet another symptom of a planning system that has yet to wake up.

> When, or if, it wakes up, all developments will be required to be low impact. All the earth is sacred. Want a new factory? Site it underground and make its outlet pipe vent into its inlet pipe. Reuse all wastes. Want a parking space for a petrol-powered car in town? Forget it. Want a house made of bricks and mortar, with oil fired central heating and 5kw demand of lighting - total ecofootprint of 3 hectares or more? Well, for such a High Impact Development you will need to prove that the house makes a positive economic, social and environmental contribution. Fact is, though, you won't be able to prove that, will you? (Wrench, 2009, p. 63)

2.4 Lammas – the cooperative

The case chosen for this research study is Lammas Tir y Gafel, a pioneer LID eco-village in Pembrokeshire, Wales. It is the first eco-village under the umbrella of the 'Lammas' sustainable living cooperative.

Figure 5: Lammas Low Impact Initiatives Logo. (Source: courtesy of Lammas)

Lammas Low Impact Living Initiatives Ltd is a cooperative made up of several hundred members and thousands of supporters in over thirty-two countries worldwide (Lammas, 2008b). This section first gives an overview of the Lammas cooperative (chapter 2.4) and then focuses on the eco-village, Tir y Gafel (chapter 2.5).

2.4.1 Objective and overview

The objective of Lammas, as stated by the cooperative itself is "to establish a flourishing network of low-impact projects working together to promote the principles of sustainability, biodiversity and environmentally conscious living" (Lammas, 2012b). Toward this end its primary focus has been to pilot a model LID eco-village, Tir y Gafel, which works *within* Pembrokeshire's innovative planning policy (Wimbush, 2009a, p. 30). A second eco-village is now being conceptualized, but is still in the early stages. Lammas owes its name to the

Lammas holiday, a cross-quarter holiday located directly between the summer solstice and the autumn equinox which is the night that Lammas was first dreamed into being by its three founders[9] (Maxey, personal communication, 2011). Lammas is a grassroots citizen initiative, as are the projects it is helping to develop. In short, Lammas supports LID by providing: a pioneer model eco-village (Tir y Gafel) which it is hoped will provide a template for future eco-villages of its type, selling shares to create financial capital, lobbying for LID policy, and supporting local groups also interesting in, or in the process of, planning sustainable LIDs (Maxey, 2009).

2.4.2 Governance and monitoring

The Lammas cooperative is registered under the Industrial and Provident Society Act. Membership is open to everybody upon buying a share (£50) and the money raised through the shares is used to help Lammas work towards its wider aims, described in section 2.4.1 (Wimbush, 2009a, p. 35). The society is managed by a democratically elected voluntary committee. By retaining ownership of the eco-village it supports, and granting resident's 999 year leases – thus comparable to ownership –, the cooperative oversees the management of the project, and, importantly, is legally accountable for ensuring the eco-village meets the LID planning requirements under which it was given planning permission. To meet policy requirements, Lammas produces an annual progress report to track the projects performance under a range of indicators (Wimbush, 2009a, p. 35).

2.5 Tir y Gafel – the eco-village

Tir y Gafel is located in the County of Pembrokeshire in Southwest Wales. It is the Lammas cooperative's first low-impact development eco-village and is the case study subject of this research thesis. It is a pioneer eco-village, as it is the first LID eco-village to have ever applied for and received planning permission under Pembrokeshire Policy 52, which is described in Chapter 1.3. The following sections will describe the village and its residents (2.5.1), explain permaculture as the guiding design strategy on which the ecovillage is based (2.5.2), demonstrate how it addresses all three pillars of SD (2.5.3), give an overview of the application process the eco-village underwent before receiving planning permission and the importance of knowledge within this (2.5.4), and finally explain why Tir y Gafel represents a milestone success in terms of gaining proactive planning permission and working within the system with positive ramifications for others wishing to engage in sustainable LIDs (2.5.5).

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[9] All three are participants of this study. One lives in the eco-village (PH8), the second is a geographer at a university (S1) and the third is still closely affiliated with the project, and a LID pioneer himself (A7)

Figure 6: The Millpond at Tir y Gafel (left) and the community hub building (right). (Photo: Karolina Rietzler)

2.5.1 Description of eco-village and residents

The land

The eco-village is a new settlement of nine eco-smallholdings and a community hub building, and is situated on seventy-six acres (approximately thirty hectares) of pasture and woodland area in the hills above the small village of Glandwr, Pembrokeshire. Occupancy and development of the site began in September of 2009 (Lammas, 2012a). See Figures 6 and 7 for an impression of the eco-village.
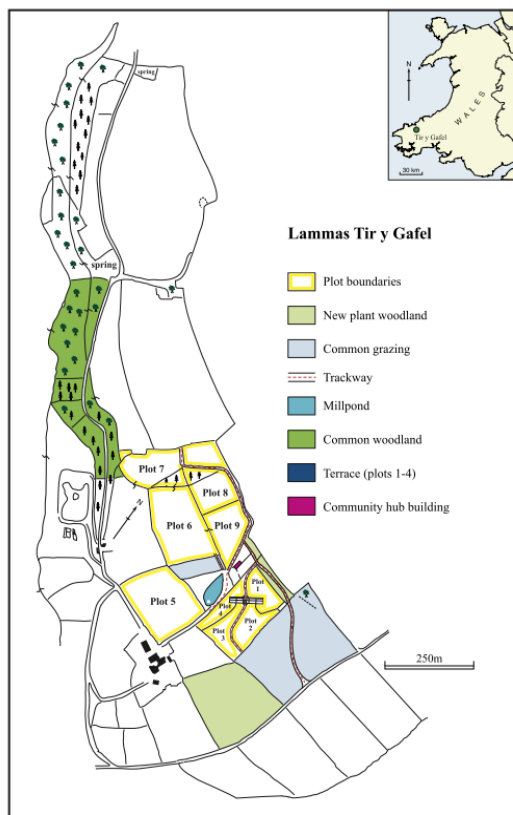
Figure 7: A map of the entire eco-village, showing plot and hub locations and use areas. (Map: courtesy of Lammas)

The residents

The nine smallholdings represent five individual plots, and four plots combined to an eco-terrace (see figure 7). They are occupied by seventeen adults, (eight couples and one single person between thirty and fifty-two years of age) and fifteen children (between one and seventeen years of age), most of which attend a local Welsh or Steiner (Waldorf) school (Tolle, 2011). At least thirteen of the adult residents hold a university degree (Bachelor to PhD) ranging from the arts, languages and architecture to politics, environmental science, engineering and physics (information from interviews).The background of the residents varies dramatically, however, forty one percent came directly from an urban location, and the remaining over fifty percent already came from a back-to-the-land lifestyle in West Wales (Tolle, 2011).

Development to date

Most residents have been on-site since planning permission was granted in November of 2009, exactly two years at the time of this study. In December 2009, Lammas won a £346,935 award from the UK Department of Energy and Climate Change (DECC) for the construction of their community hub at the centre of the eco-village (see figure 6). The community hub is meant to provide space from which to manage research and education initiatives as well as facilitate volunteer and community outreach activities. Construction began in early 2010, and while already in use, the hub is currently still under construction. The individual plots are in differing stages of development, as their occupants divide their energies between increasing soil fertility and growing food, setting up their businesses, and building their homes (or in most cases temporary shelters which will serve as barns or workshops once the main home has been built). Figure 8 shows two of the existing dwellings.

Figure 8: Earth-sheltered roundhouse with attached greenhouse on plot 7 (left) and barn made from materials sourced within a five-mile radius on plot 1 (right). (Photo: Karolina Rietzler)

2.5.2 Permaculture Design as guiding approach

Permaculture is a blended word originating from 'permanent agriculture' or 'permanent culture' in the 1970's, and refers to "the development of agricultural ecosystems intended to be

sustainable and self-sufficient" (Oxford Online Dictionary, 2012). This permanence is not about everything staying the same, rather it is about "stability, about deepening soils and cleaner water, thriving communities in self-reliant regions, biodiverse agriculture and social justice, peace and abundance" (The Permaculture Association, 2012). The important distinction between permaculture and agriculture is that "agriculture tends towards monocrops for financial return and permaculture tends towards maximising diversity of produce by working with natural systems" (Wimbush, 2009a, p. 36).

A definition which touches on the design aspects of permaculture states that "permaculture encourages people to design their own environments" in order to build resilient and self-sufficient human settlements and that it "is premised on the redesign of unhealthy systems so they become naturally re-generative and can solve their problems internally" (McManus, 2010, p. 162). From a knowledge perspective it represents a mixture of a rather science-based approach and a more practical or applied approach, originating from the science of systems ecology and the study of pre-industrial sustainable land use (Holmgren, 1997). In addition permaculture explicitly addresses ethics, as it is guided by three principles including (1) Care of the Earth, (2) Care of People and (3) Setting Limits to Population and Consumption. The third ethic is not about a one-child policy or tight border controls, but about "recognizing that the Earth's resources are limited and need to be shared amongst many beings" (The Permaculture Association, 2012). It is a design approach concerned with "living lightly on the planet, and making sure that we can sustain human activities for many generations to come, in harmony with nature" (The Permaculture Association, 2012).

As can be seen from its characteristics, it is clear that permaculture may represent a suitable design approach for LID. In fact, it has played a key role in the design of Tir y Gafel. Permaculture was of central importance in the design of the project's management plan and continues to guide the day-to-day running of the eco-village. Some examples of design aspects supported by permaculture in this case study include the creation of wildlife corridors, encouraging biodiversity, conserving water and supporting the move "toward a system in which human beings are a complementary part of the natural landscape" (Wimbush, 2009a, p. 36).

2.5.3 Tir y Gafel addresses the three pillars of sustainable development

As outlined in the context part of this chapter (chapter 2.3) Pembrokeshire's progressive LID Policy 52 places great emphasis on LID demonstrating positive impacts in all three areas of sustainable development: economic, social and environmental. A brief overview of all three benefits expected from the eco-village, from the perspective of Paul Wimbush[10] (2009) will be given.

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[10] Paul Wimbush is the main of three founders of Lammas and a resident of Tir y Gafel. He was also interviewed as a participant in this study.

Economic benefits:

All nine smallholdings have developed careful business plans, ranging from basketry and woodland products through to medicinal herbal remedies, informed by a baseline economic survey. The concept is to compliment, rather than compete with, local businesses in the area. Within five years the plotholders expect to produce £107,996 of products per annum from the land, which is a significant increase compared to the £2,500 annual income under the previous management of the land as a sheep monoculture. Much of the produce will be (and is already) sold locally, keeping the money in the local economy and helping the region to shift to a resilient land-based local society.

Social benefits:

Lammas' commitment to promoting SD locally will benefit the wider community in terms of education. Conducting and disseminating research about LID is another social benefit of the project in terms of society at large. Locally, the eco-village will provide many benefits, including a small shop selling local produce, the running of a community composting scheme, provision of a minibus service to and from local towns for visitors, residents and local people, and the creation of two new permissive walking paths on the site.

Environmental benefits

Geology, habitat and species surveys, as well as a soil analysis report, have been conducted in order to provide baseline data for further environmental research. The eco-village's management plan requires sensitive ecological management which will result in the creation of a diverse patchwork of habitats and eco-systems (instead of the sheep monoculture) ensuring an "impressive increase in biodiversity, soil health and wildlife" (Wimbush, 2009a, p. 33). Although not explicitly stated in the book by Wimbush, an additional environmental benefit of the project may be the decreased ecological footprint of its residents, and the possibility for others to learn from and emulate their example.

2.5.4 The application process

Tir y Gafel was conceptualized in 2005. Lammas meticulously prepared an application encompassing over 1200 pages of text, 150 illustrations and two large models, accompanied by a very positive assessment report from the Design Commission For Wales (Adams, Griffiths, Roberts, & Bateson, 2008). Nevertheless, Lammas was refused planning permission for Tir y Gafel twice by Pembrokeshire County Council. The first refusal was in October 2007, the second in September 2008 (Wimbush, 2009a). The council claimed that Tir y Gafel did not satisfy three of the eight criteria in Policy 52[11], namely, criterion 2: all activities and structures

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[11] Policy 52 and the 8 LID criteria can be found in Annex 1.

on site have a low impact in terms of the environment and use of resources, criterion 6: the proposal will provide sufficient livelihood for and substantially meet the needs of residents on the site, and criterion 7: the number of adult residents should be directly related to the functional requirements of the enterprise (Pembrokeshire County Council, 2008). Much of the justification for refusal was based on an assessment of the application by the Agricultural Development Advisory Service (ADAS), a consultancy familiar only with conventional agricultural practices and techniques (see ADAS, 2008). After the appeal the planning inspector expressed that "the conventional methods applied in the [...] ADAS reports are *not appropriate* to the permaculture systems proposed in this instance" (Poulter, 2009, p. 8, emphasis added). Thus, it has been found that conventional methods provide an entirely inappropriate knowledge base for judging an enterprise based on permaculture practices. Various reports and assessments from organizations and experts proficient in permaculture and organic agriculture had been submitted by Lammas, referencing the latest research on organic and permaculture yields and productivity. However, according to Lammas, these documents and arguments were not given due consideration by the local council (Lammas, 2008a). After the second refusal, Lammas appealed to the national level Welsh Planning Inspectorate, with a final application totalling over 2000 pages, and was granted planning permission in August 2009 (Lammas, 2012c). The inspector – in contrast to the council committee – gave weight to the research, data and experience provided in the reports by alternative agricultural experts familiar with LID and determined that Tir y Gafel satisfied all eight criteria set out in LID Policy 52, and thus saw no reason to refuse planning permission (Poulter, 2009).

2.5.5 The importance of Tir y Gafel as a precedent case in planning

Since planning in the UK relies upon precedent, the pioneering success of Lammas Tir y Gafel is of great importance for future LIDs. It sets a precedent by being the first *prospective* low-impact application *of any kind* to be passed in the entire UK (Lammas, 2012c). The number of people living LID lifestyles in the UK is increasing rapidly, and due to the impossibility of obtaining prospective planning permission these people have simply moved onto the land, and then often gained *retrospective* permission upon appeal at the national level after rejection on the local level (Dale, 2009). Therefore, the precedent set by Tir y Gafel and Policy 52 represents an important step towards allowing LIDers to embark on their projects legally and officially, and is thus key for promoting this type of sustainable development in the future.

In summary, this chapter has presented both the context for the case as well as a description of the case. First, the UK and Welsh contexts were discussed in terms of provisioning for SD. Then a novel grassroots type of SD called low impact development was introduced followed by a discussion of the relationship between LIDs and land use planning in Wales. The final two sections were dedicated to introducing the case, focusing first on Lammas, a Welsh

cooperative dedicated to supporting LIDs and then on Tir y Gafel, the first LID ecovillage under the umbrella of the cooperative – the first in the entire UK to be given prospective planning permission – and the specific object of this research study.

3 THEORETICAL FRAMEWORK

> A perspective is not a recipe; it does not tell you just what to do. Rather, it acts as a guide about what to pay attention to, what difficulties to expect, and how to approach problems.
> (Wenger, 2001, p. 9)

As this eloquent phrase – which is the introduction to a discussion on the practicality of theory – describes, a theoretical frame is something which should be used to help us understand the world, or a particular case or problem in a way which helps us gain interesting insights and new or useful ideas. It is something which can enhance our ability to both academically investigate and practically engage with a particular situation (Wenger, 2001, p. 11). This seems a simultaneously sensible and inspiring approach to theory and is therefore adopted in this thesis.

This chapter outlines the theoretical basis of the research, and provides various insights from the relevant literature. It does *not* culminate in providing a single suitable theory with which to conduct the research, but rather selects key concepts applicable to the topic of interest from several theoretical strains and authors and joins these to create a heuristic frame that guides the formulation of detailed research questions and the analysis of the data.

Before describing these concepts, however, it must be emphasized that finding a suitable theory, or components of different theories, to use as a theoretical lens with which to view the role of science and knowledge in citizen-driven SD projects has been a complex task. The rationale behind the literature review, and the concepts decided upon, is based on finding varied lenses through which to view knowledge, science, and 'the public' from a perspective that is as open, holistic and multi-faceted as possible. This is imperative, as the current study is taking an exploratory stance and is interested in discovering as much information from as many different viewpoints as possible. The goal is to be open to what emerges out of the study not only deductively, but also inductively. As one author explains quite succinctly, if one views knowledge as being only chunks of information, stored in the brain, this will lead to a different approach than if one believes that "information stored in explicit ways is only a small part of knowing, and that knowing involves primarily active participation in social communities" (Wenger, 2001, p. 10). While Wenger uses education as his example, this concept can be applied to any research topic under examination, and the latter perspective provides a much more open approach to the question 'what is knowledge?' The concepts finally included in this chapter were selected with this criterion of a wide-angle lens in mind. Thus, it is clear why there is no representation of viewpoints which portray a single, 'irrefutable' understanding of science or knowledge and their role in society to be found in this chapter.

In the introductory chapter of this thesis (chapter 1) the broad conceptual context and justification for this study are outlined based primarily on the work of Ulrich Beck on the role of

science and knowledge in society, calling for a fundamental reassessment of the foundations and hazards of scientific work and science itself. Beck's arguments are supported by the insights of several other authors. This chapter provides more specific and practical concepts which can be viewed as falling within the broader perspective of chapter 1. First, the understanding of science and other types of knowledge is discussed (chapter 3.1). The following section (chapter 3.2) then elaborates on Irwin's (1995) concept of 'citizen science' and describes how insights from this way of thinking about science and progress can be applied to this analysis. The next section discusses the concepts of transdisciplinary research (TR) and transdisciplinarity (TD) and introduces a TD typology of knowledge used in this study. This section also argues that TD provides a useful lens through which to view the SD project that is the subject of this case (chapter 3.2). The fourth section introduces the work of Ettiene Wenger and others related to the TD concept of boundaries between different knowledge areas and different social groups. This section describes how encounters, sharing and learning between these perspectives can take place (chapter 3.4). Following this, the concepts of grassroots innovations and green niches are introduced (chapter 3.5) and provide a final lens through which to view the case. The last section of this chapter (chapter 3.6) provides an overview and summary of the concepts introduced, and presents the research sub-questions inspired by the various perspectives.

3.1 Understanding science, scientific knowledge and other types of knowledge

Embarking to explore aspects of science and knowledge in projects dealing with environmental sustainability is not easy, as the definitions of science, the knowledge resulting from science, and other knowledges are not simple or straight forward. To begin with, the word 'science' does not have a single or simply defined meaning. As Caldwell states "'science' may mean knowledge or it may mean method," and the word is used to denote the profession as well as the activities of people we call 'scientists' (Caldwell, 1992, p. 6). He goes on to argue that the word is simply too large to be defined concisely. The description of science as being neither "a storehouse of 'facts' which different social groups can plunder nor [...] a prescribed 'method' for the acquisition of 'objective knowledge'" but instead a "collection of social institutions [...] whose boundaries are constantly negotiated and renegotiated with other social institutions" (Irwin, 1995, p. 48) is helpful. The importance of providing a differentiated depiction of science is emphasized in Irwin's (1995) writings. Without understanding, and taking into consideration, the full and often contradictory account of the meanings that science has taken on within our society any serious debate about its relationship to everyday life will not be possible.

Leaving the attempt to define the word science in favour of taking a more socio-constructivist view of the meaning science takes on in society sheds additional light on the complexity

associated with the word. Table 2 lists the eight ways in which Irwin claims science is commonly portrayed within society, and gives an example of when or how each is used.

Table 2: The range of societal portrayals of science

Portrayal of science	Example of when/how used
As independent and objective knowledge	When industry or government attempt to "reassure" the public
As the servant to business and power	When public groups react with suspicion to science as it is offered
As the most rational basis for public and private threat assessment	As scientific institutions tend to argue
As the source of hazard	When products of science become the focus of hazard debates
As a set of theories and working hypotheses	When limitations and uncertainties are downplayed
As an everyday irrelevance	For those who cannot "make sense" of science as it is available to them
As the best route to progress	As suggested by the modernistic paradigm
As a spiritual and moral dead-end	As the strongest critics of scientific rationality argue

Based on Irwin (1995, p. 108).

The range of meanings presented in this table show that science is not a single "thing", but, as Irwin argues, "a diverse cultural phenomenon" which is conducted and utilized in a great variety of institutional locations (Irwin, 1995, p. 108). It is important to keep in mind that public groups often hold these understandings of science simultaneously – despite their obvious contradictions. Additionally, debates about science often occur with such different underlying understandings that a true discussion of meanings becomes nearly impossible. Finally, the range of the significance of science to everyday life shown in table 2 stands, as Irwin says, "in stark contrast to the one-dimensional account offered by most enlightenment perspectives on science" (Irwin, 1995, p. 110).

Coming from this more constructivist understanding of science to a rather realist discussion, it can be argued (chapter 1.3; Beck, 1992) that science is blind to many of the risks it has created. As Eden (1996) summarizes, however, Beck also argues that science is at the same time very influential in environmental debates, as it plays a key role in the perception of environmental 'problems' by society. Particularly in the case of threats which are increasingly hard to perceive with the everyday senses, and which require identification through science, environmental science plays a fundamental role as identifier and definer of environmental problems. The link between the definition of an environmental problem in society and science's perception of it as such has also been made more recently (Bocking, 2004). The

imperceptibility of many of the risks stemming from modernization thus lead to the public's dependence on external knowledge to a certain extent (Eden, 1996). The external knowledge provided by science is, however, not the only type of knowledge involved in perceiving and understanding environmental threats and problems. Although it provides the basis for debates about global environmental risks (Irwin, 1995 and Eden, 1996), Eden argues that "science is neither the primary motivator of environmental action nor the main source of environmental knowledge" (Eden, 1996, p. 191).

Knowledge which is not linked to science, such as local and first-hand knowledge, is also influential in empowering and shaping the opinions and action of individuals and civil society in regard to environmental behaviour. With this insight in mind, the definition of knowledge in general, previously often closely associated with the product of scientific inquiry, has thus also been developed further. The understanding of knowledge has been:

> [...] extended beyond traditional canons of academic expertise to include "layman's" or "alternative" knowledge. This expanded form of knowledge is not pre-determined but emerges in the negotiation of multiple perspectives on a production. (Klein, 2001a, p. 37)

The following quote by Jasanoff (2004) also eloquently states that citizen's hold knowledge in their own right:

> Citizens [...] are not merely accidental inhabitants of geographically or legally delimited political spaces, with formal rights to take part in top-down regimes of governance. They are thinking, knowing and creative beings. (Jasanoff, 2004, p. 94)

Eden claims that it is specifically because people's experiences are related to the local context of their everyday reality, that this – what she calls 'first-hand experience' – becomes important in balancing the 'second-hand non-experience' of scientific information regarding an environmental problem. Additionally, there is often a sharp discrepancy between the knowledge of people living in a particular place and scientific knowledge, with local people often being 'experts' in their particular contexts (Bocking, 2004). This argument is made with the help of several examples such as Wynne's study on sheep farmer's local knowledge in the case of radioactive contamination in England's Lake District (Wynne, 1989). Based on this reality, moral judgements or 'first-hand experience' can often prevail even when contradicted by the findings of science, or 'second-hand non experience' (Eden, 1996). Looking at the balance between these two knowledge types is identified as an area into which further research is required (Eden, 1996). Thus, it becomes obvious that science is not the only important knowledge source and that other more experiential, traditional or alternative knowledges are recognized by these authors. This study attempts to explore the presence and roles of both science and other knowledge forms and their importance to the citizen sustainability initiative that is the focus of this study.

3.2 Citizen Science

'Citizen Science' is defined as encompassing two understandings of the relationship between science and citizens: as a science "which assists the needs and concerns of citizens" as well as "a form of science developed and enacted by citizens themselves" (Irwin, 1995, p. xi). Both definitions are relevant to this study and help to guide the investigation This section explores the concept of 'citizen science' as an alternative to the traditional understandings of science and citizens. 'Citizen Science' is based on the social sciences and particularly on sociological aspects, including the sociology of scientific knowledge and theories of the risk society. It highlights flaws in the roles predominantly ascribed to science and the citizen. Importantly for this work, Irwin (1995) addresses issues of science and the public specifically within the context of risk and environmental matters.

As mentioned in chapter 1, science and technology play an important role in people's everyday lives, and the relationship between them and society and citizens have been the focus of much debate (see Nowotny, Gibbons, & Scott, 2001b and Beck, Giddens, & Lash, 1994). Alternative knowledge types held by citizen's[12] are increasingly being recognized as legitimate. Irwin goes so far as to argue that without attention given to citizen knowledge, SD will not be possible (Irwin, 1995). Others confirm this, and claim that the more open the scientific community becomes, the more robust the knowledge it creates will be (Nowotny, Gibbons, & Scott, 2001a).

As chapter 2.3 highlights, government planning and building regulations policies are of critical importance to this project's current permission and future success or failure. Irwin discusses the relationship between science and policy-making process for risk and environmental threat and introduces three possible policy responses: (1) the 'expert' response, (2) the democratic response and (3) the pragmatic response (Irwin, 1995, p. 64). The first is based on the assumption that only 'expert' assessment of a situation can provide a reasonable and objective decision-making process and is still largely prevalent despite critical voices pointing out that there is a fundamentally social dimension to environmental concerns which go beyond the threat of physical and natural destruction (Irwin, 1995). It has been noted that, unfortunately, this expert centred "scientific style" of planning:

> [...] typically leaves out the information that makes most difference to the policy maker – the political ramifications of choices and the local knowledge of those who know the situation in an intuitive, experiential way. (Innes, 2002, p. 103)

Additionally, environmental disputes often centre on "different moral and social orders" (Cotgrove, 1982 in Irwin, 1995) so that discussions about risk are in fact disputes over much deeper values – such as economic growth versus spiritual well-being or large technologies

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[12] Although the 'term' citizen is used in Irwin's book, one should be aware that 'individuals' or 'people' may be more appropriate, as 'citizenship' in terms of official membership of a nation state, is not relevant to this discussion and the intended meaning.

versus 'small is beautiful' (Irwin, 1995, p. 41). The second type of response, the democratic or representative one, is logistically quite difficult to achieve and, although more participatory, still tends to favour 'expert' information and "pay[s] little attention to the expertise and understanding of citizen groups" (Irwin, 1995, p. 65). The third and final policy response attempts a pragmatic or 'common sense' approach to decision-making and combines elements from both the expert and participatory responses. In such policies, terminology such as 'reasonably practicable' or 'best practicable means' are used, leaving maximum discretion to local regulators in their specific contexts and thus, in theory, operates with a different set of assumptions regarding "science, risk and citizenship" (Irwin, 1995, p. 73). In practice, Irwin argues that all three approaches operate with similar assumptions regarding the origins of legitimate knowledge and tend to "dismiss knowledge and understanding generated outside accredited scientific institutions" (Irwin, 1995, pp. 67–68). Exploring how local, contextual, and lay knowledge is valued versus scientific knowledge, and in how far it is allowed to influence the project process from different levels, is one aim of the current study.

3.3 Transdisciplinarity and Transdisciplinary research

Transdisciplinarity (TD) or transdisciplinary research (TR), is a concept or research approach that is relatively new, and has been traced back to Jean Piaget and the year 1971 (Nicolescu, 2006). For the sake of clarity, it should be noted that TD is not synonymous with multidisciplinarity and interdisciplinarity. While multidisciplinarity is concerned with studying a problem not from only one but several disciplines and thus transgresses disciplinary boundaries, it still remains within a disciplinary research framework. Interdisciplinarity also transcends the boundaries of individual disciplines, and is concerned with transferring methods and insights from one discipline to another – sometimes even creating entirely new disciplines – but also does not break free of the framework of disciplinary science. Transdisciplinarity is concerned with what lies between, across and most importantly *beyond* the disciplines, with the goal of understanding the present world, of which one of the imperatives is the unity of knowledge (Nicolescu, 2006). As can be seen, there is no inherent opposition between disciplinarity – including multi- and interdisciplinarity – and transdisciplinarity, but rather what Nicolescu (2006) calls "a fertile compliment" (Nicolescu, 2006, p. 144). Nicolescu also points to the fact that there would be no transdisciplinarity without disciplinarity, but that there has nevertheless been "a more or less violent war of definitions" pertaining to transdisciplinarity since the 1990's (Nicolescu, 2006, p. 144). In TR, emphasis is being placed increasingly on collaboration between science and civil society and to a lesser extent on collaboration between scientific disciplines (Pohl, 2001, p. 37). TD is described as a new type of both learning and problem solving that involves cooperation between academia and various parts of society with the goal of tackling the complex challenges facing society today (Klein, 2001). It is claimed that TD:

is not confined to a closed circle of scientific experts, professional journals and academic departments where knowledge is produced. Ideally, everyone who has something to say about a particular problem and is willing to participate can play a role. Through mutual learning, the knowledge of all participants is enhanced, including local knowledge, scientific knowledge and the knowledges of concerned industries, businesses, and non-governmental organizations. (Klein, 2001b, p. 7)

Herein lies an important point of relevance for the current study: the emphasis within transdisciplinarity on *many* knowledge types and holders, and the rejection of the belief that only formal scientific methods and institutions are capable of holding, accessing or producing valuable knowledge.

Transdisciplinary knowledge types

While defining how science can contribute to sustainability, a group of Swiss researchers put forward suggestions for possible action which will "enable [researchers] to both assume their social responsibilities and contribute to sustainable development" (Proclim, 1997, p. 2). One result of their work was the creation of a typology of knowledge they claim is needed within research for sustainability and which is often also used to characterize TR (Pohl & Hirsch Hadorn, 2007). The three types of knowledge identified by these researchers are systems, target and transformation knowledge (see figure 9).
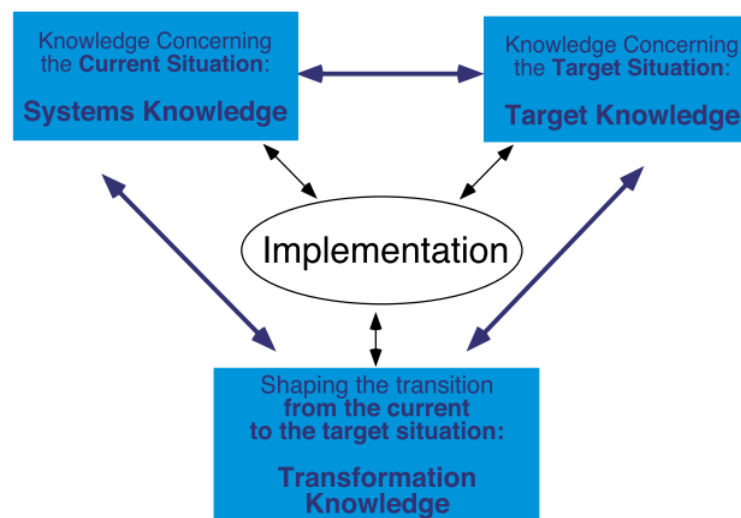
Figure 9: Three knowledge types which contribute to sustainability (Proclim, 1997, p. 15).

Systems knowledge, according to these researchers, is knowledge of the current status, including long and short term observations to allow understanding of the causes and extent of change. Target knowledge is knowledge about what may or may not be, providing guidance for what desired outcomes are and relying on scenarios, ethics and visions. Finally, transformation knowledge is the practical knowledge on "how to make the transition from the current to the target situation" (Proclim, 1997, p. 15). The researchers call for TR into "patterns of interaction between natural and man-made systems", particularly emphasizing the importance of problem and solution-oriented research of patterns of interaction, such as case studies (Proclim, 1997, p. 17). These researchers also call for increasing research on *human resources* relevant to SD,

as, along with the natural resources, it is argued "they have a significant impact on the potential for development and the stability of societies as well as the use of natural resources" (Proclim, 1997, p. 17). This challenge is taken up in the current study, and the identification of the three types of knowledge outlined above is integrated into the research sub-questions to be presented at the end of this chapter.

Using transdisciplinary research as a lens through which to view the current case

TR projects have been described as possessing the following characteristics: a problem orientation (taking on problems from everyday life, rather than from 'pure' science), an actor orientation (including scientists or researchers while requiring the integration of "representatives of societal practice"), context relatedness (considering the local framework conditions), and inclusion of the TD integration concept. The last of these, TD integration, is very relevant for the current study, as it describes the importance of "the integration of knowledge from several disciplines or specializations and from the field of practical action that the research is related to" (Bergmann et al., 2005, p. 16). Conditions which a research problem, or the subject of research, must fulfill for the resulting project to be considered transdisciplinary have been described in the literature. If the knowledge about a socially relevant problem is contested, the exact nature of the problem open to discussion, and the stakes for those directly involved and affected are high, then the conditions for TR are said to have been met (Pohl & Hirsch Hadorn, 2006, p. 16). These conditions would seem satisfied by the nature of the problems the eco-village is attempting to tackle, which include issues of sustainability, social equity, and environmental and biodiversity protection – all problems from the real life world, coming from societal actors, very much focused on the locality and by necessity integrated with knowledge from several disciplines being incorporated as well as from experience and practical action.

While the case study of this thesis cannot be considered a transdisciplinary research project per se, as it does not include scientists as explicitly involved project participants, on closer inspection it becomes obvious that indeed all relevant actors are in some way involved. It is a project that is initiated and steered not by science, but by citizens themselves, and thus inverts the concept of most TD projects somewhat. However, this must not be viewed as a deficit, but rather as an interesting and different angle from which the role of science and knowledge can be explored from the perspectives and uses of the people on the ground in something which might be defined in the terms of Irwin (1995) as 'citizen science'. Therefore, the argument is made that the current case can be treated as a quasi-transdisciplinary project. Although not explicitly, the project – with its many interlinked participants and collaborators coming from a multitude of scientific and professional backgrounds and worldviews and from both civil society, research, and politics – exemplifies a new relationship between science and society. As Bergmann claims that this is an attribute of TD research as well, and that it is especially relevant or useful when tackling complex problems like sustainability – as the eco-village in

question is attempting to do – the linkage and similarities to the case in question become quite obvious (Lovell, 2008, p. 9). The usual science-initiated and dominated form of TD inquiry into the role or participation of citizens in TD projects is thus simply inverted to look at the role of scientific and other types of knowledge in this 'transdisciplinary-like' project initiated and driven by citizens. In this case, it is the citizens themselves, which have fulfilled the transdisciplinary requirement of finding a "real-world, user-oriented problem" (Schonlaub, year unknown, in Klein 2001, p. 38).

It follows that there are relevant concepts and questions which can be taken from TD and incorporated in this study. Some of Bergmann et al.'s (2005) basic criteria for the evaluation of TD projects are used to inform the sub-questions relating to knowledge types, roles and uses. Three sections correspond to different project phases in which relevant questions can be reformulated and applied to this analysis.[13] The first is related to actors, project construction and project formulation. Within this section, criteria 1, 3 and 10 are relevant, as they pertain to (1) the competence and knowledge base of the project members (in this case the participants of the study), (3) whether the project takes up an everyday life problem, and (10) whether the project allows for generating and integrating knowledge (Bergmann et al., 2005, pp. 28–30). The second category refers to project execution and methodology in which criterion 14 – which explores whether methods for knowledge integration from various disciplines and practice exist – and criterion 15 – which asks if there is regular reflection on cooperation and integration within the team – are relevant (Bergmann et al., 2005, p. 31). The third section is related to results, products and publications produced by the project, and criteria 17, 18 and 20 are relevant as they ask (17) whether scientific innovations come about, (18) whether the results can contribute to solving the everyday life problem, and finally (20) what publications or other products are produced by the project (Bergmann et al., 2005, p. 33).

3.4 Boundaries and boundary encounters

The term boundary arises out of the context of a 'landscape' of science, or the knowledge produced by science. Within this landscape there are different disciplines that occupy separate territories and claim 'cognitive authority' over certain problems or questions within that territory. At the boundaries of these territories, disciplines struggle for dominance (Pohl, 2001). Drawing on the work of other authors (Star & Griesamer, 1989 and Klein, 1996) TD is explained as focusing on boundaries, boundary work and boundary objects (Pohl, 2001). The following quote is helpful in explaining why these boundaries exist:

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[13] For a detailed description of the criteria and how these were adapted to form the questions asked in the interview guidelines see Annex 2.

Academic disciplines not only help us classify the world, but also classify ourselves. And both of these functions and objectives are fulfilled by the erection of rigid boundaries among them. (Giri, 1998, p. 360)

Modern disciplines are thus shown to work with "an ideologically charged assumption that disciplinary boundaries reflect the different essences of different segments of reality" (Giri, 1998, p. 382). However, it is becoming increasingly obvious that the boundaries between disciplines are contrived and both their specialization and monopoly are simply part of what can be called an "academic division of labour" (Giri, 1998, p. 382). The concept of boundaries has also been applied in the context of a 'social landscape' referring not just to scientific disciplines, but also to the knowledge within so called 'communities of practice' (CmP) which are groups that are defined by mutual engagement, a joint enterprise and a shared repertoire (Wenger, 2001, p. 73). This concept can be applied to the participants of this case, consisting of eco-village plotholders, scientists researching about LID, planning officers, and people working on the political aspects of this type of sustainable LID in the countryside. Although not necessarily always equitable with one actual community – and with no one member embodying all knowledge of one community and with each member being a part of multiple CmPs – these CmP can be seen as sources of boundary as well as providing contexts in which connection of different knowledge, and thus boundary crossing, is possible (Wenger, 2001, Lindkvist, 2005). While he claims that some have criticized the notion of CmP for neglecting or inappropriately addressing issues of power, Lindkvist (2005) asserts that most have appreciated that it provides a new way of understanding 'groups', how they deal with knowledge, and the importance of tacit knowledge. This research will be explore whether the case itself, the eco-village as part of the CmP, can act to enhance the connection of different 'territories' and knowledges. 'Boundary encounters' as Wenger (2001) calls them, can be discrete events such as meetings, visits and conversations (p. 112) or longer lived connections that become part of a practice (p. 113). These types of encounters allow members of different communities to come into contact with the knowledge of the other community, and if prolonged in practice – in working on some joint enterprise – negotiation about divergent meanings and perspectives can take place. This type of learning is related to the practical aspect of the knowledge integration concept of transdisciplinarity. It provides space for an interesting exploration within the project, to analyze if the case study provides a setting in which boundary encounters and subsequent negotiation of meaning and mutual learning can take place.

There is a need to move not only across disciplinary boundaries, but also across boundaries beyond science, to include real world public actors (Giri, 1998). The following quote provocatively urges scientists to take on a new role within this more progressive and open understanding of knowledge:

[...] if by opening up science we are not meaning merely to open it up among those of us who belong to the world of knowledge but open it up to the wider society, the whole of humanity and the cosmic reality, and invite all concerned to be part of our 'conversation', then we need more journeymen and pilgrims who are prepared to hold the hands of the wretched of the earth and walk

on the dusty soil than professionals who jump from one conference to another and have no time to stand and share. (Giri, 1998, p. 390)

Drawing on the insights above, the current study attempts to explore what potential exists for new and innovative boundary-crossing research approaches in collaboration with all participants in the project. Boundaries need not only be crossed in terms of disciplines, however, but also in terms of administrative boundaries (Giri, 1998). A previous study on LID policy has shown that there is evidence that planning officers responsible for assessing the applications for LID projects in Pembrokeshire do not have an adequate understanding of what LID actually is (Lewinson, 2008). However, they are forced to engage not only with the concept, but also with the perspectives of the different stakeholders involved, from scientists researching organic agriculture and sustainable livelihoods to the prospective or current LIDers themselves. Thus, a pioneer application such as Lammas Tir y Gafel may result in learning on the end of the authorities and administrations involved, and this will also be explored.

3.5 Grassroots innovations and green niches

The term 'grassroots innovations' has been used to describe "networks of activists and organisations generating novel bottom–up solutions for sustainable development" and LID has been listed as one of many forms this type of innovation for SD can take (Seyfang & Smith, 2007, p. 585). The solutions proposed by such initiatives are said to respond to local conditions and take account of the interests and values of the communities involved. Green niches are defined below, and the applicability to the project of this case study immediately becomes obvious. Green niches are:

> sustainability experiments in society in which participation is widespread and the focus is on social learning. Niche-based approaches explore problem framings (e.g. mobility, food, energy services) and search for solutions – in contrast to technology demonstration projects that begin with 'technical solutions' to tightly framed problems. Niche practices that resonate with widespread public concern sometimes catch on, get copied, become adapted and spread. (Seyfang & Smith, 2007, p. 589)

Niche theory distinguishes between 'simple niches' (which do not seek regime change) and 'strategic niches' (which aim to sow the 'seeds' for wider transformation). Related to the discussion on boundaries and boundary encounters, it has been said that grassroots innovations can become "boundary objects; interpreted differently by networks of actors encountering one another's interests and commitments around the niche" (Seyfang & Smith, 2007, p. 598). Niche development relies on three aspects: (1) shared and robust expectations, (2) social networks that are deep and allow for a plurality of perspectives, and (3) learning processes which not only accumulate facts and data but can result in learning about "alternative cognitive frames" and ways of valuing the niche (Seyfang, Smith, & Hielscher, 2011, p. 5). Particularly the third aspect related to learning connects to the process of negotiation between different actors during boundary encounters and is focused on in this study. Through engagement of the different actors within the niche, and associated social

learning, the positions and commitments of some actors may alter. However, it has been shown on hand of green energy niches in the UK that local projects often do not have the capacity to create consolidated learning resources (Seyfang, Smith, & Hielscher, 2011, p. 14). Thus, a need for research into "the contexts, actors and processes under which niche lessons are able or unable to translate into mainstream situations" has been emphasized, and provides a justification for looking at whether cross-project strategic learning occurs at the eco-village.

3.6 Summary of theoretical concepts and presentation of research sub-questions

This chapter is based on the overarching context provided in chapter 1.3 by Beck's theory of the risk society and the role of science and technology in a process of reflexive modernization which critically reflects on the very foundations of modern society, science and development. Below, each section of the theory chapter is briefly summarizes. Table 3 presents seven research sub-questions, indicating which theoretical concepts each question is informed by.

The first section of this chapter (chapter 3.1) explores and defines different understandings of both scientific and other knowledge types, giving insights into the many portrayals of science in society and the wealth of other knowledge types that exist. The next section (chapter 3.2) elaborates on Irwin's idea of 'citizen science,' which emphasizes the importance of citizen knowledge in progress towards SD. Different approaches to decision-making within policy are introduced and discussed, and the conclusion that overall the knowledge of citizens is still dismissed compared to knowledge from accredited academic institutions is presented. Chapter 3.3 then goes on to present both transdisciplinarity and transdisciplinary research, outlining in particular a TD knowledge typology consisting of systems, target and transformation knowledge. Characteristics of a TR project are presented, then adapted and used as a lens through which to view the current case, and specific questions taken from TR quality criteria are employed to formulate more specific questions on the potential knowledge inherent in the participants and the ability of the project to contribute to knowledge generation. The next section (chapter 3.4) builds on the TD view by going into more detail on boundaries, and introduces the concept of meaning negotiation through boundary encounters. The final section (chapter 3.5) introduces grassroots innovations and green niches, which present an additional lens through which to analyze the case study in regards to learning.

Table 3: Research sub-questions and relevant chapter sections

Research sub-question	Relevant chapter section(s)
What is the balance between externally gained knowledge such as scientific information and knowledge that was gained through first hand experiences of the participants?	Section 3.1; section 3.2
What is the current role of science and scientific knowledge in the project?	Section 3.2
What is the potential for the project to contribute to mainstream knowledge (and thus actively engage in 'citizen science')?	Section 3.2
How are alternative knowledges valued compared to scientific knowledge?	Section 3.2
What knowledge of each type in the TD knowledge typology can be identified in the case?	Section 3.3
Does the case represent a setting which facilitates boundary encounters and if so what meanings are negotiated?	Section 3.4, section 3.3
Is there evidence of a LID niche or 'network' present, and in how far is cross-project learning achieved or desired?	Section 3.5, section 3.3

4 METHODS

Having introduced the theoretical concepts used to guide this research in chapter 3, this chapter outlines the methods employed in this study. It begins by explaining the overarching research strategy used (chapter 4.1). It then addresses the research approach, explaining why a single exploratory case study was used (chapter 4.2) and goes on to outline the sampling strategy used, describing how participants were selected and what type and number of participants were included in the study (chapter 4.3). The chapter goes on to address what kind of data was gathered and how it was collected and analyzed (chapter 4.4). The final section (chapter 4.5) discusses the type of data collected and how quality-assurance criteria were taken into consideration, arguing against some of the commonly held misconceptions about case study research and the ability to generalize from its results.

4.1 Overarching research strategy: exploratory, qualitative research

Qualitative research has become a widely recognized type of research in recent years, and is taught as an empirical method in a great variety of disciplines (Flick, von Kardorff, & Steinke, 2007). Used to research different perspectives from the viewpoint of the participants involved or affected, qualitative research focuses on the subjective and social meanings that are connected to these perspectives (Flick, 1999, p. 15). Generally, such research is employed to ask broad questions and gain in-depth insight into the subject area, replacing the traditional researcher's claim of neutrality and objectivity with an obligation on the side of the inquirer to report on his or her personal biases, values and assumptions (Creswell, 2005). In recent years, increasing recognition that research can be a "civic responsibility" and has a part to play in bringing needed change to society (Creswell, 2005, p. 43) has given qualitative analysis additional importance in the world of research. As the current study is interested in analyzing the research questions from the views of participants, and desires an in-depth understanding of the questions asked with the hope of contributing to a knowledge base which is aimed at creating a more sustainable future, the qualitative approach is considered applicable and appropriate. According to Flick (1999) the high rate of societal change and the resulting diversification of life-worlds are increasingly challenging researchers with entirely new contexts and perspectives. This creates a situation in which it is becoming less possible to rely on classical deductive methodologies, and increasingly important to turn towards inductive methods of empirical research. Therefore, instead of focusing on entire theories, and then testing them in the empirical setting, more emphasis is being placed on using 'sensitizing concepts' from the literature to inform the research focus. Although often misunderstood as therefore not being grounded in theory, this approach is based on theory and indeed a wide range of literature and theoretical concepts are combined (Flick, 1999, p. 10). This approach, using several

'sensitizing concepts' instead of one theory, is deemed appropriate as a theoretical basis which will allow for the type of open and receptive exploratory inquiry desired.

4.2 Research approach: exploratory single case study

The case study is a type of empirical inquiry which "investigates a contemporary phenomenon within its real-life context, especially when the boundaries between phenomenon and context are not clearly defined" (Yin, 2003, pp. 13-14). This definition applies particularly well to the research conducted for this thesis, where, for example, knowledge held by the participants is hard to divorce from the context, and the research is intended to be conducted on site. The case study is thus deemed an appropriate research strategy. A case may be selected for a variety of reasons. An 'intrinsic case' is one which is selected because it is unusual, and has merit in and of itself. Although this applies to the case in question, as it is the first and so far only, eco-village in Wales to be developed under a radically new set of development policies, the 'instrumental case' may be an even more fitting description of the case. The 'instrumental case' is one which is selected in order to study a particular theme – in this case the role of scientific and other knowledge types in grassroots sustainability projects – because it illustrates that theme in a profound way (Silverman, 2004b). Although elements of both the above listed types of case studies apply to the research conducted for this thesis, there is another type of case study, the 'paradigmatic case' which I believe best describes the selection strategy underlying this case study. A 'paradigmatic case' is one which highlights "more general characteristics of the societies in question" (Flyvbjerg, 2006, p. 232) and is "central to human learning" (Dreyfus and Dreyfus, 1986, in Flyvbjerg, 2006, p. 232). It is difficult to identify and confirm that a case is indeed paradigmatic, as there are no standards that can simply be applied, as the paradigmatic case itself "sets the standard" (Flyvbjerg, 2006, p. 232). In a personal communication between Flyvbjerg and Hubert Dreyfus, Dreyfus claimed that when selecting paradigmatic cases:

> You just have to be intuitive. We all can tell what is a better or worse case - of a Cézanne painting, for instance. But I can't think there could be any rules for deciding what makes Cézanne a paradigmatic modern painter...It is a big problem in a democratic society where people are supposed to justify what their intuitions are. In fact, nobody really can justify what their intuition is. So you have to make up reasons, but it won't be the real reasons. (Dreyfus, 1988 in Flyvbjerg, 2006, p. 232)

In the same paper, Flyvbjerg argues that although one may select a case intuitively, it is possible to explain this in a "sensible" manner (Flyvbjerg, 2006, p. 233). Regarding the case of this study, it can reasonably be argued that Lammas Tir y Gafel eco-village serves as a paradigmatic case because insights drawn about the role of scientific, and non-scientific knowledge within a unique and radical grassroots sustainability initiative may well provide insights into the role of both of these 'knowledges' in society in general, because the experiences, opportunities, and obstacles experienced by the individuals of this project are not necessarily unique to them. All people, and society in general, are faced with science and

different types of knowledge in almost every aspect of their daily lives. Learning particularly how science and individuals interact in regards to radical sustainability in this project may therefore provide insights into this relationship in society in general and may thus prove useful in the attempt towards re-thinking the relationship between science, knowledge, individuals and sustainability.

In summary, the characteristics of a well-conducted case study outlined above – relying on multiple sources of evidence, employing triangulation to converge and cross-examine results, and using theoretical concepts to guide data collection and analysis (Yin, 2003) – apply to this study's research design. Of the three approaches to case studies – exploratory, explanatory and descriptive – the exploratory approach is deemed most appropriate for this case study. Particularly because of 'what' and 'how' questions, which dominate the research sub-questions (chapter 3.6), the focus of interest is suitable for an exploratory approach. In summary, the desire to retain "the holistic and meaningful characteristics of real-life events" (Yin, 2003, p. 2) while investigating 'what' and 'how' questions of a contemporary phenomenon, which can provide insights into characteristics of society in general, has led to the exploratory qualitative paradigmatic case study approach being applied as the methodological perspective of inquiry for this research.

4.3 Sampling and participants

4.3.1 Sampling strategy and unit of analysis

The data gathered in qualitative research is often obtained on the level of the individual. A purposeful maximal variation sampling strategy is used in this study, involving the intentional selection of individuals who are deemed part of the case, or unit of analysis, and who are information-rich in different aspects of the case. This is done in an attempt to understand the real-life phenomenon of interest – in this case the role of knowledge in a radical sustainability project – in its complexity, by exploring multiple perspectives (Creswell, 2005). The applied purposeful maximal variation sampling was complimented by an additional strategy while in the field, known as 'snowball sampling', which resulted in the inclusion of three additional participants. Snowball sampling simply means that participants are asked to suggest additional individuals who might have an interesting perspective on the issue (Creswell, 2005). These individuals are then included in the sample where possible, taking into consideration time and budget constraints.

In this study, an individual's inclusion in the 'unit of analysis' was dependent on a close connection with the case study, the eco-village, in terms of both association and familiarity. The different perspectives selected were based on different types of involvement in the case, with the hope of covering all the most important actors and viewpoints.

4.3.2 Participant description and sample size

In total, the individuals included can be grouped into four categories: (1) eco-village plot-holders; (2) closely affiliated/affected individuals; (3) scientists/professionals involved; and (4) political and administrative individuals involved. It is important, however, to keep in mind that this categorization is a simplification for the sake of clarity. In reality, one individual may fit into several categories; for example, several 'plot-holders' have also completed PhDs and might also be included in the group 'scientists/professionals.' See table 3 for an overview of the individuals interviewed in each group and their anonymous identification number (based on the order of interviews). In two cases, an interview was conducted with two participants at once. Thus, there are two participants with the interview number 12 (PH12-1, PH12-2) and two with the number 3 (S3-1, S3-2).

Table 4: Overview of study participants

Participant group	Anonymous code	Number of individuals
Plot-holders (PH)	PH4, PH5, PH8, PH11, PH12-1, PH12-2, PH13	7
Affiliated/affected (A)	A7, A14	2
Scientists/professionals (S)	S1, S2, S3-1, S3-2, S6	5
Politicians/planners (P)/(PO)	P9, PO10	2
Total Participants		16

The 'eco-village plot-holders' represent the individuals who are implementing the sustainability project and living directly in the eco-village and thus have personal, first-hand perspective experience with the project. Of the seventeen adults potentially available in this group, seven (PH4, PH5, PH8, PH11, PH12-1, PH12-2 and PH13) participated in the study, representing six of the nine eco-smallholdings. Two individuals belong to the second cluster 'closely affiliated or affected.' One (A7) is a co-founder of the eco-village, is still intensely involved with the progress on site but does not live there, and owns the LI roundhouse which gave rise to the local LID policy in Pembrokeshire. The other (A14) is a resident in the adjacent village of Glandwr, who was strongly involved in the initial opposition to the development of the eco-village and thus brings in a more critical perspective. Including this villager was a result of snowball sampling while on site. The third group, 'scientists and professionals,' consists of five individuals (S1, S2, S3-1, S3-2, S6). These individuals represent either scientists, professionals or authors/editors from various research or consultancy organizations related to LID (e.g. Organic Centre Wales,

Fourth World Ecological Design Consultancy, The Land magazine) who were involved in writing reports, assessments or support statements in connection with the development application of the eco-village. Thereby, they represent a group which can provide insights from the viewpoint of various professions or scientific approaches, revealing a different perspective on the research. Included in this category are the two editors of The Land magazine (S3-1, S3-2), one of which is the previous editor of The Ecologist and coined the term "Low Impact Development" in 1996 (S3-1). A geographer who studies issues related to LID and was involved with the case since the beginning (S1), an ecological footprint professional (S2) and a scientist with the Organic Centre Wales (S6) are also part of this group. The fourth and final group of participants belongs to the cluster 'politicians/planners' and includes two individuals: the 2007-2011 Minister for Environment, Sustainability and Housing (P9), who was a key figure in getting LID included in Welsh planning policy in 2009, and a Pembrokeshire County planning officer (PO10) who was in charge of assessing the application of the eco-village on the county level, at which it was rejected. These individuals each bring an entirely different perspective to the research questions, enhancing the ability of the study to gain as holistic an understanding of the questions as possible.

4.4 Data collection

In order to collect data and gain insight into the context of the case, a three week field visit was conducted. Two sources of data form the information base used in this study. The first and most important is information gathered from the participants via interviews on site and the second is information taken from relevant documents. Using different sources of data allows for triangulation of the results, which is important for corroborating evidence to enhance the accuracy of the findings (Creswell, 2005, p. 252). The field visit and both types of data collection are described below.

4.4.1 Field visit

In order to conduct face-to-face interviews, a field visit of nearly three weeks was conducted. The first five days were spent near Plymouth and Devon, in England. Accommodation was obtained by WWOOFing (WorldWide Opportunities on Organic Farms) at an intentional community. From there it was possible to travel and interview three of the five participants in the 'scientists and professionals' cluster. The following two weeks were spent on-site at the eco-village in Pembrokeshire. Accommodation was provided by the neighbouring bed and breakfast. All travel was conducted by train, as this provided the most low-impact travel opportunity. The 'plotholder' interviews were conducted either in the plotholders personal homes on site, or in a quiet farmhouse nearby. Interviews with the remaining participants ('scientists/professionals' and 'politicians/planners') were conducted either in their homes or places of work, or, on several occasions, the participants came to the farmhouse and combined

the interview with a visit to the eco-village. The advantage of carrying out a field visit is the opportunity to conduct face-to-face interviews while also getting an impression of the country, the customs, traditions and habits of the people, and the particularities of the case, thereby gaining a deeper insight into the context of the case studied. The disadvantage is that a considerable amount of time and money is required.

Figure 10: Permaculture vegetable beds at Tir y Gafel (Photo: Karolina Rietzler)

4.4.2 Interviews as the primary data source

Interviews were chosen as the main data collection method because they allow the in-depth investigation of specific questions. Non-standardized interview guidelines were used to conduct semi-structured, face-to-face interviews (all one-on-one with the exception of two interviews, which were conducted with two interviewees at once due to situational constraints). Guiding questions in the interview guideline represent a link between the theoretically-guided research questions and the information one is looking for. They can be seen as a translation of the research questions into the context and language of the participants, with the goal of obtaining the information needed to answer the research questions (Gläser & Laudel, 2006). Open-ended main interview questions were formulated, using an 'ice-breaker' question to begin with, and probing questions were included in case more details or clarification was required. This approach allows interviewees to respond freely from their particular perspective and understanding, while still ensuring that specific information is collected in a way which minimizes the influence of the researcher's own opinions and biases (Creswell, 2005, p. 215, 223). The non-standardised guideline is meant to help structure the interview, but in contrast to a standardized interview approach, questions can be asked in a flexible manner, allowing for a naturally flowing conversation. In addition, questions can be modified in the field, added, or omitted, as important topics are either covered sufficiently or revealed in the process (Gläser & Laudel, 2006). As the participants in each group have a different perspective on the case, come from different backgrounds and have played different roles in the project, it makes sense to construct different interview guidelines for the different groups (Gläser & Laudel, 2006). Thus,

three different guidelines[14] were initially developed; for 'plotholders,' 'scientists and professionals' and for 'planners.' The politician and the local village resident were included once field work had begun, and the questions asked were appropriately selected and modified from the existing interview guidelines. A figure showing the three TD knowledge types was also taken along, and shown to participants if it seemed they needed a clearer description of what the research was focusing on[15].

Interviews were audio recorded and transcribed. Recordings and transcripts are important, in addition to field notes, as they provide details that would otherwise be impossible to remember, or which might not even catch the researcher`s attention at the time (Silverman, 2004a). In addition to benefitting the original researcher, Silverman (2004) outlines three further possible benefits of recording and transcribing: (1) the transcripts are then a public record, available to other scientists if desired; (2) the recordings can be re-played, and the transcripts can be improved; and, (3) future researchers can analyze the same data, but focus on different extracts than the original researcher (Silverman, 2004a, p. 355).

Thus, the interviews conducted were recorded, with explicit permission of the participants. The interviews were anonymized shortly after returning from the field, to protect the privacy of the participants. A coding system was used for identification, based on the suggestions found in the literature (Gläser & Laudel, 2006). However, in this report only the number of each interview, according to the sequential order in which they were conducted, preceded by letters identifying which group the interviewee belongs to, is presented as an identifier (see table 4).

Gläser and Laudel (2006) claim that listening to the interviews and condensing information in one step is methodologically not ideal, as it is not controlled, and no defined rules for such a process exist. More importantly, it also cannot be evaluated easily, as it is not reproducible or retraceable. The recorded interviews were thus transcribed word for word, leaving out only absolutely unrelated information (such as children crying). Interruptions or omissions were noted in the transcripts and time markers were placed to facilitate future referencing of these parts of the interview as well. Although this represented a significant investment of time, this thorough transcription method was chosen as the researcher did not feel comfortable making an early judgement on what might finally be relevant, and hoped that the methodological problems mentioned by Gläser and Laudel could thus be avoided. When presenting direct quotations in the results, the text was edited in such a way as to remove verbal errors and improve readability. This was done carefully to avoid changes in meaning.

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[14] The interview guidelines can be found in Annex 3.
[15] The graphic depicting the TD knowledge triangle can be found in Annex 4.

4.4.3 Document analysis as an additional data source

In order to have an additional source of information, with which statements in interviews could be compared and corroborated, it was decided to include a document analysis of several relevant items. Documents are valuable as they provide a good source of text data, and are in the words of those who wrote them, without needing transcription (Creswell, 2005). Documents included in the analysis were: a report by a conventional agricultural advising team on Lammas, Pembrokeshire planning policy documents, research reports or assessments and process descriptions on Lammas. All documents used are publicly available. See table (X) for a complete list of documents included.

4.5 Data analysis

In general, data analysis was performed according to the qualitative data analysis process described by Creswell (2005). This involves the process shown in figure 11, which spans from data collection, preparation of data (transcription), initial understanding of data, and coding of data to then capturing the relevant findings in the report and drawing conclusions about the data. This process involves steps that occur simultaneous, and must be understood as iterative, not linear.
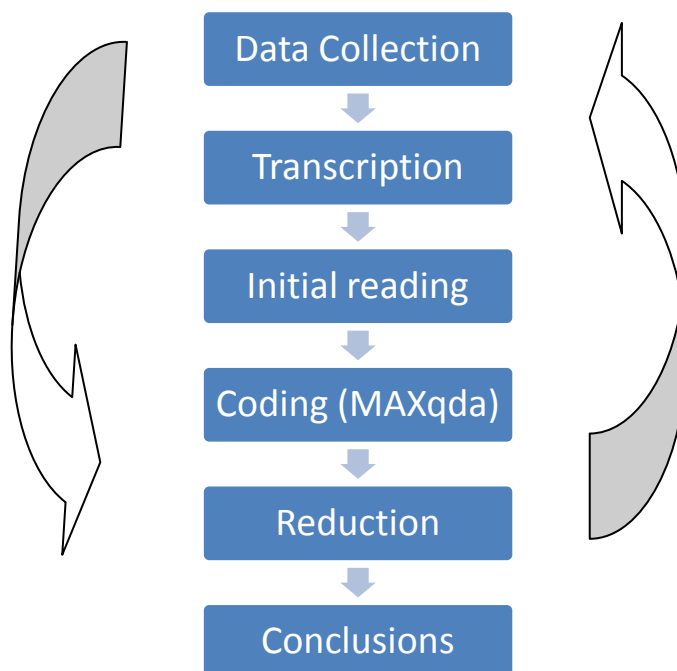
Figure 11: The qualitative process of data analysis (inspired by Creswell, 2005)

As both data collection and transcription are described above, the steps after transcription are described as follows. Both the transcribed interviews and the relevant documents were converted to a rich text file format (.rtf), and fed into a computer software program called MAXqda. This is a powerful software analysis tool which has four main windows, showing the

imported texts, the codes, the coded segments and the text itself. It also allows for the writing of memos and attaching these to codes or text segments as ideas or insights for later analysis (VERBI Software, 2004). The files were initially read several times, in their entirety. This gives the researcher the opportunity to get a 'feeling' for the material as a whole before breaking it into parts (Creswell, 2005). Memos and ideas were captured during this process. The data was then coded, in a process in which text segments were labeled with specific descriptive codes in a repetitive, iterative process. The coding scheme was based on a combination of deductive pre-set codes taken from the theoretical concepts and research questions, and inductive codes which emerged from the data during the coding process. Some text segments were given several codes, if their content addressed several different concepts. In total, this produced 89 codes[16], and 878 coded segments. In order to make sense of the data, the codes were then checked for overlap or redundancy, and finally collapsed into broad themes. During this process data was selected for use in the report, and other data, that was considered not relevant to the themes, was discarded (Creswell, 2005). The major findings were then presented in the results section (chapter 5) and discussed in relation to the theoretical concepts (chapter 6). The discussion and conclusion (chapter 7) includes the researcher's personal interpretations, which is an important part of qualitative research, as well as references to the literature, and an open account of the limitations of the research as well as suggestions for future research. Creswell (2005, p. 251) claims the researcher's personal interpretations may be based on "hunches, insights, or intuition", an interesting insight given the subject of inquiry and the results of this study, but interpretations must also be subjected to rigorous quality checks, as discussed below.

4.6 Quality criteria and the ability to generalize

Quality criteria

Ensuring quality in qualitative research is something that has long been a contentious issue, as differences in approaches and positions are common. Opinions differ on whether adoption of quantitative standards to the qualitative realm, creating unique qualitative standards or finally rejecting standards for evaluation of qualitative research altogether is the correct choice (Steinke, 2007). However, it is important to have some method by which to judge the quality of the results to be presented in this study, and therefore an attempt is made to outline how quality criteria were considered throughout this research process.

In qualitative research, reliability refers to "the degree of consistency with which instances are assigned to the same category by different observers or by the same observer on different occasions" (Silverman, 2005, p. 380). As a consistency test through several researchers was

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[16] The coding scheme, displaying the codes and sub-codes used, can be found in Annex 5.

not possible in this study conducted by one researcher, other methods to achieve reliability were utilized. The data obtained from interviews was compared with the observations and notes taken in the field, to ensure a consistent interpretation. The coding, or assigning of text segments to different categories, was done in a repeated iterative process until the inquirer was satisfied with the assignment of categories and no further changes were deemed necessary.

Related to reliability is validity, which represents the "extent to which an account accurately represents the social phenomenon to which it refers" (Silverman, 2005, p. 380) and means that the research can "draw meaningful and justifiable inferences" from the research (Creswell, 2005, p. 600). It might be argued that this is significantly more relevant to qualitative research than reliability, as it refers to the authenticity of the account. Triangulation helps to enhance the accuracy of a study by corroborating data from different individuals, data types, and methods of data collection (Creswell, 2005, p. 252). In this case four different interviewee groups participated, and data was obtained from observations, field notes, documents, and interviews. This allows for a comparison between what was claimed in interviews, what had been written about the process, and what the researcher observed. In reporting on findings, an attempt was made to give clear and detailed descriptions, presenting all sides of an argument or statement possible, including contrary viewpoints. This helps to represent the complexity that is present in real life. The amount of time spent in the field was deliberately maximised to allow for an enhanced contextual understanding of the case, which helped in conveying detailed information, and making less naive interpretations.

Having outlined how the study attempted to maximise validity and reliability, it must however be noted that it would be misleading to claim that the research was not affected by the researcher's own cultural, historical, and educational background, as well as by personal experiences and perspectives. Awareness of this, and the conscious effort to critically reflect on own assumptions, values and beliefs helped to minimize the effect these biases may have on the results obtained.

Generalizing from a single case

This methods section concludes with a discussion about the acceptance of the case study methodology regarding the type of knowledge one is able to generate and whether this can in any way contribute to the general body of scientific knowledge. The case study has not enjoyed an easy path to acceptance, and has historically been one of the most challenged research strategies (Yin, 2003). Flyvbjerg (2006) describes some of the most common beliefs that lead to misunderstandings of case studies. The first two are critical, and summarized below:

1. Context-independent knowledge is "more valuable" than context-dependent knowledge.

2. Generalization based on an individual case is not possible, therefore no contribution to scientific development occurs (Flyvbjerg, 2006, p. 221).

As a detailed explanation would exceed the scope of this thesis, this section will provide a very brief summary of the answers to these misunderstandings. Regarding the first point, it has been argued that "predictive theories and universals cannot be found in the study of human affairs", and therefore context-dependent knowledge is, in fact, of *more* value than "the vain search for predictive theories and universals" (Flyvbjerg, 2006, p. 224). Addressing the second point concerning the generalization of single cases, Flyvbjerg (2006) argues that many ground-breaking scientific insights were, in fact, based on critical *single* cases or experiments. In addition, one might argue that one must distinguish between generalization as representation (characteristic of quantitative research which does not apply to qualitative case studies) and generalization in the qualitative sense (gaining valuable insights from a single case, with applicability to similar cases). Silverman (2004) also approaches the concept of generalizability from a more qualitative direction. He states that "the concept of *possibility* is a key to this," as even if a given practice is not directly transferable to a different setting, the *possibility* that it *could* be, together with implications this carries, allows for a kind of generalization (Silverman, 2004b, p. 296). Two elements of this inquiry, namely (1) *learning* from the single case, and (2) identifying insights regarding the different knowledge types and their roles in this radical grassroots sustainability initiative that *could* apply to similar sustainability projects, do allow for a type of generalization from this work.

The following chapter (chapter 5) presents the results of this investigation. The data presented is based mostly on interviews with the participants and observations made in the field, with some supplementary data being taken from documents analyzed. An attempt has been made to include as many direct quotations as possible, to make the most of the detailed transcription and to allow the reader to 'hear' the participants themselves speak. This allows the reader to come to conclusions of her or his own which might supplement, confirm or contradict later interpretations made by the researcher, and thus enhances the transparency of the arguments made.

5 RESULTS

This chapter is divided into seven sections. It begins with a presentation of the aims of the project, outlining the participants goals and aspirations (chapter 5.1), then presents the knowledge identified in the project, including the finding that intuition represents an additional and unexpected type of knowledge that is relied upon particularly by the plotholders (chapter 5.2). The chapter continues by describing the role of science and academia in the case (chapter 5.3), followed by a section depicting the results on the potential contribution of the case to science and the mainstream knowledge base (chapter 5.4). The next section provides results regarding how different types of knowledge are valued (chapter 5.5), followed by the findings indicating the possibility of the project providing a setting in which actors with different perspectives can meet – in the form of boundary encounters – and the areas identified in which negotiation or discussion of different understandings is taking place (chapter 5.6). Finally, the chapter ends with a brief summary of the results (chapter 5.7).

5.1 Understanding the goals of the project

This section provides an overview of the goals identified in relation to the project by the various participants interviewed. These goals touch on topics that give a good indication of many issues reported on throughout the rest of the results section, and thus this first section also provides an opportunity for the reader to become more familiar with the case.

5.1.1 The project perceived as a solution to the sustainability crisis

The varied perspectives pertaining to the overall goals of the project of the different participant groups partly converge. However, as there are also differences perceived, the perspectives of the different groups will be presented separately below. In general, the three founding members of Lammas comprising a plotholder (PH8) a geographer and LI researcher (S1) and a key LID pioneer and author (A7) expressed that Tir y Gafel represented "a very important way forward" (A7) by providing an integrated answer to the "overlapping sustainability crisis" (S1) in "a world and society in crisis with very few solutions out there" (PH8). Importance was placed on the "completely integrated" (PH8) or holistic nature of the approach, which "does not separate one thing out" (S1) but instead addresses "a whole range of issues, social environmental, economic and sort of cultural" (S1). Tir y Gafel is seen as a solution that "tends to tick all the boxes" (PH8) and all three pillars of SD were mentioned as being addressed by all three interviewees. Although the project was described as a step "backward from the mainstream" (PH8), and as an example of "radical ways of living more sustainably as humans" (A7), it was emphasized that "Lammas has had a broader dream than just creating an eco-village" (S1) and that the idea was not simply to create a "lifeboat" which would survive if the rest of society collapses (A7, PH8). Rather, as PH8 explains:

> At the end of the day, and this comes back to the kind of environmental crises that we're in, you know, we're all in this boat together. You know, the [...] concept of 'go away, build yourself a lifeboat and let's just hope that when it collapses you can float and you'll be alright' is not gonna work, because we share this Earth in common and we will heal or break it in common. (PH8)

Thus, the founders emphasized the goal of creating a solution that can be applied not just for a few select radicals, but rather as "a pre-runner" which acts as a "middle road" between the mainstream and the very radical and shows that there "is validity in another way of doing things, and there is justification" (PH8). Their knowledge on the target or final effect of the project was thus primarily – although as shown below – not completely, on a rather large, universal, societal or global level. This was also found upon speaking to a representative of the political level. Addressing issues of sustainable development, and in particular climate change, were key to the 2007 - 2011 Minister for Environment, Sustainability and Housing, and she sees Lammas and LIDs as "incredibly exciting as an option" (P9), stating:

> My big policy agenda was how did we respond to the big challenges that come through climate change, the big challenges that come through being a country which had a potential leadership role in sustainability and how could we deliver that in low impact, low carbon development? And it just seemed to me, and it still does seem to me that what is so exciting about the LID size, One Planet Living, is that it is about bringing down our ecological footprint. So it's very, very clear about making different kinds of decision in terms of the way that you live. (P9)

However, in contrast to the founders who all gave an impression of this being the only viable solution, (e.g. "I haven't come across another solution in my search" (PH8)), the Minister does not believe that there will be very many eco-villages like Tir y Gafel as they require a particular setting and conditions which cannot always be met and because LID building styles are often still too far removed from the mainstream idea of what a 'normal' house should look like. Although she thinks they are sustainable, she believes that "people from more mainstream backgrounds will have a look at them and think 'that's great, but I wouldn't want to live there'" (P9). Therefore, this contradicts the founders' perception that Tir y Gafel has bridged the radical with the mainstream sufficiently to make this a mainstream solution.

The scientists and professionals' understanding of the greater aims and goals of the project differed between individuals. In terms of addressing sustainability, they all agreed the project was important, however for S3-1 the most important aspect it addresses is providing people with "an affordable place to live" which allows them to focus their energies on living differently. As a result, this project provides the possibility of engaging in a more sustainable and land-based lifestyle which then allows for a decreased footprint and thus addresses sustainability. S3-1 claims:

> If you're having to pay the rent on a standard dwelling, whatever it is, 600 quid a month or something, then you have to earn that. And earning that effectively increases your ecological footprint enormously, and you have to get a car so you can drive to work, and you haven't got enough time to do things properly so you, you know, you can't wash your own clothes, so you put them in the spinner and things like that. So it offers a kind of more LI lifestyle because you haven't got the rat race pressure. (S3-1)

Another respondent, who earns his living in part by doing ecological footprint assessments for developments, emphasized that the project addresses many different aspects of sustainability –

from housing, economics and transport to how we grow our food. He views LID and permaculture-shaped projects as a *possible* way of addressing the sustainability crises. He explains:

> Whilst I don't believe that the only sustainable way to live is in the countryside being sort of self-sufficient communities or whatever [...] that's certainly a way that has worked, traditionally, over many of thousands of years. [chuckling]. For lots of people. (S2)

The Tir y Gafel plotholders all supported the idea that sustainability is an effect of their lifestyle, but for some (PH13, PH11, PH4) sustainability was not an explicit 'goal' or 'aim', rather a natural and important side-effect of pursuing more personal aims. As PH13 states:

> I don't really have a story or a message or a mission around sustainability or.saving the planet or anything like that. Nothing global or kind of far-reaching, really. Anymore, I guess. Maybe I did at some point? I don't think I ever have on that respect. Umm...I'm kind of here quite selfishly, very much so I think selfishly. And the by-product of that probably is sustainability. 'Cause it's about life, really. I mean for me the relationship is about life. It's about life and the life energy, the life force – whatever you wanna call it. It's quite easily experienced, it doesn't have to require a belief or a name or anything. But all those forms that come through that, in relationship to each other and me witnessing that and taking part in that is, I guess, what we're talking about. (PH13)

5.1.2 The project perceived as an experiment and example to be replicated

Over half of the interviewees claimed that the main goal of the project is to provide society with an example of an alternative way of living and developing. Versions of the sentiment that what the project aims to do isn't "anything new", but that it is "putting things into practice" in "ways that haven't been done before" (PH4) or doing something that's "not new, so much, as kind of an old way but kind of, using new technology" (PH11) were repeated in all interviewee groups. One plotholder said she came to the conclusion that:

> the best thing to do was to live my life by example. And if I can show people by example that it's OK to do stuff, and that you can make changes in your life and all this sort of stuff, then I could, possibly, have an impact on the world like that. (PH11)

She goes on to state that after the Earth Summit in Rio in 1992, society had committed itself to coming up with solutions to sustainable development, and providing examples of what that might look like, but claims that "really it hasn't happened". She goes on to say "I see this place as a positive example of that. We are trying to achieve that – sustainable community" (PH11). Yet another plotholder claims, somewhat ambivalently, that living in the countryside is a topic which the eco-village "offers an example of some... of the way to do it. But who knows?" (PH5). He goes on to say:

> I see Lammas as very much like an experiment, really. Because nine, if we did manage to be carbon neutral, nine families living in a field being carbon neutral isn't really gonna make a huge impact on the world, in terms of emissions and everything like that. But if you can influence other people, then that's, that's the reason for doing it, really. I think. [...] So I see it as an experiment, and if it is successful, then people will want to replicate it. So I see it as a model really. Implicit within that is the experimental thing. And we will be producing data on how much produce we can produce, and all that sort of thing. And how many adults it takes us, and then that will help the next people. (PH5)

A planning officer sees the exemplary potential of eco-villages like Tir y Gafel more critically, stating "what's being achieved by somebody on one particular piece of land is not necessarily going to translate" (PO10). However, in referring to his own work, and somewhat

contradictorily, he claims that the "scientific approach" he uses to assess a proposal, looking for similar examples is an important component. In his words:

> so that's a scientific approach to assessing a development proposal. You know, you look at the scale of something, you work out, well, we look for examples where that type of development has happened, in an area that is similar to the area we are looking at. (PO10)

A respondent in the 'professionals' category emphasizes the importance of both the successes and failures of this exemplary project, stating:

> there's been so little development in similar areas to the one they're operating in, that it will be useful. All the things that they record will, I believe, start to inform people better as to what is sustainable. And it may be through their successes, and it may be through some of their failures, but, either way it will help. (S2)

More results relating to the potential contribution of the experience and knowledge gained by the experimentation of the project to mainstream society and science are presented in chapter 5.5.

5.1.3 The project seen to work towards affordable and equitable access to housing and the countryside

An important target of the project (with 19 text segments referring to this) for most interviewees is the provision of low cost housing, in combination with access to the countryside, for all. There are two components to this target, the first is to allow "ordinary people to come and live in the countryside, really, and pursue a sustainable lifestyle" (PH5) and the second is for them to be "able to build a dwelling to live in, out of materials that don't cost a lot of money – low impact materials" (PH11).

The first aspect was mentioned explicitly by 9 interviewees. Interviewee S3-1, who coined the term "low impact development," and has researched land management in the UK historically, explained that restricted access to the countryside and high prices of land are related to the Town and Country Planning Act of 1947 (see description in chapter 2.2). He explains how and why the act was introduced:

> The impetus was coming from CPRE [Campaign to Protect Rural England] and people like that. And they were, basically they were all middle class people who had access to the countryside, you know? If they didn't have their own place they could go and stay in an old bastard's Arcadian palace, or whatever. And they just didn't like the idea of working class people in their shacks, having access to the countryside as well. It was very much a class-based thing. (S3-1)

A plotholder explains how he previously never questioned this act, thinking "oh yeah, green for the plants and the animals, it's good" (PH5). However, now he says:

> But I'm kind of thinking 'hang on a minute, what's going on there with the Town and Country Planning Act?' I mean, was it to protect the countryside, or was there an element of Lord and Lady bla bla going 'Oh, I don't jolly well want to see these ruffians living on our estate' you know? And actually, who owns most of the land? It's *still*, even now, it's all these Lords and Ladies and things like this, and were they just protecting their own interests? (PH5)

Current planning policy still upholds this act to a large extent (S3-1, PH8, S2). The current housing situation in London, where "people are getting forced into smaller and smaller flats" was described as "bordering on inhumane! People are *just* not able to get out" (PH5). However,

the political situation is changing (PH5). The ex-minister confirmed that goals are changing on this level, stating that "we *do* want to encourage more people back to work on the land as well [and] this [LID] was the best way of releasing some opportunities in the countryside in a reasonable, *affordable*, way" (P9).

The second target, being able to build an affordable home, was mentioned almost unanimously. It was expressed that conventionally "the cost of building a house is just phenomenal" and "there's no reason why the cheapest house on the market in the UK costs 100,000 pounds" (PH4). Also, "we don't *have* the money, we're not wealthy people, we can only *just* afford the lease. There are so many people out there like us" (PH11). Therefore, the low-tech, locally-sourced and LI building variations used by the eco-village residents are seen to exemplify a low-cost alternative as well.

> We built a barn down there for two thousand pounds. I could have doubled that budget and made quite a nice living space. So, and there are people out there who have got nowhere to live, you know, really poor housing. [...] So there's gotta be some way around that [...]. And to me there's low impact in terms of your impact on the environment, but there's [also] low impact in terms of the pressure it puts on people's lives. (PH4)

Another plotholder said "this building cost 9,000 pounds. If I'd had to build it through building regulations it would have cost 19,000 pounds" (PH11). Since the plotholders therefore did not always comply with all the costly – and what they often referred to as "inappropriate" – building regulations, three families are being taken to court for not meeting all building regulations in the construction of their house or temporary residence. Views on building regulations policies lagging behind the progressive LID policies in Pembrokeshire, and in many cases even directly contradicting LID criteria, and what this means for the project, is presented in results section 5.6.2.

5.1.4 The project perceived as a way of achieving a less monetary and materially-based quality of life

A goal expressed by 4 of the 6 plotholder families interviewed was to achieve a higher, but different, level of happiness and quality of life than can be measured by material wealth (PH8, PH12-1, PH12-2, PH13, PH11). One woman used to ask herself "why was I never satisfied by money?" (PH11). She goes on to explain her joy at finding out about the UN happiness index during university, as it was perfectly applicable to her situation, and confirmed why she wanted to live differently:

> Cause I wasn't interested in money. My father wanted me to become a lawyer. Not interested in money at all. So, doing what I'm doing now, home-educating my kids, making crafts for a living – ok, it's quite hard work sometimes, but I love it! I love creating. [...] So but actually, that's what gives you... spiritual happiness, if you like. Not this kind of pursuit of the 9-5 [job] and then getting [drunk] every night at the weekend because you wanna try and forget about it all. (PH11)

Another participant describes her discovery that being close to nature makes her happy, as "whenever I went to the countryside, mostly to a festival or something, I just felt happy and free" (PH12-2). A founding plotholder claims:

> Our culture, as in the kind of capitalist, western society that we live in, is, I think, potentially unique in terms of human culture, because it is not connected to the Earth. It's kind of remote, it's displaced. (PH8)

Another plotholder agrees, and claims that "this lifestyle is providing an alternative or solution for people being out of touch with nature. Fundamentally." (PH12-2). He describes how it was the "positive draws" rather than "negative pushes," in terms of guilt about leading an unsustainable life, which led him to pursuing the LI existence:

> And then, whilst I've had those positive draws, I've been able to look back and see, you know, the negative aspects of how we're living and why that gives impetus, or justification, for this sort of thing. (PH12-1)

He also claims "that's what I've got that's the closest to religion in my life, I suppose [...] Nature and everything. That is not separate from the divine or anything" (PH12-1). The fact that happiness, a high quality of life and satisfaction with ones work cannot be measured monetarily, or by the extent of material consumption, was expressed by several participants (PH8, PH11, PH12-1, PH12-2, PH13). The following quote also shows it cannot be properly assessed in the business plans they submitted in their development proposal:

> I mean if you take into account...profit/loss is basically how they are assessing our business plans, our agricultural business plans. The cost of something or the value of something takes into... is purely monetarily based. It's all about currency. And the idea, the notion of currency, it takes into account nothing of the cost of things that cannot be measured, or are too onerous to measure in their variability that nobody bothers to do it, or discounts it... you know? In terms of biodiversity, or just happiness! [laughing] You know joy, plenty, how do you measure those things? (PH13)

Another plotholder agrees, stating that

> things like air quality and water quality are almost priceless aren't they, in this world? So those material considerations don't go down at all, do they [in the assessment of their development]? But things like not having enough income to buy clothes, then... we've stopped buying clothes a long time ago. (PH12-2)

This links to a concern the planning officer mentioned. He felt that "people's aspirations in terms of their standard of living [measured in monetary terms] were probably less than perhaps we would expect some people to have" and "what we shouldn't perhaps be doing is encouraging people to live below a certain basic living standard" (PO10). This concern was also repeatedly referred to in the ADAS report, commissioned by the planning officers (ADAS, 2008). When asked to comment on the concern of the officer, a plotholder mentions that "it's that sort of thing that would be hard to communicate" She explains:

> You can get brand new second hand clothes, you can still participate. And I think that's what they're maybe partly worried about, is we're drawing into cantons of ghetto's and stuff. But you can still participate in normal society, because the resources are still around, but you just don't have to be constantly buying and manufacturing them. So if I do need a new laptop and stuff, then we have decided that we do need to purchase and find income for those types of things, to be able to effectively integrate into the world. We can do that. But for other things, there's no material lack just 'cause we can't go to Wallstein's and buy new books every week, we just use the library. Or we can't go shopping in Cardiff once a month, 'cause we, we get the clothes which they've thrown away. (PH12-2)

The eco-footprinting professional agrees, and claims that the project's approach to quality of life challenges the norms mentioned by the planner above, stating:

> I think that, culturally, we've got used to homes being a certain way, and our standard of life being represented by certain consumer items and aesthetic qualities of decorations in the place that you

live in, and I think it's good that some people are out there unpicking some of that, and challenging those norms, and trying to see if they can make things that are less...modern traditional work in that sort of way. (S2)

The report by Lammas, commenting and countering the ADAS report also emphasizes a lower material standard of living being a part of LID:

It would only be natural to expect lower household need figures from a low-impact development. Residents choosing to live a low-impact lifestyle do so out of a desire to shift the emphasis of their lives from a consumerist basis to a sustainable basis. As such the residents will not expect to pay for dishwashers, family holidays to Spain, large fuel bills for transport, entertainment budgets, fashionable clothing, satellite television, microwave ovens and the myriad of other comforts that have come to be expected – indeed accepted as normal – in our society. (Lammas, 2008a, p. 7)

PH12-2 claims that "in terms of those basic needs of warmth, air, food and that sort of stuff, then I think you actually end up getting incidentally sometimes, a higher quality of life without, with needing less money for it" (PH12-2). Speaking of pursuing a less material existence, PH12-1 claims his family's quality of life is "certainly not synonymous with our income or our expenditure. Certainly not." He claims they get:

just a lot of joy and satisfaction out of providing for ourselves [...] being able to say 'I've made a forge out of an old scrap of car and you take some metal out of that same car and use it to make an ax, and get a handle from the woods and then use that to make firewood which we can use to heat our home' and that whole process just feels...very satisfying. (PH12-1)

He also makes the link between the ability to live well with less money and the overall wealth of Welsh society, a privilege not all people enjoy and an important factor in allowing them to live as they do:

"If I thought of all the people I've known in my life, and if I was to kind of plot on a graph how happy they were versus how much money they had, I don't think there'd be any correlation whatsoever. I really don't. I mean that's partly because we're living in an affluent society, which is the same reason that we don't need to buy clothes, is because there's so much." (PH12-1)

The ecological footprint professional believes it will be interesting to see "whether or not people manage to get by, have a healthy quality of life, in the circumstances they're in, without having such immediate access to all these services which conventional planning in the UK assumes *everybody* needs" (S2). A co-editor of The Land magazine believes there is simply a quality of life inherent to living in self-built houses that "people living in a swanky flat right at the seafront or something" can't understand without experiencing. She claims "there's just such a lack of freedom in ready-made housing" (S3-2).

5.1.5 The project perceived as providing a safe and inclusive community

Several participants expressed the opinion that certain community aspects of the eco-village were important (PH8, PH11, PH12-2, PH13, S1). Due to a family-member with special needs, one family knew they had to combine eco-living with a safe and inclusive community:

We wanted to [...] live in an eco-community, but also one in which we could support [name]. So it had to be one where [name] was understood, it had to be somewhere safe, so, yeah, it had to be a community where [name] was included and known. (PH11)

Just as someone with a disability must be integrated, the founding resident of Lammas emphasized that it is "imperative that any community structure can accommodate a hermit" and thus an important goal for him was to create an eco-village based on a "conventional" village

model, where everyone maintained their autonomy and could participate as much or little as they chose (PH8). Another community-related aspect mentioned by several plotholders and exemplified in this quote was a desire for the children to have a social life, "to live somewhere on the land, but in association with other people, small children, so they could have a life without having to drive places" (PH12-2). A social scientist and founder of Lammas working on these issues believes that in addition to wanting to live lightly on this planet "some people they're more interested in the social side of living closely to people, closely to the earth or whatever" (S1). Thus, the goal to engage in a vibrant and supportive, as well as tolerant and understanding community was found to be an additional target for some participants.

5.2 Perception of knowledge present and missing

This section first outlines what knowledge types the participants perceive to be present within the involved actors, based on a deductive exploration of the TD knowledge typology presented in the theory chapter (chapter 3.3). As well, the participants were asked if there are any areas in which they feel knowledge is lacking. Since section 5.1 focuses on the aims and goals of the participants, and gives a good impression of the desired outcomes, thus highlighting the target understanding of the participants, the first part of this section (5.2.1) simply presents a brief overview of the most important 'target knowledge' identified. The following section (5.2.2) then presents the 'systems knowledge' and 'transformation knowledge' identified as present and missing in the case. The final section (5.2.3) presents an additional knowledge type which was identified inductively and was particularly relevant in guiding the actions of the plotholders: intuition. Before beginning with the results of section 5.2.1 table 5 presents an overview of the knowledge identified in the case. The basis for the assessment of knowledge in this section comes mainly from (1) the subjective opinions and impressions given by the participants during interviews and (2), to a lesser extent, from the analysis of documents written by the participants. These documents range from scientific reports and assessments of the projects viability to relevant sections of the planning application documents and business plans of the plotholders. The knowledge associated with a particular group simply indicates that it has been explicitly linked to this group, and does not indicate that the knowledge is exclusive to said group. In addition, this presentation is not exhaustive, as the information it holds was not collected with this aim in mind, and table 5 simply attempts to provide a general impression of the knowledge types identified.

Table 5: Overview of knowledges identified. The 'X' indicates which knowledge was *explicitly* connected to a certain group of participants, "O" indicates that it was *explicitly* mentioned as missing in reference to that group. In some cases both apply to one group.

Knowledge type	Plotholders	Closely affiliated	Scientists/Prof.	Political/Admin.
Target Knowledge				
Decrease per capita footprint	X	X	X	X
Different quality of life	X	X		O
Safe/inclusive community	X		X	
Provide affordable housing	X	X	X	X
Access to countryside	X	X	X	O
Lifestyle choice				X
Living off state monies		X		
Transformation Knowledge				
Building skills	X	X	X	
Alternative food production	X	X	X	
Permaculture Design	X	X	X	O
Communication/presentation	X/O			O
Field and woodland management	X		X	
Wood working	X	X		
Business management	X			
Educational/Teaching	X	X		
Conflict resolution	X/O	X		
Water knowledge	X			
Parenting	X			
Conventional Agriculture			X	X
Systems Knowledge				
Botany	X			
Engineering	X	X		
Physics	X			
Philosophy	X			
Ecology/Environment	X		X	
economy	X			
Soils			X	
Legal	O		X	X
Social organization	X			
Intuitive Knowledge				
Intuition	X	X	X	

5.2.1 Target Knowledge

Knowledge perceived as present

The participants tend to express clearly formulated understandings of what can or should be in a desirable future situation, and thus in which direction the project hopes to transform the lives

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of the plotholders and the system within which they live. Understandings of the target of the project vary between participants. The plotholders tend to emphasize the personal advantages of the project in terms of access to low-cost housing and the countryside, quality of life, autonomy, community, responsibility and empowerment, and link these advantages to wider goals of sustainability and a decreased ecological footprint. One of the affiliated persons is fully in alignment with the views of the plotholders (in the case of the external founder A7) while, the other (in the case of the local villager) claims "I just don't get it" (A14) regarding the idea behind the project at all. In fact, he even expresses worry that the goal of the project is to provide a few eccentrics some form of livelihood for which they do not have to work and which could result in burdening the rest of society in the form of state benefits. The scientists and professionals perceive the project as clearly striving towards providing a solution to all aspects of the overlapping global crisis – economic, environmental and social. Several emphasize a contribution to global sustainability (S1, S2, S6) as the main target of the project while others tend to focus more on the local, social and individual benefits and goals of the initiative (S3-1, S3-2). In terms of the political and administrative target knowledge, the interview results demonstrate an overall understanding of the goals of the plotholders within both participants in this category. However, while the politician feels the possibility of reducing footprints and increasing sustainability are "very exciting" (P9) the planning officer expresses more doubt about whether the concept will prove feasible and more concern over possible injustice in relation to the local conventional farming community (PO10). He feels that it is difficult to justify LIDs in areas where conventional farmers struggle to erect additional buildings for their family members., but does not mention that LID is also an option available to such farmers should they be interested.

Knowledge perceived as missing

Two groups were identified, by themselves and by other participants, as lacking some form of target understanding of the project. The first and most prominent is the local administration, which some plotholders believed have a "fundamental lack of understanding" (PH4) of LID. Regarding local authorities, the politician stated "I think often they have to go beyond their local authority boundary to get the right expertise, and historically they don't work with each other well, across borders" (P9). Related to this, the planning officer himself said "there was information, that we thought we needed,[...] in an area where, you know, you're sort of breaking new ground" (PO10). The other group identified as lacking target knowledge of the project, represented unfortunately by only one interviewee, was the local village community. The interviewee repeatedly speaks of a lack of communication between the eco-village and the village residents, and expresses a desire to know more of the details, particularly in regards to financial aspects.

5.2.2. Systems and Transformation knowledge

As the participants tend to speak about 'systems knowledge' and more practical 'transformation knowledge' simultaneously (for descriptions of the TD knowledge types see chapter 3.3), and this is reflected in the quotes, these two knowledge categories will be presented here together. The findings represent the compiled results of the interviewees' perceptions. The information provided about a certain individual or group is taken either from the interviewee's self-assessments or is based on the participants' assessments of each other.

Knowledge perceived as present

In general, several participants express that in regards to the plotholders knowledge "everything's there within the group" (PH4) and that the plotholders represent "an extraordinary accumulation of very talented people, all in one spot" (PH5). The group is heterogeneous and represents "all walks of life" (PH8) with a great "variety of skills and knowledge" (PH13). This quote reflects the overall sentiment of most participants:

> The nine families here...it's like they're a fairly random collection of people with a totally random collection of experiences, backgrounds and resources, that at various stages in their life have kind of, kind of woken up to the reality, if you like, of the situation that we're in, particularly in relation to the Earth, and have come here just bringing kind of incidentally whatever background skills that they have and just in kind of rather an organic way, applying them. And some of them are more relevant than others, and some of them are still dormant. (PH8)

A scientist founder of Lammas describes the plotholders as having "a whole range of different knowledges, from their life experiences and from...well, yeah, again it's the social, economic and environmental range of knowledges" (S1). In general, non-plotholder interviewees found it difficult to answer questions about the knowledge of plotholders as many had spent only limited time with some of them. However, the ecological footprint professional describes them as being "up on the scale of people who have that, who can actually articulate why they're doing whatever they're doing and basing it on knowledge (pause) as well as experience and intuition" (S2). He thus makes an interesting distinction between knowledge on the one hand and intuition and experience on the other hand. The planning officer does not give any answer upon being asked what knowledge is present or could be seen as a strength in the plotholders. A scientist from the Organic Research Centre Wales describes the group by saying "there's quite a lot of collective brain power there" (S6). He goes on to emphasize that it is a strength to have a diverse range of knowledges and skills present:

> I mean there's a huge mix of backgrounds. I met a few people when I was here before, and just meeting those you sense that there were people coming from a bit of an economic background, scientific background, maybe some were based more in the arts. And of course with kids involved you need that kind of experience and expertise. (S6)

Overall, there is a consensus that a vast wealth of knowledge is present within the plotholders. Of this diverse range of knowledge, some types are more relevant to the project (e.g. building and growing skills) than others (e.g. book illustration skills). Also, the sources of knowledge are diverse, with a wide range of formal educational backgrounds as well as knowledge from vastly

different life experiences. Most participants claim there is not one specific common type or source of knowledge amongst all plotholders. As one participant said: "I doubt if there's even a single strand of knowledge uniting us. I think it's probably just all the intention to live in a simple, organic, natural way. And that may come from any... many sources" (A7).

The two individuals in the 'closely affiliated' group, have vastly different relationships to the project as they come from distinct backgrounds and knowledge bases. A7, a co-founder of Lammas and LID pioneer, has practical knowledge about LI construction, and has even authored a how-to book for reciprocal LI roundhouse building. He was referred to as a knowledge source by S3-1, the man who wrote the book which coined the term LID. Before leaving the mainstream to live a LI lifestyle he worked in local government and thus also possesses knowledge about the planning system from personal experience. He mentions books as being "quite influential" for him, as he "got into a phase of reading a lot of environmental books all at once, in the '70's" (A7) which then led to his adopting a new lifestyle. The other individual in this 'closely affiliated' category, A14, is a local villager who opposed the project strongly at its inception. He was interviewed to gain an understanding of what knowledge provides the foundation for such strong opposition, so questions asked concentrated on attempting to gain insight into how he understood LID and the project. The participant expressed his concerns in relation to the project, which centred mostly on the plotholders receiving "state benefits," coming from "all over the world" and a strong dislike of the building style claiming "well, a hovel is a good word for it...some of them... I mean, *really*" (A14). Speaking of the volunteers on site, state benefits are also a concern for A14 in this regard. He says "you know, I want somebody to tell me that they're not on benefit, or else I'll just believe... you can't tell me that people come and volunteer to work, and you know... for love" (A14). No knowledge relating to an understanding of the project could be identified.

The scientists and professionals who supported the project formally held systems type knowledge in engineering, soil science, architecture, environmental science, and law. Asked about his scientific education, one participant describes disappointment with the emphasis on fertilizers, claiming:

> I think they spent two or three lecture hours on farming on manure. And I just, it just, I just thought this is wrong! 'Cause as a five year old, I used to go out with my gran, and we'd walk the lanes and she'd have a little old shopping bag in the cold, and she'd pick up the horse droppings, and bring them back and she'd put them around her roses, and round, you know, in the garden, and stuff would grow! (S6)

As a result of this disappointment in the methods taught in his soil science degree he then decided to work for the Organic Centre Wales, rather than continue in conventional agricultural science. He explains, stating "I cannot, you know *morally*, I cannot go and do that sort of work!" (S6). With training in civil engineering, and working in the industry for fifteen years, another participant claimed he "became quite disillusioned with the purpose of the conventional development" (S2) which led him to try and find out what 'sustainable development' means. In

his travels he read a lot and came across permaculture and alternative living books which he claims influenced him. Three participants (S1, S2, S3-1) mentioned the road protests in the UK in the '90's as an important educational experience both in terms of systems and transformation knowledge as it linked protests about new highways:

> to the issues of wider sustainability. That was linked to things like climate change and that was linked to things like personal transport, people use cars... but also on a larger scale than that was the whole structure of the economy, and what we do with it, and the whole idea of the construction of road and transport networks in order to feed this thing that was fundamentally unsustainable in the first place. (S2)

It was "a really life-changing year for me, and so we lived in LI structures, benders and tree houses, and a lot of the people that were... it was a melting pot of people and places" said another participant (S1). In summary, all scientists and professionals had formal educational knowledge which was supplemented strongly by their reading, and particularly their personal experiences. The latter was the driving force which led them to pursuing and supporting LI activities.

Importantly, a distinction between the level of knowledge on alternative development and commitment to SD between politics on the national and local levels was drawn (S3, PH8, S1, P9). Nationally, Wales is relatively advanced in recognizing and committing to SD (see chapter 1.3.1). For instance, Welsh ministers have a legal obligation to SD. Scientific knowledge was found to be a key actor in this development, as:

> The Welsh Assembly only adopted the TAN 6 One Planet Development Policy as a result of the academic research papers, that it in part commissioned, granted, but non-the-less, those research papers were absolutely pivotal, fundamental to the emergence of the policy, for one thing. (PH8)

However, an initial understanding of the importance was already there, as the ex-minister interviewed said of her push for the inclusion of LID in policy: "I suggested that if we wanted to bring down carbon emissions, then what we might want to do was to look at *radically* different styles of low carbon housing" (P9). In addition to large-scale research, she explains that an important influence for her was contact with S1, the geographer/environmental scientist from Plymouth university and a founder of Lammas, who pushed for a meeting. He claims that "she was aware of it [LID], but I kind of put it up her agenda, and kind of gave her some information about it, briefed her" (S1). This occurred after Lammas had received development permission through appeal, so no conflict of interest was present.

Knowledge perceived as missing

In terms of knowledge that is considered missing, or which it would be useful to possess, the results are quite diverse regarding the plotholders. One participant feels "we're equipped to figure most things out, really" and claims "I can't really think of anything specific where we just go ohhh" (PH4). The LID researcher (S1) confirms this perspective externally, as he believes:

> I think, ultimately, Lammas and initiatives like that, don't need any support from anyone. They don't need expert support or guidance. It's like we've all got those skills, we've all got the potential to learn those skills very quickly, and get on and do it. What most people lack is the empowerment to realize that that is the case! (S1)

This is contradicted, to some extent, by the eco-footprinting professional who believes that in general "you can't do something like that without having access to that [scientific] knowledge" (S2). He argues that specific knowledge on "land-management, ecology, hydrology, energy-based knowledge" is knowledge must be learned or studied in an academic institution. However, particularly in the case of Lammas, he claims "I'm quite impressed," referring to their management, financial and legal structures which he feels "facilitate the other things" he refers to before.

The founding plotholder feels that the "organic" mix of knowledge present mirrors society in general, and the key for success is not in external input of knowledge but in providing a setting of freedom which allows people to "be able to find their own expertise in accordance with their own resources" (PH8). He explains, stating:

> So, in terms of what resources... the perfect situation is that people come to this lifestyle and there is sufficient space and freedom and lack of pressure for them to be able to ... to find... through some kind of mix of internal resonance and potentially their background skills and along with the resources that are available to them on the particular site, to find a path that works both in terms of meeting both their physical, emotional and spiritual needs. (PH8)

A lack of practical knowledge on how to access the resources each plotholder brings to the table, expressed as "I don't think we've necessarily cracked yet how to access it as a sort of pooled thing" are considered a knowledge weakness (PH12-2), and, as one plotholder says, "there's a lack of knowledge on any level, for the reasons I've already stated: we're pioneering something!" (PH13). Five participants (A7, PH11, PH13, PH12-1, PH12-2) specify that conflict resolution presents an area where the plotholders are lacking knowledge. One participant says:

> It is a lack of skill actually, in a way. We're not able to come together and communicate with each other, and problem solve, and conflict resolve ourselves. We need other people to come in from the outside to do that for us. So that's how it is seeming to me. (PH11)

Another are three participants mention (PO10, PH4, PH5) is legal knowledge, as no one is specialized in this at the moment. The planning officer claims the plotholders are lacking in understanding of the planning policy and process, because they "didn't have any individuals who had a planning qualification or had practice in planning" and thus he feels:

> They approached the planning process from, I suppose, a non-professional point of view. So in terms of, I think the dialogue that they have with us town planners was very much on sort of a lay person's point of view. (PO10)

Thus, areas identified in which more knowledge may be useful for the plotholders include conflict management and legal knowledge, specific scientific environmental knowledge and planning knowledge.

In terms of the 'closely related' individuals, the villager feels there is a lack of communication between the project and the villagers. He claims that he does not know the details and wants plotholders to come and tell him his concerns are unfounded. During the interview it was attempted to see why he believed that so many people worldwide are in support of the eco-village. After several attempts to receive an answer, he states:

> Well, you can support... people can support something without actually... (pause) they're never gonna do it, are they? You see.. you know... the.... (pause) we haven't got time to get into it, have we really? Umm... I don't know why people... what the hell's it gotta do with somebody in bloody Australia, or Canada? You know? You know, what has it got to do [2 bangs on table] with Glandwr? You know, what have they gotta do with Glan... or anywhere else, really? You know? (A14)

Finally, he ends by saying "but, it interferes with... it interferes with.... (pause) I just don't get it. I just don't get it" (A14). From speaking to this individual it seems that he just cannot understand the desire to live in a house which is not conventional, nor the wish to spend most of one's life engaged in work that simply results in meeting basic needs. It seems there is a lack of knowledge about the green building styles used, along with their advantages, as well as a lack of understanding how LID may positively impact sustainability in a broader sense. The main lack of knowledge A7 identifies of himself is a missing link to current research in sustainable building and living, particularly regarding alternative materials. He speaks of looking for load-bearing insulation material, and says "there are universities who are working on this kind of stuff" but feels the knowledge just doesn't get to the people and wonders "if they care that there are people on the ground who really want to know... [laughing]," meaning himself as well as the plotholders (A7). In summary, although some plotholders express a certainty that:

> Now [the villagers] see us as well-meaning, very hard working people who are trying to pioneer an alternative, that has some kind of place, even if it's not their cup of tea, it nonetheless has some kind of place in the future. (PH8)

it became clear to the researcher that this is at least partially contradictory to the feelings of some villagers. There is still a vast knowledge and communication gap between the local residents and the project. In addition, a connection to the state-of-the-art in terms of sustainability research seems to be an area in which knowledge is lacking.

There was no data collected on knowledge gaps within the 'scientists and professionals' category.

Politically, on the Welsh Assembly level, no knowledge gaps on LID were identified by the participants. Although locally Pembrokeshire developed a forward-looking Policy on LID (see chapter 1.3.2) to manage the situation of the roundhouse in the national park, they are seen by most plotholders and scientists as generally unsupportive due to a lack of knowledge about alternative development and relying solely on conventional research. As PH11 explains:

> Local county council only know how to do things one way. And that is the way they've done things before, and the way that they... or they accept things. It's the status quo, it's the system, it's how things are, and they use the accepted research organizations.

Although one scientist says the planners "make it quite difficult" (S6) and a second expresses doubts that "maybe they don't have such an acute grasp of the urgency of climate change and the sustainability crisis" (S1) an important point made by another is that local planners are "not expected to have a knowledge of absolutely everything, and that's why you have these consultants coming in, you know?" (S3-1). This was echoed by several participants who believe the important question is not how much knowledge the local planners themselves have, but

rather that progressive policies are in place and that missing knowledge on the specifics is gained from sources familiar with LID and permaculture (PH8, PH11, PH12-1, PH12-2). The discrepancy and amount of knowledge and support for LID differs widely between the local planning level and the national assembly level, where all successful applications so far have had to appeal to before being given planning permission. The planner himself claims that:

> We would say that there was information, that we thought we needed, that we were going through a process of trying to engage some consultants to help us in an area were, you know, you're sort of breaking new ground (PO10).

In summary, the results show a lack of knowledge on some level for most participant groups. The plotholders were identified as lacking particularly in legal and planning knowledge, but also a lack of understanding about how to resolve conflicts as well as how to access the vast knowledge shared by them are identified as areas in which external help may be useful. The closely related individuals highlight a lack of practical communication knowledge between the project and the local residents, as well as a general lack of understanding about LID on the side of the local villager. The external founder within this category points to his own frustration at a lack of knowledge about the newest green building materials, and mentions this as an area which may also affect the plotholders, pointing to a need for more effective collaboration between scientists, scientific knowledge and people on the ground. Finally, it is shown that in terms of political knowledge, the national level seems to understand the methods and benefits of LID well enough, as they are supportive in general, and have made allowances for this type of development within policies. On a local level, however, the participants tend to express the belief that local authorities and planning officers lack understanding of LID and that this is combined with an unwillingness to depart from standard conventional agricultural assessments when additional information is deemed necessary.

5.2.3 Intuition

Once shown the figure of the three TD knowledge types, the first interviewee, a scientist (S1), immediately says there is "a whole 'nother sphere, a whole group of knowledge, that's not really covered there where you get some sort of insight, some sort of intuition." He claims that "it really varies" but that "some people within Lammas certainly use that a lot and draw on that source of knowledge." Therefore he recommends taking intuition up in the investigation:

> Just as [...] the bureaucratic system privileges expert knowledge versus lay knowledge... well, equally it privileges scientific knowledge versus other kinds of knowledge: rational versus intuitive for example. So that would be another dimension you might want to include. (S1)

Following this recommendation a question on the existence and importance of intuition as a form of knowledge was taken up in most remaining interviews. In several cases (PH13, PH11, PH8), however, intuition is mentioned by the participants before the question is even asked, indicating its relevance. Six participants (PH8, PH11, PH12-1, PH12-2, PH13, A7) claim intuition plays a major and important role, saying for example "I think it's absolutely critical. Yeah, completely critical. I mean it affects everything" (A7). The planning officer (PO10) was

not asked directly, but mentions that he feels the Welsh government "want a scientific approach to decision-making [...] rather than people making decisions, sort of just on sort of gut-feeling, or instinct." Finally 3 participants (S3-1, S3-2, S2) do believe intuition plays a role, but one warns that it can be "counter-intuitive" (S2) as people may believe they are doing something which reduces their impact and increases sustainability, but "actually their footprint's considerably higher than people who are on low incomes in social housing in the city here and actually don't give a monkey's about most of the green issues" (S2). He adds "you've gotta match some of that intuition – and some of that spirituality even – in some people's behaviour with checking in on rational things." Similarly, S3-2 claims "intuition is all very well, but it's no substitute for doing your homework! You've actually got to get the information, do the homework, learn your stuff." And S3-1 says he "tend[s] to do things from a logical point of view" but also acknowledges that "you do decide where you're going to put your house and which way you're going to face it, and you *feel* your way into the landscape, by intuition" (S3-1).

Participants who feel intuition is very important give various reasons and examples for this, and within these explanations very different understandings of intuition can be seen. The founding plotholder (PH8) says "my core motivation, and I suspect that's true for most of the people here, is not the scientific papers, it's an intuitive drive within." He points to a relationship between science and intuition in the project, as he says the plotholders are "using academic research to justify an intuitive lifestyle approach" (PH8). He also describes a tension between the pre-planned design strategy required by the building regulations framework in Wales, and the "much more intuitive" LI approach. He describes:

> It's much more about a direct relationship between humans and materials. It's much more about having your hands full of cob, or holding a piece of round wood timber and judging for yourself whether that needs turning into squared wood, whether it needs stripping, whether it needs processing, whether it needs treating, what is it going to be used for... and taking into account all of the kind of considerations involved. (PH8)

Three families claim it was an inner knowing or intuition which led to them joining the project. One woman describes that this happened when she first walked onto the site, saw PH8 and "as I walked up to him I had this kind of premonition that this was where our life was gonna be going" (PH11). The other family intentionally sent the husband "on a sort of shamanic journey to the beach [laughing]" to "decide whether to wait for this bloody project or not" (note the three year application process in chapter 2.2.4). The wife claims that by getting in touch with his intuition her husband received the 'answer' that they should be patient and go ahead with their plans at Tir y Gafel (PH12-2). The same woman explains that the strain of the application and now the problems with building regulations have led to an increased reliance on intuition. She states this has taught her to "trust my intuition [...] it's almost like, when you're nearly taken to breaking point, what else have you got, in a way, to decide things?" (PH12-2). She feels passionately that intuition is important, and laments that:

> People are so cut off from their knowings aren't they? And the 'expert,' 'specialist,' thing is of course a huge one. No one's allowed to trust in simple decisions, that even in our lifetime people were used to making...are being cut off from them, and being told 'you don't have that'. (PH12-2)

The third family, represented by PH13, explains: "I've come here the way I've come anywhere, I suppose" and goes on to describe "I've never done the pros and cons of anything, or made practical decisions in my life. [laughing]. They've all been based on, I guess an intuition" (PH13). He defines intuition as "kind of an impulse, it's a movement, it's a kind of also a jumping in with a movement that's already going. That's my image, you know?" (PH13).

5.3 The role of scientific and professional knowledge in the case

Having outlined the forms and types of knowledge both identified as present and as missing, as well as the unexpected but important place that intuition plays in the project, this section presents findings on the role that scientific and academic knowledge have played in Tir y Gafel. As mentioned in previous sections, many of the plotholders themselves have a scientific or academic background, and scientific knowledge has a strong influence on their beliefs and opinions. It is very difficult to separate exactly how science and it's knowledge has influenced the participants and the project, as it is all-pervasive and presumably has influenced and informed almost every aspect of this case. It was however, possible to determine several particular functions of scientific knowledge in the present case. In general, formal knowledge has played and "continues, well, to play a very pivotal role" (PH8) in the project. It is present in the "scientific background" of many of the people on site (S6), with one plotholder claiming "I've got scientific data coming out of my ears! We've got [name]'s PhD, Masters, that kind of stuff. [name]'s a botanist, so there's a lot of scientific knowledge around, you know?" (PH4). It is also believed to be influential in society as a whole and important to people interested in LID, since:

> The presence, or absence, of academic research validating and justifying this approach is an influence on them. Now to different people to different degrees, but it is nonetheless an influence on them. (PH8)

One plotholder (PH13) echoes the sentiments of several (S1, S2, PH4, PH5) by claiming that science can, if that is the goal of society, play a role in sustainability. He feels "science has a role to allow us to use optimally the resources on the planet, to care for ourselves – if the consciousness, the collective consciousness' priority is that!" (PH13)

Four main roles of science and scientific knowledge were identified at Tir y Gafel. First, the role of science as legitimation of the rather alternative approach to development, particularly in terms of agriculture and the planning system is presented (chapter 5.3.1). Following this, the role of providing specific systems knowledge and technology is depicted (chapter 5.3.2), and the academic research activities going on at the eco-village are portrayed (chapter 5.3.3). Finally, the dual role of mainstream academia and science as both a barrier to and facilitator of Tir y Gafel (and LIDs more generally) is outlined (chapter 5.3.4). Figure 12 provides an overview of the project stages and shows that knowledge has flowed between science and the

eco-village throughout the entire process. The arrow from the project back to science as well as the integration arrows of the different knowledges interacting and being negotiated are presented in subsequent sections of this chapter.
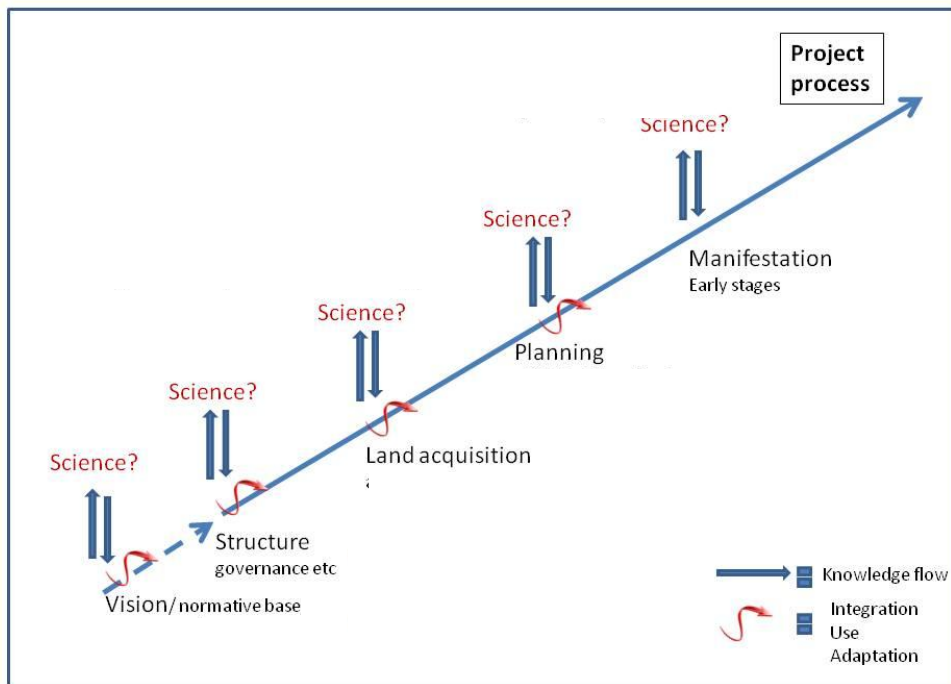
Figure 12: Graphic depiction of the flow of knowledge between science and Tir y Gafel. (Source: Own depiction)

5.3.1 Legitimation

As presented in chapter 5.1, a critical goal of the project is to bridge the gap between alternative (and often illegal) sustainable development initiatives which tend not to be recognized and mainstream development, in order to spread LID as a wider sustainability solution. The founding plotholder says:

> Because academia kind of represents the cutting edge of science... in a way, or impartial perspective, its support is so crucial. And that's why I do try, as hard as I can, to support all the research papers that go on. (PH8)

This kind of legitimation, as a major role of science and academia at Tir y Gafel is mentioned by all participants interviewed. Although all indicate there is also an inherent value in what science provides, some (PH4, PH8, S1, PH12-1, PH12-2, PH13, S3, S1, PH11) see this legitimating function critically, while others feel it is justified and important (P9, SO10, S2, PH5). The founding plotholder claims that by providing what is generally accepted as an "impartial perspective" science has been necessary to "justify our continued existence here" (PH8). As shown in the introduction to this section, the legitimating function is important on a general level in society, as the participants believe everyone is more or less influenced by science's findings. It is also important very specifically in planning policy as you "can't persuade an English local planning authority to adopt a LI policy without that kind of academic basis" (PH8). The planning

officer also claims scientific knowledge is important and feels that the Welsh government "want a scientific approach to decision-making" (PO10). This is supported by the ex-minister who states that in government:

> We very, very strongly used a science base. We have a chief scientist in the government who is a physics professor from Imperial, and he gave advice as well. So very, very strong scientific based, the overarching policy, which is: 'on the back of this we need to think about more sustainable futures and we need to tackle the climate change issues'. (P9)

In terms of the planning application, Lammas included reports and assessments from nine "expert witnesses" – individuals with academic qualifications as experts in relevant areas or from well-known institutions such as the Organic Centre Wales and the Permaculture Association. Some, such as an assessment of the functional need to live on the land, were required by the planners (PH5) while others "were just a good idea" or were hoped to enhance the impression that the plotholders "were very rigorous" (PH12-2) in their application. When asked why these reports were necessary, answers range from "they were needed just to give us credibility" (PH4) to "I think we needed to just bombard them with some sort of 'proofs' from all directions or something" (PH12-2). The founding plotholder sees a bias in society towards scientific knowledge, claiming:

> The scientific papers are important because our culture is – and you could argue imbalanced in this regard – but it is pre-occupied with rational argument and reasoning and, you know, thus it is imperative that we as a movement are able to articulate ourselves in that way. (PH8)

The planner himself says of the reports that "they are, I suppose, examples of where they [the applicants] justify the number of hours that somebody puts into their operation, and gives credence to, I think the value that can be realized from that activity" (PO10). When asked if an assessment by someone who had experience, but no formal qualifications and wasn't from a known organization, would be considered by the officers, the planner replied it would. However, evidence from "somebody with membership of a professional organization, that perhaps we know" he believes "carries more weight than perhaps individuals who we are not aware of, whose maybe, professional qualifications seem you know, perhaps, to be outside the mainstream" (PO10). Deciding whether such evidence gets any, or how much weight and belief assigned to it is something he feels is up to the person assessing the application:

> They [the person providing an assessment] *might* be putting forward something which is umm.... you know, maybe significant, maybe could be the difference between granting permission and not granting permission, but umm... I guess it's, it's for the decision maker to try and apportion the weight and decide." (PO10)

A plotholder explains that in preparing documentation for relaxation of the building regulations they are accused of violating he has "been trawling through for academic references, because that makes the arguments respectable, acceptable" (PH12-1). The same was expressed by another plotholder preparing his relaxation documents, stating he quotes "both the recent IPCC report and also the IEA (International Energy Agency) reports" (PH8) to support his arguments – again pointing to the legitimating function of scientific knowledge from recognized sources.

5.3.2 Provision of specific knowledge and technology

In response to the question on the role science has played, the interviews clearly demonstrate that scientific knowledge is influential and helpful throughout the project. Participants state that scientific and academic knowledge play a role particularly in three key areas: (1) providing specific understanding of natural systems, (2) providing a foundation for permaculture design principles and (3) providing useful technologies which aid in the set-up of sustainable systems.

Knowledge on natural systems

One important area mentioned was the soil. PH4 states:

> We had some fairly complicated soil analysis done, 'cause I'm sort of interested in that. Because where I'm used to growing is totally different to here. The climate's different, the altitude's different, the soil's completely different. And I was just hoping to give myself...just a bit of prior knowledge for that. (PH4)

This shows an attempt to gain specific information from scientific analysis to assist in agricultural endeavors. Several other participants (PH12-1, PH12-2, PH13, S2, S3-1, S6), mention the role of science in terms of specific knowledge about soils and growing requirements for plants, stating that it is valuable and useful for such activities, and one speaks of the "wonder and amazement" that scientific insight about nature has evoked in him. He also mentions he uses scientific knowledge in farming his worms, and when speaking of that soil he claims:

> I'm also aware that within a teaspoon of that stuff there are as many organisms or life forms as there are stars in the universe. I'm aware of the existence of certain entities – at least in my belief system, I've never necessarily seen these things myself – through science...because of it. And so I can apply that to what I'm doing as well (PH13).

In terms of the interaction between humans and the environment in which we find ourselves, he believes the overall knowledge science has contributed is very simple and basically just supports common sense. He sums it up by saying "I think the environmental stuff is actually quite easy, it's quite simple: 'don't [excrement] where you live!'" (PH13). Although he mentions having commissioned a soil assessment to help make decisions on growing, PH4 also claims "Umm... but in the end all we're doing is just sticking anything in the ground and seeing what's happiest, really [laughing]" confirming an earlier statement that reports by scientists had been needed for credibility "but in terms of what's actually happening on the ground now, I think.... I've never referred to them at all. [laughing]" (PH4). Not using or referring to these reports in their daily activities was confirmed by all participants asked (PH11, PH12-1, PH12-2, PH13). As a group, however, it became clear that all plotholders refer to scientific knowledge in terms of looking up reports and scientific work, by having a scientific background themselves, or – most importantly – in the form of permaculture.

Permaculture

Through its strong presence at Tir y Gafel – explained as "I don't wanna call it a shared ethos, because I'm not even sure it's that, but [...] it kind of fits with what we're doing, very much fits

with what we're doing" (PH8) – permaculture represents a way in which science and scientific thinking has been married to more traditional principles and has come to play a strong role in the actions of the plotholders.

Permaculture design (see chapter 2.5.2), although it includs a decidedly alternative form of agriculture, comes "from a strong scientific basis" (PH12-2), and "there's quite a lot of yeah, energy-based physics associated with the principles of permaculture...and a linking of old skills and old knowledge with modern science and science thinking" (S2). Permaculture design is "a rationalization of a kind of integrated, holistic, design system" (PH8). One plotholder and permaculture design teacher says:

> I'm very proud of its strong academic roots, and how rigorous...and it was basically grounded in earth sciences and the original materials on it is all very much proper geography stuff, you know like proper looking at soil and everything. (PH12-2)

PH8 says "it's incredibly thorough and meticulous, and brings into awareness that there is interrelationships that exist and so on." The following quote helps portray the holistic thinking permaculture is seen to facilitate:

> I often get asked about permaculture and I usually say something along the lines of 'OK. Well when this field was down to agriculture the farmer would look at it, and evaluate what profit he or she could make from it. What can this field bring him in terms of a cash crop?' That's the perspective of agriculture, whereas the permaculture perspective is much more: 'how can I work with potential ecosystems in this field to meet my needs directly? My needs being multiple in terms of food, water, fuel, air, shelter etc. etc.' (PH8)

Interestingly, although the plotholders are very much aware and appreciative of the scientific foundation inherent in the design principles, it was found that the attraction to permaculture is often not scientific at all. Rather, one plotholder and permaculture teacher says "what drew me into it originally, was it is taught so creatively and with no...a lot of emphasis on things that weren't factual" (PH12-2). Additionally, she describes it as "a brilliant synthesis of left and right brains, or you know whatever you want to call it, analytical and creative" (PH12-2). The eco-footprinting professional, who is also a permaculture teacher, mentions some worry about the unscientific application of permaculture, stating:

> I have a slight fear myself that there are people out there getting involved in the *idea* of permaculture without perhaps going into the depth of the reading and absorbing the knowledge that underlies the principles that people have come up with. And then sometimes use that to justify doing things that perhaps aren't as good a quality or as productive as they might be in other circumstances. (S2)

Learning by observing was mentioned by three plotholders (PH11, PH12-2, Ph13) and S2 confirms that:

> The *best* permaculturalists I know do observe and record and reflect on the information which they've observed and recorded... which is scientific technique, scientific method. Carry out your thing, observe, record, reflect, alter your system, observe, record, reflect, alter your system... round and round and round you go, and that's what permaculture is entirely about. (S2)

Hence, permaculture was found to strongly influence the thinking, approach and actions of the eco-village plotholders and thereby also bring in a strong element of scientific thinking, scientific methodology and science-based action to the project.

Technology

All participants are in favour of an approach to sustainable living that marries the traditional and rather un-technological labour-based LI lifestyle with the high tech provision of modern science. Thus, modern technology plays an important role, and represents yet another way in which scientific and institutional knowledge is of significance to this project. There is an emphasis placed on "using it as a tool, rather than having it control me" (PH4). The rationale applied to using technology as a tool for sustainability, when appropriate and necessary, is explained below:

> We're able to hire a digger relatively cheaply, or a sawmill relatively cheaply. And there are people within the LI movement who say 'look, that's not fair, that's cheating, because really we should be completely...' but I guess we see it as, rather than using fossil fuel to perpetuate an unsustainable system, the use of fossil fuel to create a sustainable system is probably the only really justifiable use of that resource. (PH8)

Figure 13: Use of machinery and fossil energy to set up a sustainable permaculture system. (Photos: courtesy of Lammas)

Information and communications technology is also used extensively in the project. Every family visited is in possession of at least one cell phone, and all make use of the internet to communicate via email, gain information specific to a question that might come up during their activities, or set up websites to share and disseminate their experiences and opinions. The following quote by the eco-footprinting professional describes the return to a more local, land-based and agricultural lifestyle combined with the newest information and communication technology, ensuring complete inclusion in society:

> Drawing on the best of modern technology and using computers and internet, and mobile communications technology, all that sort of stuff, coupled with renewable energy resources has got to be the way. (S2)

He feels this combination ensures that exclusion or marginalization and an inability to enjoy education and culture, often a case for migration from villages into cities, is avoided:

> It's possible for you to have both a grounded physical life, based on working on the land and with materials from the land, for example crafts and things like that, and also combine that with something more academic and more intellectually challenging, and have access to culture and entertainment and things, in a relatively low-impact way. (S2)

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5.3.3 The current role of research in the project

Research projects were found to represent an important way in which science and academia interact with the case. Most projects so far have been undertaken by graduate students and other university researchers interested in learning about various aspects of this pioneering approach to LID. Completed projects can be found on the Lammas website, and range from several Masters and PhD dissertations on the role of the planning system in LID (Lewinson, 2008, Habib, 2009, Kulbicki, 2011), a descriptive masters case study on Lammas (Tolle, 2011), to an anthropological study of conflict and emotion in the local opposition to the eco-village proposal (Shaw, 2009). Additionally, several research papers were commissioned and funded by Science Shops Wales in response to the request of Lammas Ltd. as a civil society organization. These include a description of the application process (Wimbush, 2009b), a paper portraying how Tir y Gafel meets Policy 52 (Wimbush, 2008), an initial carbon investigation (Wimbush & Swallow, 2009) and a masters engineering project designed to devise a rocket stove cooker suited to the fuel availability and cooking needs of the village (Dian, 2009). While this research has been conducted, it has lacked in actual participation with the project members (PH12-1, PH4, PH13). Although, as one plotholder says "I try as hard as I can to support all the research papers that go on" (PH8) the "overwhelming" amount of work all plotholders have to accomplish in attempting to meet the five year deadline has meant that they don't have as much time as they would like to commit to engaging in the research (PH12-2). The reports discussed in section 5.3.1 are also conducted with basically no contact to the plotholders (PH4), a finding which was confirmed by the scientists and professionals interviewed (S2, S3-1, S6). Thus, although research activities certainly play a role, and are considered imperative and supported in as far as possible by the plotholders, it was found that the research is generally not conducted together with the project members, but rather it is simply "on" or "about" them. More results on this topic will be presented in section 5.4 dealing with the potential of the eco-village to contribute to mainstream knowledge.

5.3.4 Barrier to and driver of LID

A final category which stands out in terms of the role that scientific or professional knowledge play at Tir y Gafel is that it simultaneously supports and hinders the project, and LIDs in general. The supporting role is based on the fact that the permission for this pioneer village and "our ability to replicate this elsewhere, is reliant – totally reliant – on backing from academic institutions" (PH8) such as the many alternative reports written for the application. The hindering aspects are related to conventional scientific or professional planning and building requirements which, if adhered to, would mean that "before you even put a brick, or you know, dig a hole in the ground, you're looking at a ten grand bill" (PH4). These financial burdens resulting from a requirement for scientific or accredited verification of construction aspects, combined with the application of mainstream agricultural knowledge in assessment of the

project's viability, is seen as a barrier to achieving the LI and low-cost sustainability solution the project is attempting to provide (see figure 14).

Figure 14: Plotholders wrapped up in red tape outside County Hall (left), and delivering the final planning application. (Photos: courtesy of Lammas)

In terms of support, science has made society and individuals aware of the environmental crises, as "they also are influenced by the IPCC reports and the IEA reports" which in combination with the belief that they see "the trends themselves" has led to PH8's perception that "now I would say that we have passive support from the large majority of our local communities" (PH8). This type of support is strongly related to the legitimating role of science outlined in section 5.3.1. However, here the emphasis hones in on the more concrete demonstrations of support by specific scientists or academic institutions in terms of influencing policy directly in relation to LID. A plotholder says science is "really important" and claims "I can see how the academic connections have helped to validate this, really" (PH12-1). He goes on to say he feels science is also at the heart of the political support they have received:

> That's been part of us getting this far, is that we've had political support, which has probably partly been born out of involvement with academic institutions, and the academic research which has backed it up (PH12-1).

This sentiment is echoed by PH8 when he states that major environmental reports provide backing support for radical solutions like LID by painting "an absolutely catastrophic future. Imminent, if not upon us!" (PH8). P9, the ex-minister interviewed, confirms the supporting role of scientific information when pushing for more alternative LID policies, saying:

> We used sort of the wider, the global evidence from the NGO's in terms of the work that they'd done to actually push as far as we could. And we used the Tyndall Centre, which is, obviously is the most, in UK terms, is probably the best climate change institute. (P9)

In terms of creating barriers to LID projects the eco-footprinting consultant points to the hurdles that meeting scientific requirements can bring when he says:

> I've seen people struggling now for the last ten to fifteen years, struggling to get projects off the ground, literally burning up in the five or six years it takes them to scrabble through the bureaucracy in order to get the opportunity to even start. And then when they do start they've already exhausted themselves in the process, which is a real shame. (S2)

Related to this, a plotholder explains that over the years he has developed an idea he calls the "tyranny of the professional" which he claims creates a situation in which information or

knowledge is only considered valid if it comes from someone who has studied at a recognized institution, and has "letters" after their name. This results, he says, in people at Tir y Gafel "having these big issues with building control at the moment, [since] you need an approved such and such...you need architects and structural engineers" who are, he claims "making ridiculous amounts of money for just rubber stamping basically" (PH4). PH4 himself is an engineer. He gives an example of when he spoke with someone from Pembrokeshire County Council about the 'standard assessment procedure' required to report on the energy efficiency of the homes:

> And I was saying to the fellow, I could buy one [a 'standard assessment'] off the internet from an approved bloke for 100 quid, but I'll know it's wrong, and they'll have to make certain assumptions. Or I could do one myself 'cause I've looked at the calculation. And he said 'no, we'll have to get the approved bloke to do it.' [PH4 replies] 'but you know it'll be wrong!' [the 'fellow' replies] 'yeah, but it's approved'. And so there's that whole sort of thing. (PH4)

The most obvious and significant obstacle that science presents for the project is in the form of the Agricultural Development Advisory Service (ADAS). This is a service called on by the council to assess the agricultural viability of planning applications (see also chapter 2.3). On the basis of the ADAS report, which had "really been very dismissive about the potential for horticultural production" although "they'd never been on site" (S6) and which was based on scientific data gained from research on conventional agricultural practices conducted between 1970-1990, the council turned down the Lammas application (S6, S2). A scientist interviewee from the Organic Centre Wales says that, for example:

> ADAS have a way of describing soil nutrients as, you know, index 1, index 2 – where 1 is pretty close to deficient and 4 is pretty good and so on. But organic soils tend to perform beyond their indices. (S6)

This example illustrates, says S6, that applying data obtained from conventional research to assess organic systems is like "chalk and cheese, apples and oranges. It just [does not] bear comparison" (S6). S2 confirms this with another striking example, stating that in terms of the assessment of applications by planning bodies:

> Currently, the only tools available to do that are a set of guidelines laid out in the appendices of various planning policies, and they're quite rigid. And they're based upon a perception of a functioning agricultural economy that's in the 1970's. And that isn't what these people are trying to do! And so if you compare them, it's like comparing chickens and aircraft – it doesn't work! (S2)

Yet it was the foundation for assessing this LID and S6 claims the councils tend to say "well look, this is what ADAS say, they're the experts!" In this sense, the application of scientific knowledge can clearly be seen to hinder and block the progression and acceptance of the project. S6 claims his report (an agricultural assessment through the Organic Centre Wales) was necessary to "kind of rebut the official assessment that came from the council's side." To do this he used information that was based on research he had done on the performance of organic small-scale agricultural practices, showing that "if you're working it by hand, and you successfully crop, and you get stuff as close together as you can" the yield on organic small scale, non-mechanized production is "quite surprising" (S6). In addition, he states one can

provide enough vegetables to feed a family on "250 square meters" (S6). Indeed, a the Lammas report commenting on the ADAS assessment also refers to a 1980's UN agricultural study on small versus large scale farming which found that smaller farms are up to twelve times as productive as larger farms (Lammas, 2008a, p. 7). Such findings, however, seem not to have been considered by the conventional advisory service when making judgements about the viability of the project proposal.

As this section shows, science and institutionally accredited knowledge are identified as being both supportive of and necessary for the success of the project as well as presenting a substantial barrier to the case, and seemingly to LIDs in general. Particularly in terms of creating major bureaucratic obstacles in planning it is shown to present significant delays and affordability problems for the participants in this eco-village. One of these obstacles was the requirement of applicants to provide masses of 'expert witness reports' to counter the data of mainstream agricultural research. Another obstacle was referred to as the "tyranny of the professional" whereby it is expected that LID applicants spend thousands on reports and assessments by 'certified' specialists, despite often feeling capable of providing even more accurate information themselves for no cost. When these requirements are not adhered to, legal problems and additional delays – including court hearings – have resulted, revealing a second level of difficulties also ultimately related to scientific knowledge and requirements.

5.4 The project's potential contribution to science and the broader knowledge base

> People keep coming and interviewing me [laughing] so I suppose somebody's interested. (PH13)

As indicated by this quote, the participants of this study, from plotholders to scientists and politicians to planners, have unanimously agreed that this pioneering eco-village has the potential to provide useful information to society. As the Organic Centre Wales participant says: "it's gonna be, and probably is already, but *will* be, as it matures, is gonna be a huge source of information" (S6). Almost all participants asked about the potential of Tir y Gafel to contribute to the mainstream knowledge base feel that it could be very important. One plotholder, however, says:

> I don't see there being anything particularly, nothing we're doing here hasn't been done before. We're not doing anything new. We might be doing lots of different old things in a new combination of ways. (PH4)

And just this innovative and context-specific combination of existing aspects seems to be the feature that most participants feel holds great potential for contributing practical knowledge to the current debate on sustainable rural development. S6 explains that scientific data obtained in experimental lab situations often has limitations as:

> That data from very sort of tightly controlled, single variable experiments... how do you apply that in the situation which has got variables going in every which direction, you know, soil is so complex. As indeed human beings are. (S6)

S2 confirms this statement, stating that the project can contribute data and knowledge, particularly as they have so many monitoring requirements to prove they are meeting their goals:

> They are having to record, and compile information and data that lots of people just never would have to do. You'd never have to go through that, especially on an on-going basis! So the fact that they've got a need to do these sort of annual, bi-annual reports on their progress towards various targets that they've set, or that their local authority has set, that's gonna provide a whole wealth of data for the future. You know, so I see them as being pioneers on a different sort of rural development. (S2)

He feels that:

> All the things that they record will, I believe, start to inform people better as to what is sustainable. And it may be through their successes, and it may be through some of their failures, but, either way it will help (S2)

As a "pilot project" (P9) for LID, Tir y Gafel may be a valuable example for those wishing to replicate such development. For science, it may provide a knowledge base useful for filling in the gaps in knowledge about alternative lifestyles, organic agriculture and green building knowledge. Finally, it may present an ideal setting in which to explore new and participatory research strategies. The following three sections are dedicated to presenting results related to these potentials.

5.4.1 Example to be replicated

Most (PH5, PH8, PH11, PH13, P9, PO10, S1, S2, S3-1, S3-2, S6, A7) participants stated that this project can contribute to knowledge by being an example of LID working within the legal and political framework. As this was already discussed in section 5.1.2 on goals of the project, the perceptions on the project's potential to contribute knowledge in this way will only briefly be presented here. One plotholder claims "I spent the first years of my degree learning how to be an environmental scientist, and the last year learning what all the problems with science were" (PH11). This made her realize "I couldn't *possibly* be telling people what to do [laughing] and the best thing to do was live my life by example" (PH11). It certainly seems that both the scientific and public realm believes this case is an interesting example, and one plotholder says "we often feel like it's an experiment, 'cause we get an awful lot of people interviewing us" (PH5). Another participant mentions "there are a lot of visitors who go there and stay there for a bit, and experience what it's like to live quite basically, and then they go back into academia or wherever, and that [experience] obviously carries some influence" (S3-1). The ex-minister feels it's an exciting "pilot project" (P9) and a professional participant calls it "so pioneering" (S2). While there is no debate about the exemplary role of Tir y Gafel, there are however voices which also feel some apprehension or caution in terms of using the eco-village in this sense. One couple interviewed feel:

> We are kind of setting a lot of precedents and sending out a lot of messages about what LID is and how it's done and what's good. And yeah [laughing] I'm kind of struggling with that a bit. Yeah, I feel like I'm very, we are very aware of that wider community and that historical practice, and that...maybe the majority of other people here don't have that kind of awareness. (PH12-2)

They mention feeling responsibility towards the historical heritage of LID – as a very radical type of living that did not cooperate with the mainstream system and thrived outside the realm of formal rules and policies – and are concerned that by placing such focus on the mainstreaming potential of the project precedents might be set which actually do not do justice to the original principles and visions of LID. The author who coined the term LID addresses another way in which caution might be advisable. He believes the main concepts LID subscribes to, such as "renewable energy, off-grid, organic farming, local food" are becoming mainstreamed at the moment anyhow, and while the Tir y Gafel project may add "another arrow to your quiver of arguments" (S3-1) it may also backfire to mention these concepts in connection with such an eco-village. He says:

> Well, then the opposition will say 'that exactly proves our point! The only people who can live this way are people who live in hobbit houses' you know? And 'nobody else wants to live like that, it's just a thing for weirdoes' you know?" (S3-1)

In addition, he feels that anything new and radical will not be adopted immediately. Rather, "it tends to work more through osmosis [...] when it's gone through a whole series of Chinese whispers, you see?" (S3-1). Therefore, although this case no doubt has a role to play in providing an example for others to follow and learn from, it was found that this must also be approached with caution and consideration for the possible consequences of mainstreaming a radical sustainability approach.

5.4.2 Alternative data source on agriculture and green building

Agricultural scale and yields

In particular, agricultural knowledge regarding yields and soil improvement potentials were mentioned as an important area in which the project could contribute to the broader knowledge base. One plotholder says:

> I think it'd be great if we could feed into general academic research that's showing small scale yields, because a lot of that hasn't really been measured. You know, that sort of concrete thing of the... that conventional minds want to see about yields and viability. (PH12-2)

Another confirms "we could do with someone looking at our yields, and then producing a paper on yields and things like that" and confirms the importance of this data in planning, as "one thing I found difficult, actually, was when we were trying to justify things, when we got rejected and things like that, there's very little data on small scale production" (PH5). The planning officer confirmed that regarding increased outputs from small-scale holistically managed land:

> There may be some evidence associated with that, but I'm not sure there have been many experiments that I'm aware of that have been measured in that sort of ordered type way. To say whether one method of production is more productive, you know, than the conventional one. (PO10)

Another plotholder feels the Welsh government has unfortunately not made the most out of this unique chance. She states:

> They could be making use of this, and then they could extrapolate that to other land which is similar, on the outskirts of a village. [...] If people can make it that much more productive from their

own labours, then *surely* you can rely less on imported food, and you can start making the *whole* country, you know – I don't know how many hundreds of times more sustainable! (PH11)

But she is very sceptical, and concerned that instead of making use of "the positive side" for gaining knowledge on sustainable living and food production "what they're going to do is they're going to quantify whether we've reached the 75% or not, and if we haven't they're going to try and beat us over the head with it, and get us to move off and pull our buildings down!" (PH11)

Green Building

One plotholder, who built his entire barn out of materials sourced within a five mile radius (see figures 8 and 15), claims a lot can be learned from such an undertaking. He feels "it's seeing where you want to compromise, and what limits...what's achievable, really. And using totally natural materials, that kind of thing" (PH4) is what many of them are doing. Another plotholder says "hopefully coming out of this court conflict will be a whole thing – we'll be able to be part of a wave towards addressing building regulations and materials and energy use" (PH12-2). She feels:

> If you don't want to build conventionally, and you don't have tons of money to make sure everything is assessed in labs, your natural materials, maybe it might well be that Lammas becomes quite a research base for stuff like that. (PH12-2)

Figure 15: Previous LI home of one Tir y Gafel family (left) and hay barn, materials sourced within five miles (right). (Photos: courtesy of Lammas)

Describing the need for sustainable and low cost housing (discussed as a goal of the project in chapter 5.1.3) PH4 says that everyone is experimenting and "using different materials" and that "part of what we do is show that certain things are possible" (PH4). In terms of scientific data, he explains that there are building experts producing contradictory requirements, which drive the cost of housing up. He gives an example of how LIDs try to find a low-cost, low-tech solution:

> You come up against this hurdle of 'it's gotta be airtight' but if it's airtight the building won't function like you want it to, 'cause you want draughts and movement of air, and rather than introducing that mechanically, just let the building do it for itself. (PH4)

Energy efficiency of less tightly sealed homes of course goes down, but this is not critical, as the fuel they use is wood from on-site, and carbon neutral in production and consumption. The ex-minister, P9, feels that the difficulties Lammas have experienced in terms of building

regulations that are not adjusted to meet the new LID policies, and the evidence gained from the homes they are building, will be influential in providing knowledge to change the regulations. She says "I think what will happen now, is there will be changes to building regs in Wales that will be able to reflect this" (P9).

5.4.3 Innovative research possibilities

It was found that a vast array of research possibilities and new and progressive research forms may feasibly bring the knowledge and experiences of the project into the mainstream. A plotholder eloquently expresses his desire that science and research at Tir y Gafel should contribute to "developing technology that actually works with the needs, you know, responds to the needs of the people" (PH13). S1, a researcher in geography and LIDs feels that the people at Tir y Gafel represent an opportunity: "there's a potential there that they could do really high level research, on the ground in their projects. And that's really exciting!" (S1). An example of what can be achieved with little funding was provided by mentioning a recent study conducted on a tiny budget of under 2000 pounds which was labeled one of Britain's top 100 high-impact research studies in 2011 (see Maxey, Laughton, Rodker, & Wangler, 2011). S1 emphasizes the possibility for "participatory research" at Tir y Gafel, which he claims:

> Is about recognizing that the research process can be a participatory process and that we're all equals rather than the researcher with all the knowledge, and the researched, you know... that they mine for the information. (S1)

Specifically, he feels:

> They [the plotholders] could do some useful research into helping, you know, look up, measure and improve techniques and ideas. It could be really kind of low cost, and high impact research looking at very simple stuff like measuring soil quality in different areas and looking at how the different practices change soil quality. It could be looking at support in measuring biodiversity – getting at how that project's changed that. It could be looking at more the social and cultural and economic context, looking at how the project impacts some of those in the area around it. It could be looking at physically measuring the performance of the buildings. And measuring, doing the figures on the ecological footprinting of what energy and then the efficiency – coming up with designs which really improve those performances. It could be a whole range of different kind of practical bits of research that could be done. (S1)

This quote gives a good impression of the many areas participants mention as potentially yielding important research results. However, S1 claims "I don't think the model for higher education, and academia is really geared to produce that research cost effectively at the moment" and feels that what he calls "empowerment research projects" are needed. By focusing research on practical, holistic, on the ground projects, and thus:

> empowering people within those communities to do the research, and you're supporting them, so you're using minimal time from the high-cost academics, and you're doing maximum sort of empowerment of the people on the ground. (S1)

He feels valuable sustainability knowledge could thus be generated at a low cost. The closely affiliated Lammas founder (A7) feels that in terms of sustainability knowledge, there is no time to "play around" as "there's not actually very much time left before we actually go down the tubes kind of thing" (A7). He states that "there's a very fruitful vein to explore between

universities and colleges and stuff like that, and doing stuff on the ground" and desires more interaction between projects like Tir y Gafel and academia, stating:

> There's no point in a few people in their ivory towers still thinking they can continue this research forever and it'll eventually filter down to the rest of society. [...] it's not working like that at the moment. And also, we need to know, I mean, a lot of us who are really working on it would benefit from tapping into that knowledge quicker. (A7)

He also feels that engaging the plotholders in doing the research themselves would potentially be very useful, and says he can imagine it in "lots of ways" because even though he feels not many LIDers use the scientific method, he claims that "to a certain extent we, I mean some of us, are kind of right up there in research, but in a very funky kind of way" with techniques that are "cutting edge" but "totally applicable to the third world (A7). He believes:

> You'd need a bit of an infrastructure, wouldn't you? I mean you'd need a kind of... instead of a university building another lab in Oxford it might build a little funky one here, and have an offshoot here. (A7)

A "bit of infrastructure" and some external coordination were found to be goals of several plotholders. Due to the tight schedule and demanding targets the plotholders must meet within five years, a participant claims:

> I think that [research] is a good thing. But the way it's happening at the moment is really quite ad hoc. Just because we *just* don't have the time. No one here has the time to be coordinating, a coordinated program of research. (PH5)

But the plotholders do tend to believe they have the skills for research. For example, PH5 lists the research qualifications of several plotholders, ending with "you know, there's a lot of skills here, like 'sciencey' skills that could be used" (PH5). The Organic Centre Wales participant states:

> My colleagues are always banging on about 'listening to the farmers, listening to the growers, let's get the bottom up approach' but so often it turns into a top-down 'oh this is a great idea, let's see if we can find some farmers that are interested in this'. (S6)

He explains that "the problem is, and the reason why we tend to do the top down thing is the funding models" (S6), which gets back to earlier comments about the need for more low cost and participatory research needed. The importance of funding in determining the knowledge produced by research was also mentioned by several other participants (PH12-1, PH5, S1, S2, A7). One plotholder explains that he feels the knowledge produced in projects such as this struggles to compete with a much larger quantity of industrially funded research:

> We're kind of in competition with high-tech scenarios, and you know, around buildings and things there's a lot of support and research budgets and lobbying budgets for materials manufacturers and things like that to, say, push and investigate passive house standards and these sorts of things, but in terms of the low-tech or the power-down type of options and scenarios, then there's, yeah, there's not so much scope for that to happen. So I hope that's something which is, will continue to happen and expand, through projects like this coupling with the academic. (PH12-1)

Another plotholder believes his ideas on sharing knowledge, particularly in terms of events at the community hub, might be "a bit high-faluting," but he does not want the hub to "have anything to do with ownership" (PH4). He believes the hub:

> [...] ought to be some sort of global commons almost, you know, as a resource for people to come use it, exchange that sort of information, run workshops there, hold courses, or just get together

where they talk about composting toilets or whatever, it could be anything. [...] and maybe we've got this 80 acre playground for that sort of thing. (PH4)

Finally, a rather alternative field of research was suggested by one plotholder (PH12-2). She feels that looking at the development and utilization of intuition at Tir y Gafel may be interesting as she feels "there's gotta be some skill in that" and explains that for herself "being outside and doing things that connect me to the source of stuff all the time, probably, that's probably what it is, isn't it?" (PH12-2). She says:

> I would be interested to collect some evidence, I should probably write down occasions when it's come true, shouldn't I? Would I need to map ones that didn't come true as well, to have an appropriate...? [laughing] (PH12-2)

Thus, a plethora of research areas in which the case may contribute to science and the mainstream knowledge base are identified. In addition, suggestions are made regarding how academic partnership could be facilitated in a simultaneously low-cost, empowering and skill-enhancing way, which might provide a path towards knowledge production that is relevant to the current sustainability challenges and has been gained from an integrated real-life setting.

5.4.4 Contribution to a larger LID knowledge 'network'

The existence of a LID network – albeit an organic and in no way centrally regulated network – became obvious during the course of the interviews. When asked if he feels to be a part of any type of network, one plotholder says yes, and describes the impact he perceives for himself and others:

> Yeah, I suppose in the past we have felt like that's existed. And that's part of what brought us onto this path, was coming across other people who are doing similar things, other LID's and so on. And we grew a lot on that, and we got a lot of encouragement from that, as much as actually any expertise, or formalized knowledge, we just got a picture, and yeah... 'let's go for that.' Which is the same thing that I see people picking up who see what we're doing. (PH12-1)

Thus, it seems apparent that knowledge is gained from exchange with others undertaking similar initiatives. This can be practical knowledge about gardening or building for example, but is not restricted to such knowledge as it also plays an important role in simply showing the possibilities to people new to this type of development and thus giving them the courage to trust their own capabilities.

In particular, the role of the volunteers, or WWOOFers (volunteers with Worldwide Opportunities on Organic Farms) was considered critical to the dispersal and growth of LID in the UK. As one plotholder says "we've had some fairly skilled people come and teach us things" (PH4). He believes the project, with its innovative building techniques draws interested – but also in many cases knowledgeable – volunteers, resulting in an information exchange. He claims:

> People want to come and they might be a carpenter, but they just spend all day knocking out kitchen units, and you say 'do you want to put up a timber frame, big round wood frame?' and they go 'yeah!!' [yelling] so they'll come. And so you're relying on their skills of accuracy, but they're learning from you how to knock together something out of round wood, for example, which they'll never really have the opportunity to do normally. (PH4)

This shows that, by providing the space for exploring and experimenting with innovative building methods, for example, the project may be attracting volunteers with high prior knowledge of certain aspects important in LID, but who normally are restricted to practicing within a much more restrictive frame and thus welcome the opportunity to share and apply their knowledge in a different setting. Within the informal network identified, two distinct groups seemed to be distinguishable, and again the importance of the volunteers and visitors becomes obvious:

> You know, so it's felt quite often to us that there's this, these kind of two different groups if you like; the kind of fixed nodes, and these travelling pollinators who carry the knowledge, and both are equally putting the work in and living off these individual projects, but you know, we're maybe steering and providing continuity, and they're providing more like that communication by travelling from one to the other, in a very symbiotic sort of relationship. (PH12-1)

In this way, it was found that there is a two-way exchange of knowledge and skills between the plotholders and the volunteers, which is beneficial to both.

This section has thus shown that another role of Tir y Gafel is to provide some contribution to the flow and exchange of information about LID that is transmitted through this network of similar projects.

5.5 Valuation of knowledge

A question this research has attempted to answer is how different types of knowledge are valued, comparatively. This has to some extent, as a result of its appearance in many questions relating to the type and role of knowledge, been mentioned in previous sections. For example, the simple necessity of providing scientific "legitimation" as presented in chapter 5.3.1 points to an elevation of the value of science and institutionally gained knowledge over other types of knowledge in both policy and planning. The data does not permit a detailed division of knowledge types and assignment of value level to each, but does point to a general distinction in valuation between knowledge that is on the one hand academic or scientific, 'rational', 'professional,' quantitative, materially based and conventional, and on the other hand knowledge which is rather experiential in origin, intuitive, qualitative, based on non-material considerations or alternative to the mainstream. Data collected on the value assigned to these broad categories of knowledge in general will be presented first. A second section will then discuss the possible role of knowledge valuation in the planning process, also pointing to factors which showed that political aspects may also be influential in this setting.

Knowledge valuation on a societal level and how this affects the project

A scientist participant says:

> We live in a technocratic, bureaucratic kind of system, and that kind of knowledge is privileged, absolutely. That's why I'm working in academia, because I can then use that knowledge, or use that position, to kind of help support those that don't have access to that status. (S1)

This statement shows that an understanding of the way that our society values some knowledge more than other knowledge has been used strategically by this participant in his

goal of contributing to SD. The statement "I do believe that people are basing quite a lot of what they do upon things they've read in books and based upon *genuine* knowledge" by the eco-footprinting professional (S2) lends support to the statement that scientific or academic knowledge is considered "better" or more true by some. Upon being shown the TD knowledge triangle, one plotholder says "it's interesting that there's a triangle there, but maybe it's coincidence that the system knowledge is up at the top, but maybe it's not. And things like that bother me" (PH4) showing a sensitivity for the dominance of systems, or scientific knowledge over practical or more goal-oriented knowledge in society. This comment also caused the researcher to pause and reflect. There had been no conscious intention behind placing systems knowledge at the top of the triangle. Was it therefore, a coincidence? Or did it point to a subconscious bias within the researcher towards placing scientific, material and data type knowledge over goal and practical knowledge? A plotholder gives his explanation for why intuitive knowledge, or other non-materially based knowledge tends to be dismissed:

> Because we're so, I think, you know, *obsessed* with form, because it's so gross, so obvious, it hits you over the head – and if you don't pay enough attention to it sometimes it really *can* hit you over the head – form really grabs the attention. And because there's so much a focus on form, and because form can be measured, supposedly, umm... peer reviewed, supposedly... there requires a lot of taking out of certain things, like consciousness, intuition for example. (PH13)

By saying there is a "taking out" of consciousness and intuition, this plotholder seems to mean that in order to make things fit with the very rational and materially-based understanding of the world he describes, society tends to disregard the more qualitative, or 'formless' kinds of knowledge. He goes on saying that this "obsession" with form, with quantitative measure, is historically rather a new phenomenon, and that for himself, in this project, he is "finding a balance between that qualitative, intuitive, sensuous, kind of, relational, kind of cyclical, kind of essential lifestyle, with the quantitative" (PH13). This indicates a desire for balancing the scientific with the spiritual or the modern with the traditional that many other participants also express.

A situation observed in the field, while sitting in on a meeting between building control officers and one couple accused of not meeting all building regulations, provides a striking example of knowledge valuation. The wife had done the plumbing on the temporary home herself, quite naturally, since hiring a professional plumber would cost more than the family could afford, and was not deemed necessary given the simple plumbing used. When told that a plumber's certificate stating that a hot water valve was up to standard was needed, she said she would be happy to provide the control officers with such a statement. In response, the control officer exclaimed "well, it would have to be a competent person!" The wife was visibly insulted. This simple situation – which was loaded with emotion and uncomfortable in reality – provides an illustration of one type of knowledge (that gained by the wife through her *experience* in plumbing) being assigned a low value – in fact, not valued as being knowledge at all – by the control officer, compared to knowledge he assumes is inherent in a professional plumber.

Although all plotholders mentioned valuing experience, intuition and alternative knowledge types highly, it became obvious that they are not unaffected by society's general esteem for institutional knowledge. One plotholder says of the supporting reports by scientists and professionals:

> It felt good to have people from the academic world or whatever, professionals, saying this is a good thing, and providing that support. So, I guess there was a kind of moral support side of it, there is also some of that definitely. (PH11)

This tied into S1's claim that what Tir y Gafel residents really need, is not any form of external scientific or institutional knowledge, but rather the empowerment to realize they have the necessary knowledge in themselves to build their "own house and create [their] own sustainable kind of livelihood" (S1). He says:

> All of us can do that, it [Tir y Gafel] kind of demystifies, debunks and brings back a level of a sense of 'well, it's not just about experts creating a kind of sustainable architecture, everyone has the ability to do that.' (S1)

Demonstrating this at Tir y Gafel is something he believes can be of value to society and the search for sustainability more generally, and was a sentiment echoed by other scientists and professionals interviewed (S2, S3, S6, A7) that points to a higher valuation of the holistic "can do" (PH11) knowledge found at the project by these more 'alternative' members of the professional and scientific community.

Valuing knowledge in the planning system – role of political alliances?

It is found that the extent to which certain knowledge is valued differs between people in different levels of decision-making. This may be seemingly confirmed by the fact that all approved LIDs in the UK received planning only upon appeal to the national level, and inspection by a planning inspectorate. The same was found in the case of Tir y Gafel; the acceptance of the proofs – alternative agriculture and permaculture reports – supplied by Lammas did not result in approval from the local planners, but "did seem to work" (PH11) once in the national appeal process. Therefore, one plotholder feels "it depended on who you presented it to" (PH11) whether the knowledge was considered valid or not. Some participants linked this with a perceived difference between the local planning authority and the national level inspectorate in terms of education (see chapter 5.2.2). S3-1 deemed the inspector's education to be very high, stating:

> They're *extremely* well trained. I mean I have a lot of respect for the appeal system. And inspectors in general. They're incredibly well trained and incredibly good at running appeals.
> (S3-1)

This statement indicates the perception of highly knowledgeable appeal inspectors. Interestingly, S3-2 thinks the difference in approval of LIDs on the national versus local level can be attributed to inspectors being "more prone to like it because they are more experienced" (S3-2) which would indicate that more experience and higher education lead to a higher valuation of the knowledge and arguments presented in favour of LIDs. Another participant

outlines a different cause for the discrepancy as he felt it stems rather from a desire of the inspectors to bypass local political alliances. S3-1 claims:

> I think what leads a person to become an inspector, quite frequently, is a certain disappointment or disgust with local politics. And the planning system, and the way it's compromised. And I can't see many incentives for becoming an inspector, but one of the incentives is that actually, you can make your decision without anybody very much leaning on you. (S3-1)

Thus, disenchantment with local politics and the desire to make less biased assessments are felt to be possible reasons for more serious attention being paid to alternative knowledge forms on the inspectorate level. The quality of the arguments, or knowledge, presented to the local council may therefore not – although this is the official claim – be the only motivation for discounting the proposals. The planning officer himself mentions that:

> I guess working in a rural area where you come across the farming community, and there's a conventional farming community that run into difficulty with the planning system because they've got, you know, people who grow up on the farm, who work on the farm, and who would like to live locally and continue to work at the farm. But they can't get a justification for a farm worker's dwelling, because there might be a sort of a part-time element to it. (PO10)

This excerpt shows a dilemma the local authority might have in approving this new type of rural development, based on existing ties to and sympathy or loyalty with the local conventional farming community. This may provide an additional incentive to accept information only from conventional sources, while arguing that the quality or value of alternative arguments stemming from experience or less mainstream research is somehow deficient. The ex-minister interviewed also believes that sometimes opinions at the local level are:

> [...] directly political, in the sense that in rural areas there are always councillors who think their job on the planning committee is to help a farmer down the road who they know has got problems with lack of accommodation or whatever, get accommodation. (P9)

Accepting local responsibility for allowing non-mainstream development may be an additional knowledge-independent reason why the decision is often negative or undecided on the local level, then deferred to the inspectorate. If a council feels a proposal is "a bit dodgy" S3-1 believes they tend to "let it go to appeal and the inspector can decide." If it then "turns out to be a disaster [...] nobody can accuse the local authority... 'well we didn't allow it, we told you so!'" (S3-1). Therefore, although a lack of trust in or value given to the knowledge and data presented to support LID applications may be a factor in the refusal of LIDs locally, it was found that political and personal ties to the local conventional farming community may also be influential in the local authorities' rejection of LID applications.

5.6 Boundaries crossed and meanings negotiated

Section 5.4 indicated a potential for the case to contribute to the knowledge base by (1) providing an *in vivo* example of a LID eco-village, (2) the production of alternative data related to many areas of a LI lifestyle, and (3) presenting a setting open for and interested in new and innovative partnerships with research and academia. Section 5.5 then discussed the question of what value is assigned to knowledge of different kinds, or different sources, finding that a rough division between more quantitative and materially based knowledge on the one hand and

rather more qualitative and non-materially based knowledge can be seen in terms of the value generally attributed to each. This final section will present the results on the potential of the eco-village to act as a setting where actors with different understanding and meanings come together in so-called boundary encounters (see chapter 3 for more details), and where negotiation or discussion about meanings occurs. It first makes the case that indeed Tir y Gafel and the Lammas initiative presents a setting in which boundary encounters do occur (chapter 5.6.1) and then gives insight into several different areas in which differences of understanding were found (5.6.2).

5.6.1 The eco-village providing a setting for boundary encounters

It was found that in the case of Tir y Gafel, the various actors brought together tend not to normally associate or exchange information. The following quote describes the situation well, and makes a link between the specialization and delineation in science to the hierarchies found in society:

> The local planning authority has no particular obligation to the Welsh Assembly Government. They're different entities. That's the thing, is...the disconnect that science, to some degree...we're talking about the rational mind, which created the scientific method, which creates scientific endeavour and experimentation, is the same mind that creates government and creates hierarchies, and creates all of those different kinds of things. And it's all about dissection. It's all about delineation. And so the local government doesn't want to talk to the national government, except about money [...]. Planning enforcement only occasionally talks to planning. They're different. You know, the guy who would come and enforce against us, and bulldoze us, is actually a different team than the person who would give us permission in the first place, and consider our applications, or even changes to our application, to our existing planning permission. Planners don't talk to building control, at all! [laughing] They don't particularly like each other, to be honest. (PH13)

This case study shows that the eco-village Tir y Gafel, under the umbrella of the Lammas cooperative, brings together a wide collection of actors, and because of the unique character of the approach, and the many issues this throws up, it seems that boundaries which are normally not crossed are being approached, or at least there seems to be more information exchange and discussion going on. Even amongst the plotholders there is a great diversity to be found, as they include people from different countries, entirely different educational and social backgrounds and different life histories. In addition, as the project is breaking new ground in terms of cooperating with authorities and complying with planning policies and is situated near a small village, the case also involves scientists – both alternative and conventional, local authorities such as planning officers and building control officers, the local village residents, political persons, and both local and international supporters and volunteers. In speaking with participants it became clear that there are many areas in which the education and training, perspectives, practical knowledge and more philosophical and value-based understandings of the actors are contradictory. As discussed in the theory part of this thesis, when these understandings – each with their own boundaries and realities – come together (even if out of necessity) over an extended period of time, to engage in a joint endeavor, there may be some

discussion and negotiation of these understandings. 'Boundary encounters' – situations in which people both formally and informally meet and negotiation about divergent meanings can take place – may occur. PH13 describes what a 'meeting' is to him, saying:

> There are meetings all the time, this is a meeting. You know, I meet my neighbour on the road, or a track way, you bumped into so-and-so and had a chat, meetings happen all the time. And they are primarily qualitative. Because there's no minutes, there's no agenda, there's no outcome necessarily. Unless I've come to talk to you about something, we've come to resolve something. (PH13)

Hopefully, such encounters can contribute to a modified and enhanced knowledge base, made up out of bits and pieces of different perspectives. What PH4 says about professionals may also be true for non-professional actors:

> All these people are holding onto their little bit, and I think that's a real barrier to progress, because it's sometimes difficult to get hold of the information you want. [...] People have their own little specializations, and that's what they focus on and that's what they protect. (PH4)

The following section attempts to outline some areas which are found to reflect such differences, and present the current state of their negotiation at Tir y Gafel.

5.6.2 Knowledge dichotomies negotiated

Several areas which are subject to a negotiation of meaning at Tir y Gafel, and which are referred to here as knowledge dichotomies, have been found. This section presents knowledge on a different level than the previous sections, as it shows that in addition to intuition and target, transformation and systems knowledge the participants also possess a wealth of knowledge more philosophical in nature.

The qualitative versus quantitative dichotomy

The first type of knowledge dichotomy, or knowledge spectrum, the qualitative versus the quantitative, can be seen to reach through all the remaining dichotomies. Through being on site during the field visit, the researcher was able to observe that qualitative aspects are emphasized at the eco-village. This ranged from people expressing a desire to build a house based on the 'feeling' they want to generate (PH13) and explaining that their choice of lifestyle is based on 'intuition' (PH8, PH12-1) to mentioning that the group cooperation during building workshops is strengthened by doing a joint dance each morning (A7). Thus, it became clear that qualitative aspects enjoy more attention and are seen as more significant at Tir y Gafel than is generally the case in society. One plotholder explains that:

> The basic meeting of the qualitative and the quantitative I think has to do with land. Use of land. Everything's land based. You know, investment banking's land-based [laughing]. It's quite far removed, it's very processed, very, very, very processed, but it is land-based. 'Cause everything is. We live on a planet. And there's just the one. (PH13)

Within the eco-village, however, it was observed that some plotholders are very focused on quantitative aspects while others are very much focused on the qualitative. This can be seen in the struggle with building regulation compliance. As three plotholders (PH4, PH11, PH13) separately explain, there exists a continuum between those who wish to comply with the

quantitative and often problematic building requirements completely – in order to get official permission – and those who feel the highest priority is the *concept* of the LI home, and the values they are following with this lifestyle, and are not willing to allow certain measures or quantitative requirements to change their approach. This difference also becomes noticeable in meetings, and is related to the "obsession with form" and the graspable, as was presented in chapter 5.5. As PH13 says:

> What's happened is the meetings themselves are dominated by those that have a more quantitative sense. They make a proposal, there's yes or no, you know, these are kind of delineated. There may be room for people to speak their qualitative experience, but that may not necessarily be integrated into the decision, or it might not necessarily be integrated into the conversation, because it's not really going anywhere. You know, I attend few meetings, because my role is mostly to name a dynamic or a pattern that I might see. (PH13)

The dichotomy is of course even more visible when the building control officers and the plotholders meet. It will be seen that this first and most basic dichotomy can be seen within the dichotomies presented below. The next section will attempt to describe the difference between emergent and planned design, a main issue of relevance to the different participants in the case.

The emergent versus planned design dichotomy

In order to apply for LID, a detailed planning application must be submitted. This seemingly simple task was shown to mark the beginning of a long and laborious relationship between planners and building control officers, and the LI developers, marked by two very different approaches to the project process: the planned versus the emergent design approach. LID has been called "an intuitive approach" (PH8) dominated by an observing and open attitude which reacts and adapts to the process as it emerges. In contrast, for example, the building regulations are set up only to deal with "an approach to building which is entirely prospective" and in which "you design everything, absolutely *everything* on paper first, meticulously! [...] before you actually start works" (PH8). As another plotholder describes:

> For me there is qualitative sense of what I'd like to experience and feel here. And because that's now, and only ever happens *now*, that's kind of how I have to do what I'm doing here. And the design is emergent, the reality is emergent, this experience and this relationship is emergent. So it makes my life and my experience here emergent. (PH13)

The difference between being in the "now" and reacting to what emerges, versus planning prospectively and thus pre-determining the design completely, was found to be substantial. It is argued that, as the following quote states, the emergent reality is *real*, while attempting to predetermine and execute a plan without taking into account the changing reality is either "insanity" or "fantasy":

> We created a plan for the planners, which is about what we will do on the land in 5 years time. Which is kind of an insanity! [laughing]... at the very least it's fantasy, and has to be acknowledged as that. (PH13)

A planned approach "doesn't necessarily speak to the intuition and the emergent reality that might have you do something quite different with that building because you're told to do that, or

your materials dictate that, or the sun suddenly..." (PH13). Since the design at Tir y Gafel is strongly permaculture based, with an emphasis on setting up self-sustaining systems that are based on mutual relationships and closed-loop material cycles, all aspects of planning and building are included in the need to be adaptable:

> Yeah, and so the design is something very different. It has to do with an arising need, desire, observation of present limitations and resources. And the bringing of those things together, in a way that I think perhaps honours, or at least shows a willingness to work and use the flows...energies, whatever, that are already here. (PH13)

The argument was made that only once in the middle of the process, and with the reality unfolding, is it possible to see certain connections, or know the correct next step. However, having shown the divergence in the planners perspective and the plotholders perspectives in general, it is important to mention that differences were observed amongst the plotholders themselves, as shown by the description of the continuum between those who tend to fight the system completely if it compromises their vision of LID and those who feel it is better to jump through the hoops and cooperate (discussed in previous sub-section). Although the latter represent a minority, the argument made by one plotholder is that not cooperating is for him simply too risky. He describes the difference in approach, saying it has been cause for significant tensions in the project:

> Some people are very, umm, anarchic, really. And they don't want to recognize the law and the system, and things like this. And then there's other people, me for example, who I could just kind of think 'well, that route's just gonna get us in a massive pickle, whether you agree with it or not, the route to success is this' and so there's a lot of ideological difference there. (PH5)

Although not enough information was collected from those who tend to feel cooperation is a better route, it seems that fear of the consequences of non-compliance were a main driver in their desire to comply. In stark contrast to this fear of enforcement, PH4 speaks of the fact that they have a five year limit to achieve their targets, but that he's not worried about being "tripped" off the land if not every target has been met or every requirement has been complied with. He claims that "yes, we've got this five year limit, but I don't really see that as being anything significant at all, really, in terms of what the planners are expecting, 'cause there not going to trip us off!" (PH4).

Those who emphasized the importance of being able to react and respond to the emergent moment, such as PH12-1, say things to the effect that "even building buildings, or something like that, you know – as vastly unrespectable that would be in the context of building regulations – but you know, you can have an intuitive feeling about something that's right" (PH12-1). However, PH13 claims that the planned and the emergent, the focus on the qualitative and the existence of the quantitative are:

> [...] not necessarily contradictory, and I think that's the...if there's a message about life, it's that they're not contradictory. That they actually need to be in balance and feed each other. That they are present always at the same time. (PH13)

Recent events in the case, which occured after the study was completed, show that the confrontation between understandings in the case of building regulations may be coming to a positive resolution. After hearings, the following was recognized by the court:

> That the Lammas project is pioneering new ground and that special consideration was required in how Building Regulations were applied to low-impact development given the use of raw natural materials and innovative solutions being adopted by such projects. (Lammas news, January 2012)

This provides hope that, at least in regards to building regulations, the hard work and hours of discussion between the plotholders and the authorities as well as amongst the plotholders themselves are contributing to a new understanding of the situation which may end up facilitating innovative solutions to sustainable development that were previously not possible.

The empowerment and responsibility versus control and authority dichotomy

The idea of taking responsibility, being empowered and managing one's own life versus the need for external control and authority is what the planning officer (PO10) calls a philosophical question "about the freedom of the individual to choose for themselves and their family" (PO10) and what a plotholder refers to in his desire to take "responsibility for absolutely everything" (PH4). He states: "I'm sort of into everybody taking responsibility for *everything*. And that's kind of what we're about here, really. And that's why we struggle with the authorities, the regulatory authorities" (PH4).

This represents an important area where again the actors involved come from widely different perspectives, and the understandings of the plotholders can be contradictory to the basic presumptions inherent in the system they are trying to fit into. Although the plotholders did vary in the strength with which they discussed this area, the overall findings indicate a strong desire for "empowerment" overall, which was also strongly found in most scientists and professionals associated with the project (S1, S3, S6) and the external founder (A7). The desire to provide for themselves and live independently in terms of food and energy was complimented by a desire to be able to live as their humanity dictates. As one plotholder describes, he sees fear as the cause for people thinking:

> 'I couldn't possibly realize my potential, I couldn't possibly be a creator, I couldn't possibly embody my own power, my own responsibility. It's got to be outsourced to a higher power, whether it's God or science, or the local authority, or the Welsh Assembly government.' (PH13)

He believes that the reason "all of this personal will and determination" is "outsourced" is because of a lack of trust in the plotholders own capabilities and particularly a lack of trust in others that is inherent also in today's society. He feels people tend to think: "I can't be trusted, and neither can my neighbour! Even if I can be trusted, we gotta have a management plan or a leasehold in place to keep him in line, 'cause he's a bit dodgy!" (PH13). However, he believes that most people at Tir y Gafel would actually "love to do away with all these agreements and all these ideas" (PH13) in favour of relying on more traditional ways of making decisions and dealing with conflict, such as a council of elders (PH8, PH11, PH13). The plotholder founder eloquently expressed that he believes the "professionalization or specialization of our culture" is

partly responsible for building regulations emphasis on "reports from qualified person all the time for all the different aspects" which simply contradicts the LI approach which he says has to do "with empowerment of the individuals, because we are the ones who are gonna be living with the results" (PH8). A statement by the planning officer underscores this aspect. He says:

> I think the difficulty with Lammas sort of...proposal is that they did produce work, that I think they perhaps regarded as perhaps being a scientific...but I'm not sure we were satisfied that it has perhaps been rigorously tested, or perhaps wasn't from a source that was accredited in some way. (PO10)

This idea of Lammas presenting 'unscientific' data had, however, been thoroughly overturned once the application reached appeal, as the appeal inspector accepted the evidence from these reports, writing, for example "reports prepared by experts in permaculture have examined soil fertility and depths in detail and have not cast doubt on the suitability of the land" (Poulter, 2009, p. 7).

Another plotholder sums up the "satisfaction" he feels in providing for himself and building his own home with the words "It's ownership of your life. I think that's a kind of liberating thing, isn't it?" (PH12-1). He also believes that "people should maybe be allowed to live without electric or carry their own drinking water rather than having it piped and pumped to their house" (PH12-1) if that is what they want. The scientist from the Organic Centre Wales exclaimed:

> [...] and it is the diversity, if nothing else it's the diversity!! You know? Because life would be so *boring* if everyone lived in a box and had a 50,000 pound mortgage and so on. The fact that they, again, they've had the commitment, and *god* they've had to slog to get to where they are! And as you were saying earlier there's still some issues going on. Umm...I mean people should be free to go for alternative models, if you like. You know, within appropriate constraints. (S6)

Yet another plotholder mentions that he feels the controls placed on them in the name of "risk elimination" are "completely mad" and explains how much more independence he experienced in his previous career as an engineer in the steel works, despite much greater potential for harm to many:

> In the past I was regulated by the environmental agency, health and safety executives, central government, but I've never been told what to do. And you know, I was responsible for things that could poison the river in Sheffield, could blow up half of Sheffield, could, all of these big things! (PH4)

PH13 gives an example for this, describing how he feels the systems "extreme authority" approach places individuals into positions where they:

> [...] don't feel like they can act on their own behalf. On their own humanity. Or act upon the experience of the humanity of the other. They have to act according to parameters within an organization or within a structure of which they are functionaries. Poor them. You know? (PH13)

He feels it is the rules of the system which dis-empower it's "functionaries," such as building inspectors:

> If my house burns down and my family's killed, the guy who said 'it's OK, you don't have to have a heat test guy to look at your wood burner' would go to prison! So they accept liability for my existence, my family's existence! [laughing]" (PH13)

He makes the choice not to accept that authority, as he feels that would be "something of an enabling of that disempowerment" (PH13).

The planning officer acknowledges this difference in understanding, and poses the question "If somebody wants to live a sustainable lifestyle, live in that LI way, should they be able to choose to put themselves potentially at risk of a radioactive gas?" (PO10), indicating that he rather doesn't think so. PH4 claims that lots of these regulations are simply outdated. This is confirmed by the planning officer's statement below, which also provides a question which seems at the centre of the meanings negotiated in this section:

> A lot of the building regulations and planning legislation came out of a necessity to address slum conditions of the Victorian era, really. And that's where a lot of public health and planning legislation actually came into force. To what extent can we set aside that legislation and say 'well, people are now informed and often educated enough to be able to decide for themselves'? (PO10)

Finally, the Organic Centre Wales expert makes a statement that is relevant to this discussion on empowerment versus authority and which highlights a sentiment expressed by most participants:

> I've kind of been through all of these experiences. Not just the scientific ones, but it is these sociological, if you like. And I can understand it. And, *me*, you know, me the person, sort of when, particularly when some young people say 'We wanna work the land. We wanna work hard. We don't care if we don't make a lot of money, but this is what we believe in' I think... why do councils make it difficult for such people? Because they should be treasured! (S6)

The conventional agriculture versus permaculture dichotomy

The difference between conventional large-scale and high input agricultural methods, and the more labour intensive but low-input and organic small scale permaculture principles used by the plotholders is discussed in chapter 5.3.4. However, it must be mentioned here as well as the vastly different understandings of these two approaches not only represent a way in which science is acting as a barrier to LID, but also represents a knowledge dichotomy which is still under negotiation between the participants of the case.

5.7 Brief summary of results presented

Chapter 5 has attempted to present the results of the study conducted, in seven separate sections. It begins (chapter 5.1) by outlining the goals expressed by the participants. Five main themes are identified: (1) the project presenting a solution to the sustainability crisis; (2) the eco-village providing an experiment or an example to be replicated by others wishing to live more sustainably; (3) the LI approach increasing equity by working towards affordable access to housing and a life in the countryside; (4) the personal goal of achieving a high quality of life that is less reliant on materials and money, and finally (5) goals related to the social or community aspects of living in an eco-village. The second section (chapter 5.2) presented the knowledge types identified as present and areas in which knowledge is possibly lacking in the case. It starts by briefly summarizing the target knowledge, and then goes on to present the transformation (practical) and systems (scientific or data) knowledge from the perspective of all participants, finding an immense wealth of different knowledge types and experiences and also identifying areas where further knowledge would be useful. Finally, the last part of this section

presents an additional knowledge type found to be relevant in terms of guiding particularly the plotholders actions: intuition. The following section (chapter 5.3) continues by presenting results on the role of scientific, academic and professional knowledge at Tir y Gafel, finding 4 main functions, namely: science as (1) a necessary element of legitimation for an alternative and more sustainable lifestyle; (2) the provider of specific knowledge and useful technology; (3) playing a role in the community by undertaking of multiple research projects examining different aspects of the project; and (4) representing both a supporting driver as well as barrier to LID. Following this, chapter 5.4 outlines the current and potential contribution of the case to science and the broader knowledge base. Four areas are identified, and include the project providing (1) a physical example which can be learned from and replicated elsewhere, (2) a source for alternative scientific data, (3) a platform for innovative and more participatory or "empowerment" type of sustainability research, and (4) one node in a broader network of LIDs capable of contributing to the exchange and flow of LID knowledge particularly through the travelling volunteers. Following this, the next section (chapter 5.5) presents results on the valuation of knowledge, finding that in general a distinction can be made in terms of the level of value assigned to on the one hand more quantitative and material-based knowledge and on the other hand more qualitative and non-material based knowledge. Chapter 5.6 then provides evidence that the case provides a platform where 'encounters' between individuals with different understandings takes place, and presents four knowledge dichotomies, or knowledge spectrums, in which meanings are conflictual and continue to be negotiated: (1) qualitative versus quantitative knowledge, (2) emergent versus planned design, (3) individual empowerment and responsibility versus external control and authority and (4) conventional agriculture versus permaculture. The following chapter will provide a discussion of these results, relating back to the theoretical concepts presented in chapter 3.

6 DISCUSSION

This chapter provides a discussion of the research conducted, the results found, and the methods employed. It links the empirical aspects of the research back to the theoretical foundations which helped to guide the exploration (chapter 3). It first attempts to provide a stimulating yet critical discussion for each research sub-question (chapter 6.1), then goes on to critically assess both the strengths and weaknesses of the methodological approach (chapter 6.2) and finally, presents suggestions for further research (chapter 6.3).

6.1 Discussion of results

The two overarching research questions presented at the end of chapter 1 ask:

1. **What is the current role and potential of science and academia in a grassroots sustainability project?**
2. **What other knowledge types or ways of knowing can be identified, and what role do they play?**

In order to explore these questions more closely, the theoretical concepts introduced in chapter 3 were used to provide the basis for the formulation of seven more detail research sub-questions. This section begins with sub-question 5, as it asks the most fundamental question, and then work through the remaining sub-questions in order of presentation in chapter 3. At the end of the discussion of the findings of the seven sub-questions, the relation to the above overarching research questions is briefly presented. The first sub-question to be discussed asks:

What knowledge of each type in the TD knowledge typology can be identified in the case?

Based on the TD knowledge typology presented in chapter 3.3, the research intended to explore what systems, transformation and target knowledge could be found. As presented in chapter 5.2, all three types were identified. While systems knowledge was found to permeate the case, from plotholders backgrounds to knowledge on SD held by the political level and the local authorities to specific knowledge held by the scientist and professionals, it varied in form and kind. In some instances the knowledge about how the system works was found to vary so dramatically between participant groups that it could be said they had knowledge of an entirely different 'system'. The same can be said for the target knowledge, as the goals or aspirations were in some cases similar between participants (e.g. agreement that a more sustainable future is necessary), but also vastly different (e.g. totally different understandings of what is a desirable material standard of living and what constitutes a high quality of life). For example, the understanding of LID as providing equitable access to housing held by those in favour of LID contrasts strongly with the planning officers' concern that it is unfair to the local conventional farmers to allow LIDers to live on the land when these farmers are often not granted permission for additional dwellings. This was then also reflected in the transformation

knowledge, as can be seen, for example, in the different understandings of what building methods or materials are required for a dwelling to be sustainable. For example, the building control officers tend to emphasize highly insulated dwellings for optimal energy efficiency (often using fossil fuel energy), which require high-tech and expensive ventilation systems, while LIDers tend to focus on zero-carbon energy sources (e.g. locally sourced wood which is re-grown on site), allowing for less tightly sealed homes which breath naturally and do not require high-tech ventilation. As all three types of knowledge played a significant role in the case, this confirmed the assumption made in Proclim (1997) that all three knowledge types are critical in order to move towards sustainability, and showed that participants all possessed knowledge of each type. However, the variety of understandings possible in each knowledge type seems to present obstacles to reaching a common understanding on the characteristics of the system (such as agriculture and soil fertility), what the goals of LID should be, and how one can best achieve the defined goals.

In addition to the three TD knowledge types, a fourth kind of knowledge was identified as holding particular importance to the plotholders. This knowledge is labelled 'intuition' by the participants and tends to refer to action-guiding 'knowing' from an indefinable source. Although clearly important, it is more difficult to achieve a detailed understanding of what this type of knowledge is, and since it had not come up in the literature on science and knowledge consulted at the outset of the study, the literature was consulted once again. One author says intuition is "the capacity to acquire information, knowledge and understanding apart from rational thought, the senses and ordinary memory" and claims it comes when people profoundly trust their own inner minds, or what he says is usually called "the collective unconscious or superconscious mind" (Kautz, 2011, p. 6). Another author who studied knowledge in the context of planning defines intuition as "the participants' personal sense of the situation and of the other participants" and calls it an "essential form of information" (Innes, 1998, p. 59). Thereby, it seems intuition may be a personal type of knowing that is based on something other than the intellectual or rational information we tend to associate with the term 'knowledge'. Although not easily categorized and difficult to define, this study has shown that intuition can be important in terms of guiding the choices of the plotholders and that it seems particularly relevant in terms of choices made in relation to sustainable behaviour. Thus, it would seem sensible not to hastily dismiss the knowledge value of intuition. A reliance on intuitive knowledge, or even an acknowledgement of its existence and importance, is found primarily amongst the plotholders and those affiliated scientists or professionals who are involved with radical sustainability initiatives such as LID. This may point to a connection between accessing this knowledge source and acting in a deeply sustainable manner, and indicates a need to consider adding it to the mainstream discourse on knowledge and action, such as TD and TR, required for tackling problems society is facing on an everyday basis.

However, intuition must also be analyzed as critically as any other knowledge type, and it was found that some believe sustainability may even be counter-intuitive and thus intuition could potentially lead to decisions which are entirely unsustainable. In addition, it may be difficult to know when one is accessing intuition, or when this is rather an expression of a deep-rooted fear or personal desire. Thus, it seems that while interesting and worth paying attention to, it should also be subject to similar checks as all other knowledge sources, and not idealized.

The second question to be discussed is related to theoretical concepts surrounding the many understandings of science by society. The acknowledgement of the existence of other knowledge forms and the need to study the balance between the influence of external versus experienced knowledge (chapter 3.1) are also addressed. This question asks:

What is the balance between externally gained knowledge, such as scientific information, and knowledge that was gained through first hand experiences of the participants?

The results sections show that many of the participants in favour of LID referred to 'experiences' being a key factor in shaping the course of their careers or life choices – from gardening with their grandmother to participating in protests which changed their worldviews. This pattern shows a tendency towards confirming Eden's (1996) argument that first-hand experience may be more influential than second-hand non-experience (chapter 3.1). A strong emphasis on second-hand or scientific knowledge by some professionals and the local planner on the one hand, and the idea of science only supplementing the knowledge inherent and acquired by experience expressed by many plotholders on the other hand, tend to confirm the different portrayals of science held by different societal groups. These are outlined in Table 2 and range from viewing science as producing independent and objective knowledge to science being seen as a spiritual and moral dead-end (Irwin, 1995). The fact that a given individual may also hold several contradictory understandings of what constitutes knowledge and what role science plays (Irwin, 1995) is also seen to be the case as, for example, some plotholders express gratitude to science for providing useful systems knowledge while also believing that science is dogmatic and blind to more qualitative realities. This relates to the next research sub-questions to be discussed, which ask:

What is the current role of science and scientific knowledge in the project? and **How are alternative knowledges valued compared to scientific knowledge?**

As shown in section 5.3, science and scientific knowledge have played a critical role in the project. Many participants, including plotholders, possess a scientific background of some type and science is seen by participants to influence all of society on a general level. The strong emphasis on permaculture can be seen as a way in which science influences the project, as the principles and methods used are strongly based on systems ecology and energy science.

Here it is interesting to note, however, that what is considered particularly attractive and useful about permaculture is its holistic and creative approach, which combines the scientific aspects with other types of knowledge.

Another aspect, the role of science in legitimation of the project, is shown to be crucial in this case. This is linked to the idea that science provides 'rational' and objective knowledge (section 5.3.1) and can be linked to Irwin's (1995) claim that knowledge from outside accredited institutions tends to be dismissed. The belief that science-based, quantitative and matter-related knowledge tends to be valued more than qualitative, experiential and non-matter-related knowledge is expressed by most participants, and confirms Irwin's discrepancy in valuation. The difference in valuation between the local authorities, the plotholders and the national inspectorate, provides particularly interesting insights. The results indicate that within the project alternative types of knowledge are valued much more than is typical in society, and also that the national level, both in terms of policy-making and deciding on planning proposals seem to 'listen' to these more alterative knowledge types more than the local authorities. This was found to possibly result from local political alliances with conventional farmers, and may thus not be a true indication of differences in value assigned to the knowledge. Instead, it may be more indicative of an excuse for maintaining the status quo. In relation to legitimation, the results seem to indicate a need for differentiating between science in terms of a more traditional strictly disciplinary science, and a more alternative science from centres practicing alternative and more participatory research - such as the science which helped justify this development (e.g. Organic Centre Wales, Permaculture Association). This second type of science is much more holistic and reminiscent of the call for an evolution of science seen in TR (section 3.3).

This links to the finding in section 5.3.4 that science can be both a barrier and driver of LID. On the one hand science creates awareness of the urgent need to live more sustainably, and thus promotes the acceptance of LID. On the other hand science provides mostly conventional agricultural research on large-scale industrial farming, which places those who use alternative food production scales and methods under the need to justify themselves and struggle to provide research indicating yield and productivity data for alternative farming. The barrier function is seen particularly in descriptions of the role that ADAS, a conventional agricultural advisory service, played in the initial refusal of the Tir y Gafel application. Another role for scientific knowledge identified was in the form of technologies, which also have a role at Tir y Gafel. The use of machinery (and thus also fossil fuels) was said to allow for a more rapid set-up of long term sustainable and fossil fuel independent systems. All participants appreciated the importance of technology and felt that ideally the project would combine the useful aspects of science with alternative, intuitive and traditional knowledge to achieve sustainable yet modern lifestyles. This use of science to meet present needs in a reflected and participatory way relates back to the objective of a science which meets the needs of citizens (Irwin, 1995;

chapter 3). Finally, science was found to play an active role in the project in terms of conducting research on aspects of LID. Although present in this way, the science conducted as such has yet to play a major role in the project, and is not participatory in terms of incorporating plotholders as research partners rather than research objects (chapter 3; Klein, 2001 and Pohl, 2001). This may be in part because the current projects are low-budget Master or PhD studies, and in part because the plotholders are overwhelmed with work and do not have time to become more deeply involved. However, a desire to find ways in which the project can actively contribute to both science and mainstream knowledge in general leads to the next question, which asks:

What is the potential for the project to contribute to mainstream knowledge (and thus actively engage in 'citizen science')?

In general, the potential for the project to contribute valuable knowledge was unanimously categorized as very high – from providing a practical example which may be replicated, to supplying a wealth of data (collected to satisfy monitoring requirements) which can fill gaps in knowledge on this type of building, agriculture and lifestyle. Even in the event that this project should fail, it was felt this would provide valuable lessons on the practicability of this type of development. Particularly in relation to research possibilities, it was found that much interest in increased cooperation with academia exists on the side of the plotholders, as well as the scientists. This confirmed the ideas of one of the scientists that the plotholders would be interested in and capable of becoming active partners with academic institutions. This type of research would be problem-oriented and practical (such as required by TR; chapter 3.3) and would directly address the needs of the citizens (as envisioned in citizen science; chapter 3.2) – resulting in what is hoped would be socially "robust" knowledge as a result of a more open and comprehensive approach to science as described by Nowotny et al. (2001. p. 258) and presented in section 3.2. Funding and coordination of the research were seen as the main barriers to implementing such research projects. However, it was also claimed that very low-cost and high-impact research would be possible – particularly if ways could be found in which the plotholders could advance their education and achieve acknowledged academic titles by researching on aspects of the project they are directly involved in. An example of what can be achieved with little funding is provided in section 5.4.3. However, this innovative research would need to transparently address conflicts of interest and would most probably be subject to dismissal or mistrust from authorities which expect "objective" and non-biased knowledge from academia. In order for this type of research to be truly acceptable to society in general and decision-making bodies in particular, the value of local, contextual and location-specific knowledge would presumably have to be promoted and acknowledged first. Thus, the results show a high potential for the project to contribute to science and knowledge, and provide interesting and innovative ideas for how to facilitate increased collaboration between such

alternative and on-the-ground projects with academic institutions and mainstream science, perhaps contributing to a type of 'citizen science' as envisioned by Irwin (1995). The results also, however, indicate that currently this type of science is not felt to be supported, and also present evidence which suggests that the acceptance of alternative knowledge is increasing but still lags behind in terms of the trust placed in information once it has gone through accredited routes.

Does the case represent a setting which facilitates boundary encounters and if so, what meanings are negotiated?

It is found that indeed the project brings together people from many different groups, and compels them to interact and work towards a joint goal: achieving LID in the open countryside. Thus, the findings indicate that a setting in which such encounters can take place is provided, and areas in which discussion and negotiation about divergent meanings were found and are presented (section 5.6.2). Areas of contention identified, and termed "knowledge dichotomies," include differences in emphasis on qualitative vs. quantitative aspects, emergent vs. planned design, emphasis on the importance of empowerment and individual responsibility vs. the assumed need for control and authority, and finally conventional agriculture vs. permaculture. The encounters – sometimes formal and sometimes informal – between individuals in these groups demonstrated an exchange of more tacit knowledge, and often occurred on a philosophical or value-related level. Although still cause for much frustration on all sides, it seems that progress towards a more joint understanding of LID and its various aspects is resulting from these negotiation processes. For example, recent gains have been made towards agreeing on building standards. Extricating negotiation of meanings on an informal and personal level from formal negotiation in the courts or the WAG level is a challenging task, as both are happening simultaneously and both contribute to the overall state of negotiation on the various issues. For example, individual conversations between authorities and plotholders have led to certain compromises being negotiated, while simultaneously this was influenced by discussion and decisions conducted in court.

Is there evidence of a LID niche or 'network' present, and in how far is cross-project learning achieved or desired?

This final research sub-question relates to Seyfang and Smith's (2007) elaboration on grassroots innovations and green niches (chapter 3.5). The results indicate that although not formal, a type of LID niche, or network in which participants exchange information, does exist. Outlined to be a space in which regular rules and conditions do not at first apply, niches are considered spaces where innovation to be possible (Seyfang and Smith, 2007). Similarly, the LID niche also started out (see chapter 2.5.5) as a place in which the rules were simply not adhered to (as it was at first conducted illegally and is only in recent years being incorporated

into policy allowing for formality). The participants of this study all acknowledged the existence of some connecting network between many similar LID projects in the UK. However, while some thought it would be beneficial to make this network more formal to allow for increased exchange of people and information, others expressed the opinion that this would be counter-productive. On the one hand because the original idea behind LID is very non-hierarchical and organic, and the focus and strength of LIDs is to concentrate on the local context primarily and on the other hand because in strengthening its internal network some believed the risk for 'exclusivity' or clique-like attributes would increase. In order for a niche innovation to become mainstream – a goal which most participants of this study expressed – it must "resonate with widespread public concern" (chapter 3.4; Seyfang and Smith, 2007). Since this seems to increasingly be the case for LID, it can "develop" by niche practices becoming adapted and spreading. The third of three requirements for niche development – cross-project learning – was indicated to occur in the present case. As the residents of LIDs are generally very bound to their land and animals, it was found that particularly the many volunteers that visit these projects act as 'pollinators' to spread information, specific techniques and general knowledge and news from project to project (chapter 5.4.4). Thus the answer to this sub-question seems to indicate that yes, a LID niche or network exists, and cross-project learning takes place. However, a more formal development of this niche is not necessarily desired, as the grassroots character of the development and the focus on the local surroundings are considered of vital importance.

The above sections have reflected on each research sub-question, and related the results to the theoretical concepts guiding the analysis. Within this discussion, the overarching research questions asked in chapter 1.4 have been answered. The first question asks 'What is the current role and potential of science and academia in a grassroots sustainability project?' The answer inherent above is that science has and still continues to play a critical role in the project. It was shown to be of vital importance to legitimating this type of alternative SD development, while at the same time also creating barriers and difficulties. In terms of the future potential of science, a strong interest in more collaboration with academia was found, and innovative suggestions for a 'citizen science'-like approach of participatory and collaborative research were identified. The vast variety of knowledge types, including practical and goal-related knowledge, and in particular intuition, identified, begin to provide an answer to the second overarching question which asks 'What other knowledges or ways of knowing can be identified, and what role do they play?' It was seen that all these alternative knowledge types have their place within the eco-village, however the role they can play externally is dependent on how they are viewed and valued by society and the external authorities. At the moment, although critical in guiding action at Tir y Gafel, the more qualitative or spontaneous, as well as the more

lay and traditional knowledge types are not enjoying widespread acceptance amongst planning authorities or building control officers.

6.2 Discussion of methods

As the chosen methodology used to explore the research questions inevitably has an influence on the results of the research, this section is dedicated to reflecting critically on the methods used. The overall research strategy is discussed first, followed by an analysis of data collection and analysis and the participants sampled. Finally the participant's interests and the role of the researcher are reflected on.

Using an exploratory qualitative case study approach to analyze a rather broad range of aspects, led by several theoretical concepts has advantages and disadvantages. On the one hand, particularly as these questions in relation to LID had not been encountered in the literature, this approach allowed for the development of a relatively wide and encompassing understanding of the role that science and alternative knowledge types play in such a grassroots sustainability initiative. On the other hand, the breadth of aspects and theoretical concepts covered prevented the research from going into great depth on any one issue. However, this weakness was known from the beginning and accepted as a trade off for gaining a broader understanding. The inclusion of participants from not only the eco-village itself, but also researchers, a local villager, an affiliated founder and from the political and administrative level provided different perspectives on the case. However, since any grouping of individuals into certain categories is bound to be a simplification of the more complex reality, and the individuals could in some cases easily fit into several categories at once, the presentation of results based on participant group was difficult if not impossible, and thus avoided whenever not pressingly necessary for understanding. Collecting data via relatively lengthy face-to-face interviews (on average 1.25 hours per interview) with 16 individuals from different groups, allowed for much information to be gathered. However, the ensuing transcription and analysis of over 330 pages of transcript proved to be time consuming. Although this was a disadvantage as it meant that less time was left for the actual analysis and write-up of the thesis, this thorough approach proved useful as the data drawn upon was comprehensive and the inclusion of many exact quotes allowed for a presentation of the results which attempted to let the data 'speak' for itself in addition to being interpreted by the researcher. Analysis of the data with the help of the MAXqda qualitative analysis software proved very useful. It allowed for detailed coding of text segments, and the efficient retrieval or re-arrangements of codes during the writing of the results. Finding an appropriate level of abstraction for the codes was found to be challenging, but coding in an iterative and cyclical process helped finally come to a middle ground which provided enough detail and yet was not too specific.

The length of the interviews and the readiness with which individuals agreed to be interviewed indicates an interest on the side of the participants in participating. This should be understood

in two ways. On the one hand, it was helpful for the study – as the interviewees were willing and cooperative in answering questions (with one exception being the planning officer who began the interview with the warning that he was not going to say anything 'controversial'). This allowed many aspects to be explored, and provided a wealth of information for the analysis. On the other hand, it must be kept in mind that the interviewees will also follow an agenda of one sort or another themselves. The statements from a founding member of Lammas are unlikely to include radical criticism of LID, just as the claims made by the planning officer will be cautious not to expose too many flaws in the action of the participant or his colleagues. Thus, the researcher attempted to keep the potentially biased interests of the interviewees in mind when coming to conclusions about the findings. Although at times participants may have emphasized aspects related to their own agenda, overall it can be stated that they made an honest effort to answer the questions in a thorough and fair manner. Several participants even mentioned that the research was particularly timely for them personally, and inspired them to re-think some of the basic assumptions towards science and knowledge they tended to hold.

As outlined in chapter 4.6, the effect of the researcher's personal background and education on the research must be transparent. In this case, the researcher comes from the field of environmental studies, and thus it can be expected that an affinity for environmental initiatives is inherent. In terms of knowledge background, the researcher has both a natural and social science background, perhaps providing the basis for a deeper ability to comprehend boundary issues between disciplines and knowledge types. As the researcher is not from Wales, understanding the local and cultural subtleties is more difficult. Language competency presented no problems, as English is the researcher's mother tongue, and all participants spoke English fluently (while only some were additionally Welsh-speaking). To combat coming from a different context the researcher engaged in as many informal conversations as possible and extended the field work as much as time and budget constraints allowed. The participants did not question the ability of the researcher to understand the local context, and were in fact inquisitive about aspects of SD in both Germany and Canada. One advantage of coming from a different background is that the researcher has the ability to look at events in Wales with a certain measure of distance, perhaps aiding in an unbiased interpretation of the results.

6.3 Suggestions for further research

As this exploratory study identifies the presence and roles of science and other knowledge types in this particular grassroots sustainability initiative, it would be interesting to continue this research by seeing what impact power relations as well as political and economic dimensions have on the way knowledge and science is used and valued at Tir y Gafel. It may also be interesting to conduct a similar study on several additional cases of LID projects as well as other radical grassroots sustainability projects, determining if the results can be replicated, and possibly identifying additional types of knowledge, or ways in which science is incorporated.

Since intuition is identified as important for guiding the actions of particularly the plotholders, it would be interesting to conduct research looking specifically at aspects of intuition, attempting to grasp the nature and relevance of this rather alternative and not well-researched knowledge type more closely within the context of sustainability. The affiliated founder (A7) mentioned that he feels LID building methods are not only applicable to the Welsh or UK (or indeed Western) context, but are highly relevant for providing low-cost sustainable housing in developing countries. It would therefore be interesting to see if similar developments are being conducted in such contexts, and to explore what aspects might be transferable to countries where there is an even greater need for affordable housing and food security, yet less fertile land and less societal surplus (possibly making the use of recycled building materials more challenging). In order to apply a lesson learnt from this study directly, it is recommended that future researchers speak directly to the participants of this study, and jointly determining aspects which would be interesting to explore in more detail. Finally, conducting a joint Lammas/University research project where support, coordination and funding is provided by the university, but the majority of the research is conducted by the plotholders themselves would provide a chance to test the innovative research ideas emergent in this study. Sufficient support and guidance would be a prerequisite, as the plotholders are still under considerable time pressure. Additionally, the research should attempt to focus on everyday aspects of the plotholders lives in the process of setting up a LID in order to fit with as little effort as possible into their daily routine.

7 CONCLUSION

Science, scientific knowledge, and other knowledge types are key factors in determining individual and societal decisions and thereby influence the direction of human 'progress'. For the past several hundred years, science, and more generally institutional knowledge, has predominated the public discourse. This study has found that scientific knowledge can legitimize and support bottom-up attempts at sustainable development by generating specific knowledge and providing useful technologies. However, science is also found to be a major barrier to introducing more radical types of sustainable development through its rather rigid and narrow focus on conventional research and its inability to recognize other types of 'knowing' or reflect critically on the consequences of its implementation.

As environmental and social problems are worsening, despite the immense increase in scientific data and 'facts', the case is made that alternative ways of knowing should be explored and identified. Within this study, participants are found to possess a vast variety of knowledge, including knowledge about the system within which they are acting, knowledge about what a more sustainable future should look like, and knowledge about practical ways in which to transition from the current situation to a more desirable future. Intuition is found to be an unexpected and additional form of knowledge, important in determining people's actions on the ground. An intuitive perception of the environmental crisis, as well as an intuitive understanding of the value of living lightly and respectfully on this planet are shown to be underlying motivators for choosing a radically sustainable lifestyle. In addition, practical aspects of low impact living are guided by intuition as well as other alternative knowledge types. However, it is seen that scientific and accredited knowledge continues to be valued much more highly, particularly by local decision-making bodies, than such alternative and rather experiential knowledge. Thus, it is concluded that the more qualitative, local, traditional and holistic knowledge forms must be given more attention and seen as valid sources of information in addition to the more quantitative and compartmentalized knowledge types produced in recognized institutions.

Importantly, the emergence of innovative suggestions for collaboration between researchers in academic institutions and the people conducting radical sustainability projects on the ground provides a starting point from which to begin re-valuing local and alternative knowledge. It also presents a chance for investigating the role of intuitive knowledge in radical sustainability. This study demonstrates an interest and willingness on the part of both the eco-village residents and scientists involved in sustainability research in engaging in a deeper and more equitable joint production of knowledge. In order to realize this potential, funding and coordination must be provided, and the research must be directly related to the activities of the project.

This grassroots sustainability initiative is shown to be a setting in which important discussions on different understandings of fundamental sustainability issues are facilitated. These

'knowledge dichotomies,' range from green building methods to philosophical perspectives on the determinants of quality of life, take place between a variety of actors, and have the potential for generating joint perspectives and new understandings of these issues. The eco-village is shown to be a context where boundaries between different understandings are crossed, and joint knowledge creation is made possible. The resulting combination of local and expert knowledge, if sought and heard, is argued to have the potential to contribute substantially to the broader societal discourse on sustainable development. It is found that a LID network, in which cross-project learning is possible, does exist. However, there is a lack of time, funding and resources available within the local initiatives to make the best use of this possibility.

Viewing science critically, and exploring alternative knowledge forms, should not be interpreted as questioning whether there is a right or wrong type of knowledge. Rather, it should be seen as an opportunity to ask ourselves what it is we believe in, what it is we want to value, and what it is that we actually want to know? What knowledge do we need in order to become more sustainable, and is this the knowledge we are generating? An important result of this study is the emergence of innovative suggestions for ways in which local initiatives can collaborate with scientific organisations to create research projects which may result in the creation of context-related and alternative, yet legitimate, knowledge on many aspects of sustainable low impact living.

In conclusion, this study argues that we are now at a point where it is time to realize the potential of alternative knowledge forms, and re-focus efforts of knowledge creation away from strictly disciplinary and non-contextual generation of data and 'facts' towards more holistic, alternative and intuitive understandings of systems. These can be accessed through collaboration between scientific and societal actors on the ground, and by producing policies and regulations which allow for more negotiation and discretionary decision-making by empowered individuals on all levels of society. Understanding and valuing the importance of alternative expertise and intuition, in addition to scientific expertise, provides a fresh perspective from which to tackle the important goal of engaging in more equitable and sustainable development.

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9 ANNEXES

Annex 1. The 8 LID criteria of Pembrokeshire's Policy 52

Low impact development that makes a positive contribution will only be permitted where:

1.   The proposal will make a positive environmental, social and/or economic contribution with public benefit; and

2.   All activities and structures on site have low impact in terms of the environment and use of resources; and

3.   Opportunities to reuse buildings which are available in the proposal's area of operation have been investigated and shown to be impracticable; and

4.   the development is well integrated into the landscape and does not have adverse visual effects; and

5.   the proposal requires a countryside location and is tied directly to the land on which it is located, and involves agriculture, forestry or horticulture; and

6.   The proposal will provide sufficient livelihood for and substantially meet the needs of residents on the site; and

7.   The number of adult residents should be directly related to the functional requirements of the enterprise; and

8.   In the event of the development involving members of more than one family, the proposal will be managed and controlled by a trust, co-operative or other similar mechanism in which the occupiers have an interest.

Annex 2. From Bergmann et al.'s TD evaluation criteria to interview guideline questions

For the complete list of evaluation criteria see the original text (Bergmann et al., 2005, pp. 27–34).

Below the criteria selected as useful for this study and the corresponding question asked to specific interviewee groups is outlined.

A: Actors, project construction, project formulation

1. Do the disciplinary composition and the competence in the team permit the treatment of the essential aspects of the problem or object of study?

This question can be adapted to the context of this study to explore the types of competencies and knowledges that exist within the ecovillage team (citizen's involved directly), as well as asking what disciplines, practical competencies, technical knowledge, etc was missing and required consultation from outside the direct team.

3. Does the project take up an everyday life problem, and how is this problem relevant?

This question can be adapted to explore what interviewees perceive as the main problem the initiative is concerned with, and it's relevance in the 'big picture' (global context?)

10. Does the structuring of the project correspond to sensible processes of generating and integrating knowledge in the research process and to the requirements of the participating actors?

This can be adapted to explore what methods, tools, etc can be identified which facilitate the generation and integration/sharing of knowledge at Lammas

B: Project execution and methodology

14. Are suitable methods used or have they been developed to conjoin contributions of knowledge from the participating scientific fields and from practice?

Related to point 10? Can be adapted to explore what methods are used which bring together practical, local and lay knowledge with more formal professional and scientific knowledge

15. Is there regular reflection on the cooperation within the team and on the implementation of plans for knowledge integration? If applicable, are conclusions drawn from this?

Closely related to 14 above. Can be adapted to explore whether the generation of join knowledge is an explicit goal within the case study, and if not, whether some aspect of this occurs can be found nevertheless

C: Results, products and publications

17. Do scientific innovations (methodological/conceptual) come about?

This can only partially be answered, since the project is still in the early phases of implementation, but some results may already be present, and expected results can be identified.

18. Can the results make a contribution to solving the everyday life problem?

Here the impact of the actual/expected results can be asked from the perspective of the different actors interviewed

20. Do publications and other products represent an appropriate yield from the project?

Here, the document analysis can help describe what types of products have resulted so far, and questions to interviewees can determine what additional products the project is expected to yield.

Annex 3. Interview Guidelines

Interview Guideline – Plotholders

Introduction of research interest:

I am very much interested in LIDs, intentional communities and eco-villages and in the people that engage in them. I think it's important to look at such initiatives closely, so that we can learn from the experiences that have been made. Particularly the role of science and expertise is of interest to me. I hope to gain a better understanding of what knowledge and information has been influential at Lammas, where the different knowledges comes from, how and when they have been used, and how they have interacted with one another to shape the process.

Warm-up questions:

1. I'd like to start off by asking you to very briefly tell me your own story. How did you come to be involved with LID and particularly with Lammas?
   o What factors, events or experiences shaped your way to where you are today?

2. If we were to look at Lammas in a bigger picture sort of way, what would you say is the problem (on a global or societal level) that the idea of LID and Lammas is proving a solution for?
   o What problem, on a global scale, would you say that LID or Lammas is trying to tackle?
   o In other words: what is the relevance of Lammas, in terms of the big picture?

Knowledge types and balance of influence

As I see it, there are basically four different broad sources of knowledge that are relevant for Lammas: knowledge which the members bring with them, knowledge shared by or created within Lammas members themselves, knowledge which comes from within the LID community, and knowledge for which external sources were consulted. Within each of these categories there is knowledge that has to do with understanding the system (data, facts, scientific knowledge, experiences with the system), practical knowledge about methods (ways in which we can interact with the system and change it or our relationship within it), and a knowledge connected to values, and to what we believe are the right goals to achieve. I would like to explore what knowledge comes from which source, how important these different knowledge types and sources are for Lammas, how they have been used, and so forth.

3. When you first became involved with LID, where did you turn to for information?

4. Could you describe to me what knowledge, in your opinion, Lammas members themselves (the plot-holders) hold, and have brought with them to the project?

5. What types of knowledge would you say are created at Lammas?

- Is the sharing or mixing of experiences, opinions, methods, ideas and so on between the plot-holders and others something that occurs at Lammas?
- How does this happen?
- What kinds of procedures – if any – has the group set in place to share knowledge amongst themselves?

6. In terms of external knowledge required by Lammas, could you give me an idea of what types of knowledge this was, and why it was necessary to also call upon this outside knowledge?

Role of science/'expert' knowledge

7. In terms of academic science, and scientists, how have they contributed to Lammas?
   - How, and during which phases of the project was this most important?

8. What role did the reports and assessments (such as the permaculture project appraisal, or the agricultural report) play in the application process?
   - Why were these external documents needed?

Valuation of knowledge

9. During the process of Lammas so far, various scientists, institutions and professionals have supported the project in different ways. How do you feel that the knowledge held by you, and other Lammas plot-holders, is viewed by these scientists and professionals?
   - Was this any different compared to how the planning officers viewed and valued your experience and knowledge?

Planners and administration

10. Particularly when dealing with planning officers, building regulations inspectors and other authorities, do you get the feeling that certain kinds of information or certain knowledge sources are regarded as more important or legitimate than others?
    - Could you elaborate on why you believe this is the case?

11. Did the planning officers, according to your experience, have a good enough understanding of LID and permaculture to adequately assess your applications?
    - If not, what was lacking in their understanding, and how do you think this might be overcome?

12. In terms of barriers or drivers for LID, and in your experience related with Lammas, what would you say is the role of administration and politics?

Knowledge Production and Integration at Lammas

13. Do you think that Lammas can contribute to the formal scientific knowledge base?
    - In what ways, and how?

14. What about local or practical knowledge? What role does Lammas, and the activities and experiences associated with it play in this context?
    - Who might benefit from this knowledge?

15. In terms of actual products, I know that, for example, a Masters student developed a rocket stove for and with Lammas plot-holders, and several scientific studies about LID policies and various aspects of eco-villages have been conducted and resulted in reports in connection to Lammas. Do you expect there to be many of these kinds of 'products'?
    o Is this something that is an outright goal of Lammas, or is it simply a side effect?

Strategic learning - LID niche?

16. Do you feel that by now a broader sort of LID 'community' exists, that spans across various projects?

17. How have the experiences of other eco-villages, builders of low impact homes, etc impacted Lammas?
    o Is there a way in which these experiences - this knowledge - is shared, transferred, adapted, modified and applied again between the different projects?

Other

18. Regarding what we have been talking about today, is there something important that we have missed? Is there anything you would like to add, or anybody you would recommend I still talk to?

19. Was there any part of this interview, or any questions I asked that you found difficult to understand? Do you have any tips for how I might improve my interview method?

Interview Guideline – Planners/Authorities

Introduction of research interest:

I am very much interested in LIDs, intentional communities and eco-villages and in the people that engage in them. I think it's important to look at such initiatives closely, so that we can learn from the experiences that have been made. Particularly the role of science and expertise is of interest to me. I hope to gain a better understanding of what knowledge and information has been influential at Lammas, where the different knowledges comes from, how and when they have been used, and how they have interacted with one another to shape the process.

Warm-up questions:

1. I'd like to start off by asking you to very briefly tell me your own story. How did you come to be involved in the work that you do, and when did you begin to be involved with LID and particularly with Lammas?
   o What factors, events or experiences shaped your way to where you are today?

2. If we were to look at Lammas in a bigger picture sort of way, what would you say is the problem (on a global or societal level) that the idea of LID and Lammas is trying to provide a solution for?
   o What problem, on a global scale, would you say that LID or Lammas is trying to tackle?
   o In other words: what is the relevance of Lammas, in terms of the big picture?

Knowledge types and balance of influence

As I see it, there are basically four different broad sources of knowledge that are relevant for Lammas: knowledge which the members bring with them, knowledge shared by or created within Lammas members themselves, knowledge which comes from within the LID community, and knowledge for which external sources were consulted. Within each of these categories there is knowledge that has to do with understanding the system (data, facts, scientific knowledge, experiences with the system), practical knowledge about methods (ways in which we can interact with the system and change it or our relationship within it), and a knowledge connected to values, and to what we believe are the right goals to achieve. I would like to explore what knowledge comes from which source, how important these different knowledge types and sources are for Lammas, how they have been used, and so forth.

3. When you first became aware of LID, where did you turn to for information?

4. Could you describe to me what knowledge, in your opinion, Lammas members themselves (the plot-holders) hold, and have brought with them to the project?

5. What knowledge would you say is created at Lammas?
   o Is the sharing or mixing of experiences, opinions, methods, ideas and so on between the plot-holders something that occurs at Lammas?

o How does this happen?

o What kinds of procedures – if any – has the group set in place to share knowledge amongst themselves?

6. In terms of external knowledge required by Lammas, could you give me an idea of what types of knowledge this was, and why it was necessary to also call upon this outside knowledge?

Role of science/ `expert` knowledge

7. In terms of academic science, and scientists, how have they contributed to Lammas?
   o when, and at which phases of the project was this most important?

8. What role did the reports and assessments (such as the permaculture project appraisal, or the agricultural report) play in the application process?
   o Why were these external documents needed?

Valuation of knowledge

9. Relating once again to the knowledge held by the members of Lammas themselves, what would you say are their strengths, and where do you feel the knowledge they hold is not sufficient, or they are in need of better or different knowledge?
   o Is the additional input of scientists and experts really filling a knowledge gap, or does it play more of a legitimating role, since it represents a more 'official' source?

Planners and administration

10. When you receive a LID application, such as Lammas, what types of knowledge must they provide you with?

11. Which of this knowledge is most important to making a decision on the application?
    o Could you elaborate on why this is the case?

12. In terms of your own knowledge as a planning officer, would you say that you had enough information and experience with the goals and methods of LID, and the concept of permaculture to assess the Lammas application, or can you think of areas where additional knowledge would be necessary or useful?
    o If there are areas where more knowledge would be useful, what are these, and how might this knowledge be acquired to assist with future applications?

13. In terms of both barriers of and drivers promoting LID, and in your experience related with Lammas, what would you say is the role of administration and politics?

Knowledge Production and Integration at Lammas

14. Do you think that Lammas can contribute to the formal scientific knowledge base?
    o In what ways, and how?

15. What about local or practical knowledge? What role does Lammas, and the activities and experiences associated with it play in this context?
    o Who might benefit from this knowledge?

Other

16. Regarding what we have been talking about today, is there something important that we have missed? Is there anything you would like to add, or anybody you would recommend I still talk to?

Interview Guideline – Scientist/Professional

Introduction of research interest:

I am very much interested in LIDs, intentional communities and eco-villages and in the people that engage in them. I think it's important to look at such initiatives closely, so that we can learn from the experiences that have been made. Particularly the role of science and expertise is of interest to me. I hope to gain a better understanding of what knowledge and information has been influential at Lammas, where the different knowledges comes from, how and when they have been used, and how they have interacted with one another to shape the process.

Warm-up questions:

1. I'd like to start off by asking you to very briefly tell me your own story. How did you come to be involved with LID and particularly with Lammas?
   o What factors, events or experiences shaped your way to where you are today?

2. If we were to look at Lammas in a bigger picture sort of way, what would you say is the problem (on a global or societal level) that the idea of LID and Lammas is proving a solution for?
   o What problem, on a global scale, would you say that LID or Lammas is trying to tackle?
   o In other words: what is the relevance of Lammas, in terms of the big picture?

Knowledge types and balance of influence

As I see it, there are basically four different broad sources of knowledge that are relevant for Lammas: knowledge which the members bring with them, knowledge shared by or created within Lammas members themselves, knowledge which comes from within the LID community, and knowledge for which external sources were consulted. Within each of these categories there is knowledge that has to do with understanding the system (data, facts, scientific knowledge, experiences with the system), practical knowledge about methods (ways in which we can interact with the system and change it or our relationship within it), and a knowledge connected to values, and to what we believe are the right goals to achieve. I would like to explore what knowledge comes from which source, how important these different knowledge types and sources are for Lammas, how they have been used, and so forth.

3. When you first became involved with LID, where did you turn to for information?
4. Could you describe to me what knowledge, in your opinion, Lammas members themselves (the plot-holders) hold, and have brought with them to the project?

5. What knowledge would you say is created at Lammas?
   o Is the sharing or mixing of experiences, opinions, methods, ideas and so on between the plot-holders something that occurs at Lammas?
   o How does this happen?
   o What kinds of procedures – if any – has the group set in place to share knowledge amongst themselves?

6. In terms of external knowledge required by Lammas, could you give me an idea of what knowledge this was, and why it was necessary to also call upon this outside knowledge?

7. In terms of the goals and mission of Lammas, what values are expressed in these, and where have they come from?
   o Has permaculture and it's principles impacted the desired direction, or the goals, of Lammas?

Role of science/'expert' knowledge

8. You yourself are a scientist, and work in an academic setting. What role do you see for science and scientific knowledge within the Lammas project?
   o In general, what can science contribute to the project?
   o when, why and during which phases of the project was scientific knowledge most important?

9. What role did the reports and assessments of experts (such as the permaculture project appraisal, or the agricultural report) play in the application process?
   o Why were these external documents needed?

Valuation of knowledge

10. Relating once again to the knowledge held by the members of Lammas themselves, what would you say are their strengths, and where do you feel the knowledge they hold is not sufficient, or they are in need of better or different knowledge?
   o Is the additional input of scientists and experts really filling a knowledge gap, or does it play more of a legitimating role, since it represents a more 'official' source?

Planners and administration

11. Turning now to planning officers, building regulations inspectors and other authorities, do you get the feeling that certain kinds of information or certain knowledge sources are regarded as more important or legitimate than others?
   o Could you elaborate on why you believe this is the case?

12. Did the planning officers, in your opinion, have a good enough understanding of LID and permaculture to adequately assess the Lammas application?
   o If not, what was lacking in their understanding, and how do you think this might be overcome?

13. In terms of both the barriers and drivers for LID, what would you say is the role of administration and politics? Is this rather a supporting or hindering factor, and how?

Knowledge Production and Integration at Lammas

14. Do you think that Lammas can contribute to the formal scientific knowledge base?
   o In what ways, and how?

15. What role do you think Lammas might play in terms of impacting policies to do with LID?

16. What about local or practical knowledge? What role does Lammas, and the activities and experiences associated with it play in this context?
    o Who might benefit from this knowledge?

17. In terms of actual products, I know that, for example, a Masters student developed a rocket stove for and with Lammas plot-holders, and several scientific studies about LID policies and various aspects of eco-villages have been conducted and resulted in reports in connection to Lammas. Do you expect there to be many of these kinds of 'products'?
    o Is this something that is an outright goal of Lammas, or is it simply a side effect?

Strategic learning - LID niche?

18. Do you feel that by now a broader sort of LID 'community' exists, that spans across various projects?

19. How have the experiences of other eco-villages, builders of low impact homes, etc impacted Lammas?
    o Is there a way in which these experiences - this knowledge - is shared, transferred, adapted, modified and applied again between the different projects?

Other

20. Regarding what we have been talking about today, is there something important that we have missed? Is there anything you would like to add, or anybody you would recommend I still talk to?

21. Was there any part of this interview, or any questions I asked that you found were unclear? Do you have any tips for how I might improve my interview guideline?

Annex 4. TD Knowledge Triangle – used in interviews.

System Knowledge
- Scientific data
- Understanding how system works

Types of Knowledge

Practical/Methods Knowledge
- Understanding how to interact with and transform the system

Values and Goal Knowledge
- In which direction should the system be changed?
- What is desired?

Annex 5. MAXqda coding system

- **Code System**
  - Target knowledge - vision, goals
    - ecology/biod. not carbon and GHG and sust
    - Inclusive, community, safe
    - founders reasons
      - support local community
      - not intentional, just a village
    - provide a mainstream alternative
    - Low income housing/land equity
    - Political: decrease footprint and affordabilty
    - Experiment/example to replicate
    - Individual desires no greater vision
    - other quality of life, nature-connection, spirituality
    - Lammas/Tir y Gafel as a group
  - Transformation Knowledge (mostly)
    - experience of road protests
    - Scientists/professionals
      - practical experiences as 'education'
      - academic/external sources
      - first hand experience
    - Political policy level
      - Class based inequality
      - democratic change demanded
      - TAN 6 and LID
      - Sources and types of knowledge
    - Planners
      - rely on experience to assess
      - maintain conventions/protective role
      - System creates the problem
      - supportive/not supportive
      - Knowledge and LID
        - rely on conventional knowledge
        - need alternative ag know.
        - unwilling/afraid to change
        - arbitrary idea of what land is good for
        - openness and policy, not info needed
        - lack of knowledge/resources
      - science
      - PO10 background
      - Strengths
      - Permaculture
      - External needed
    - Lammas/Tir y Gafel
      - Integration - common pool
      - Types
      - Individual background
        - Academic
        - Perception of group composition
        - Second-hand non-experience
        - First-hand experience
      - LID sources used
  - Science
    - Economics
    - Technology
    - Role of reports/assessments
    - Legitimation/Justifying
    - Role in Lammas/Tir y Gafel
  - Intuition
    - SD can be counter-intuitive
    - discerning between it and fear
  - Boundaries, perspectives, sharing/network
    - meanings negotiated
    - boundary encounters
    - Boundaries
    - New perspective from others
    - Network
    - Learning
  - Contradictions_balance science/experience
    - Requirements don't fit LID
    - One idea contradicts another
    - Science needed formally, not used on site
    - Design
  - Research possibilites
  - Lammas potential contribution
  - Valuation of knowledge
  - Governance
    - planners perspective
    - Equality
    - Processes/methods used or reguired

MAXqda coding system continued.

- Opposition
  - Related to Glandwr village
  - expressions of racial/origins/looks discimination
  - "I just don't get it"
  - desire for comunication
  - problem with building style
  - worries about money
  - Critique of specific people
  - contradictions
  - problems with others non-lammas
- Problems
- Empowerment, philos.
  - Specialization/generalization
  - knowledge diffusion
  - Hippies
  - Context connection - Beck
  - Gender aspects_or masuline feminine
  - Autonomy vs. group
  - Philosophical
    - Fear
    - Crisis and change
  - Risk and responsibility, empowerment
  - "Can do" attitude, pioneers
  - Interviewee views on know. types
  - End thoughts, w/o question