

Reinventing the Wheel to Guide Ecovillages towards Sustainability

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2013

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Thesis submitted for completion of Master of Strategic Leadership towards Sustainability,
Blekinge Institute of Technology, Karlskrona, Sweden.

Abstract: Ecovillages acting as experimental community models have the potential to help move society towards sustainability by developing alternative solutions for sustainable living. Their contribution is through the power of example, demonstrating successful alternative systems that can be replicated at higher scales through the broader community. However, ecovillages often struggle with long-term planning and lack a systematic approach to integrating structure, processes and actions into strategic planning. Research was conducted to examine how ecovillages could be supported in this deficiency to make them more successful as models of sustainability. An initial document review of tools and concepts currently used in the ecovillage movement uncovered a recently developed concept called the Wheel of Sustainability (WoS). The Framework for Strategic Sustainable Development (FSSD) was applied to analyse this concept and to inform the development of a new prototype tool. The research was conducted in collaboration with experts in the ecovillage field and FSSD practitioners, through interviews and a final validation survey. The result of the research led to the co-creation of an enhanced communication and strategic planning tool, the Direction Indicator for Sustainable Communities (DISC), intended for use by ecovillage communities. Further research is recommended to field-test and further refine this tool.

Keywords: communication, ecovillages, eco-village, strategic sustainable development, Direction Indicator for Sustainable Communities (DISC), tool, Wheel of Sustainability

Statement of Contribution

This thesis is the product of a joyful collaborative effort. We each brought our passion, commitment, life experience along with our professional talents, energy and skills to this work.

We came together in a rather serendipitous way around a shared vision – to contribute to the strategic development of the ecovillage movement as we believe that these experimental centres are an important source of learning and knowledge for the transition towards a sustainable global society.

Due to the iterative nature of our work, it was for the most part conducted with all members present and contributing; all having contributed equally and significantly to the final thesis product. Tasks were divided between the three members, taking into consideration each member's skills and interests, aiming for a fun and productive work process. We placed a lot of importance on the process itself making sure to check-in with each other at each meeting, and also practice a grounding and visualisation technique before starting any work, which made a huge difference. Each of us reviewed and provided constructive feedback to each other's work, which allowed us to continuously improve, develop and learn from each other.

Pete brought his long practiced skills at academic writing and ability to think in a holistic way that balanced the group. His professional experience and inherent understanding for natural systems combined with his ability to provide different perspectives when analysing complex problems allowed us to keep challenging our own assumptions, which is key for conducting great research.

Johanne brought her creativity, facilitation, project management skills, training and coaching experience to the group - these were key to the development of this work. The process approach to the thesis work introduced by Johanne and her assertive yet cool attitude led the team to an effective learning and working process.

Clarissa brought her sustainability experience, positive attitude and methodical manner to the group work. Her attention to detail and dedication to the project helped us maintain momentum and her organisational skills always kept us on track, which was key for successful project realisation.

We are certain that our collective effort on this thesis allowed us to achieve something far beyond what we could have achieved if each of us had to work on a thesis individually.

And most importantly, we celebrated, became good friends and had a lot of fun!

Sincerely,

Clarissa de Oliveira Arend

Johanne Gallagher

Peter Orell

Karlskrona 2013

Acknowledgements

We would like to express our sincere appreciation to everyone who has supported us in our research.

We want to especially acknowledge the important contribution of the following wonderful people who helped us with our research: Felix Wagner and Sandra Mende who inspired us with the Wheel of Sustainability and have been an invaluable source of support and information; Diana Leafe Christian who we were pleased to meet in person at the ecovillage conference (ERO) in Ångsbacka, Sweden; Jonathan Dawson who inspired us with his book; Torbjörn Lahti for his enthusiasm and support; Davie Philip, Cloughjordan, Ireland, who hosted us while on our personal visit; and Simon Richards, Tony Sirna, and Christoph Strünke, long-term ecovillage residents who gave us direct and valuable insights into ecovillage life and planning.

A special thank you to Robert Gilman, a pioneer of the ecovillage movement, who has been a great support to us since the start of our thesis.

In addition, we would like to thank Professor Karen Litfin, Department of Political Science at the University of Washington for her generous support, by providing useful literature resources based on her book on the study of ecovillages.

A big thank you to Janaína Fensterseifer Martins for creating the beautiful graphic design of our prototype DISC.

We thank our Masters in Strategic Leadership towards Sustainability (MSLS) 2013 Class for the great camaraderie during the year, our Peer Cluster for the support during the thesis process and especially our classmates Anita Berner, Elaine Daly, Narayan Silva and MSLS alumna Telma Gomes.

We also extend our deep appreciation to the 2013 MSLS Staff, especially our thesis advisor, Tracy Meisterheim, with her knowledge and experience, for her guidance and supportive insights.

Clarissa and Peter are very grateful to Tamara Connell for her diligent help and support with the application process for the MSLS program. Clarissa would also like to thank StratLeade and BTH for the scholarships, without which she would not have been here.

Finally, we would like to thank our families and friends all over the world for their help, love and support through this amazing journey, including our furry, four-legged friends Ava and Jaz.

Executive Summary

Introduction

Since the Industrial Revolution, population growth and our technological power to consume resources have increased exponentially placing ever greater demands on the Earth's natural systems (Biggs et al. 2011; Steffen et al. 2011; Rockström et al. 2009; Vitousek et al. 1997). The speed and scale of our impacts on the biosphere, including biodiversity loss and climate change, is unprecedented and we are now rivalling geophysical processes (Steffen et al 2011). Climate change adds further uncertainty regarding the resilience of the biosphere and its capacity to support human society now and in the future. Clearly, the current trajectory of our global society is unsustainable and changes are needed to avoid collapse.

Global society has become increasingly urbanised with more than half the world's population now living in cities and expected to exceed 70% by 2050 (United Nations Human Settlements Programme 2009). Thus the urban environment is now the dominant human habitat. Some of the current realities of an unsustainable urbanised society include

- transformation of local, ecological cycling of vital nutrients and other chemical resources into global, linear throughput systems (Rees and Wackernagel 1996 in Rees 2003);
- ecological footprints indicating excessive consumption of resources, contributing to climate change and loss of natural capital (Rees 2003);
- social and economic inequality affecting access to resources (Massey 1996; OECD 2008; Wilkinson and Pickett 2010); and
- technological and economical influences that have contributed to changes in the way people relate to each other, leading to a loss of social connectedness and sense of community (Putnam 2000).

These realities are in contrast to the characteristics of a sustainable society where economic security and ecological integrity mean that communities function through cyclical support systems that promote harmony with nature and provide for meaningful livelihoods. Such a society also promotes health and well-being, a sense of connectedness and belonging as well as promoting active participation and equal opportunity in community affairs and governance (Kelin 2003 in Irrgang 2005). One model of a sustainable community that can demonstrate powerful examples of these characteristics is the ecovillage, supported by a small but global movement.

Through their holistic worldview and by prefiguring a viable future, the ecovillage movement has the potential to promote real planetary change, as ecovillages provide living laboratories for experimenting with new models in sustainable community and in finding and disseminating solutions to our many environmental and social problems (Dawson 2006; Dawson 2013; Lahti 2013; Leafe Christian 2012).

While ecovillages have access to a range of tools and concepts to assist with governance, designing, planning and decision-making, they rarely utilise these effectively to move strategically towards shared visions of sustainable communities. There seems to be a

deficiency in not having a systematic approach to integrating structure, processes and actions based on a systems understanding of sustainability. It is evident that ecovillages need tools to assist them in meeting this deficiency (Leafe Christian 2013; Philip 2013b; Wagner 2013a).

A search for current tools or concepts that have been developed to assist ecovillages uncovered the Wheel of Sustainability (WoS), designed to help ecovillages promote a culture of sustainability. While offering valuable guidance for ecovillage communities, this tool has not been developed nor informed from a whole-systems perspective. Such an approach requires the application of a conceptual framework to enable a comprehensive and systems-based understanding.

The Framework for Strategic Sustainable Development (FSSD) enables structuring of information in a way that allows us to deal with the complexity of the sustainability challenge and avoid reductionism (Broman, Holmberg, and Robèrt 2000; Robèrt 2000). It enables an understanding of complex systems that supports strategic planning through the practice of backcasting from a vision of a sustainable future. This is the conceptual framework that ideally lends itself to assessing tools such as the WoS.

The goal of this research is to develop a tool embodying a whole-systems perspective and strategic thinking that can provide a shared mental model for ecovillages for improved communication and orientation in community planning and decision-making processes to assist in their progress towards sustainability.

The main research question is:

How might ecovillages be better supported in demonstrating a systemic and strategic approach to sustainability?

In order to answer this question, the following supporting questions were posed:

1. What does the FSSD reveal about current tools and concepts developed for ecovillages to plan towards sustainability?
2. What would a tool to facilitate communication and strategic thinking look like?

Methods

The research design comprised two phases, each answering the supporting research questions and linked sequentially to answer the main research question.

Phase I: An analysis was undertaken of the WoS using the FSSD to identify strengths and weaknesses from a whole-systems, strategic viewpoint followed by the development of a new prototype tool based on the WoS and informed by the analysis.

Phase II: Ecovillage and sustainability experts were invited to review the initial prototype and co-create an improved version through semi-structured interviews. A follow-up survey was sent to the same experts and FSSD practitioners to validate and refine the final prototype.

Results and Discussion

Overall, adjustments made to the first prototype referred to the enhancement of the concept by introducing the scientific boundaries of the system, represented by the four Sustainability

Principles (see page 12 for definitions), and also the scientific theory of human needs and satisfiers, as defined by Max-Neef (1991). It also included a five-step strategic process with instructions to use the wheel.

Based on the feedback received on the interviews, the second version of the prototype placed the vision and values of the community in the middle, surrounded by Max-Neef’s human needs, with a ring around them representing the fourth Sustainability Principle (SP) relating to social sustainability. The Implementation (middle) level was changed to comprise the seven petals of the Permaculture Flower, to facilitate the understanding of the concept and the language, as it is familiar to the audience. The first three Sustainability Principles relating to ecological and environmental sustainability remained in the outer part of the wheel representing the biosphere and the ecological system boundaries. Guiding questions to help integrate the use of the prototype within planning processes were included.

Survey results informed improvements in the design and concept of the prototype and also in the creation of a prototype introduction. To enhance the understanding of the concept, the SP boundary rings were renamed as “Ecological Sustainability Principles” and “Societal Sustainability Principle”, and an outer ring was added to represent the biosphere. Introductory information to the prototype was created in order to further clarify the prototype concept, intention, and use.

The final prototype is presented below:



Direction Indicator for Sustainable Communities (DISC)

Conclusion

As living laboratories, the purpose of the ecovillage movement is to test out and present viable options to society for sustainable living. The goal of this research project was to answer the question as to how ecovillages might be better supported in demonstrating a systemic and strategic approach to sustainability.

Through the integration of the conclusions of the two phases of research the main question has been answered. Prototyping a new tool through the research fulfils the intention to help ecovillages be more successful at what they set out to do and therefore fulfil their role in moving society towards sustainability.

The new prototype tool can act as a navigation tool, strategically guiding ecovillages in the direction of a sustainable society. It provides a shared mental model for ecovillages and supports improved communication and orientation in community planning and decision-making processes, both within and outside their communities. Through application of this tool it is intended that ecovillages can be better supported in their ability to communicate and plan ways of satisfying a community's human needs within ecological and societal boundaries.

It is suggested that further research is undertaken to explore the potential of the use of the tool with different audiences, for different purposes and scales.

Glossary

ABCD planning process: A four-step strategic planning process that a societal system can use to implement the Framework for Strategic Sustainable Development, using backcasting from sustainability principles (Ny 2006; Robèrt 2000).

Art of Hosting: A highly effective way of harnessing the collective wisdom and self-organising capacity of groups of any size. It blends a suite of powerful conversational processes to invite people to step in and take charge of the challenges facing them (Art of Hosting n.d.).

Backcasting: Used to plan in complex systems, this approach starts by defining success in the future and then plans strategically from the present to achieve the envisioned future (Holmberg and Robèrt 2000).

Chaordic Path: The path that walks between chaos and order, to add a certain structure or form, for when the future is unclear. The steps are intended to create generative structures that allow people to create together, allowing the emergence of new ideas and new ways of doing things (Corrigan n.d.).

Chaordic Stepping Stones: Steps to implement the Chaordic Path. Can be used both as a planning tool and to help understand what is being discovered about the community (Corrigan n.d.).

Dragon Dreaming: “(...) a holistic method for the implementation of creative, collaborative, sustainable projects” (Dragon Dreaming n.d.).

Ecovillages: “A human scale, full-featured settlement, in which human activities are harmlessly integrated into the natural world, in a way that is supportive of healthy human development and can be successfully continued into the indefinite future.” (Gilman and Gilman 1991).

Eco-municipality: A municipality or county government that adopts a particular set of sustainability principles and is committed to a systematic, participatory approach for implementing them (Institute for Eco-Municipality Education & Assistance 2013).

Five-Level Framework: A generic framework for planning in complex systems. It comprises five interdependent levels: (1) System, (2) Success, (3) Strategic Guidelines, (4) Actions and (5) Tools (Robèrt 2000; Robèrt et al. 2002).

Framework for Strategic Sustainable Development (FSSD): The application of the generic five level framework to the socio-ecological system, that is ‘society within the biosphere’. The FSSD was developed through a scientific consensus process (Robèrt 2000; Robèrt et al. 2002).

Fundamental Human Needs: Innate and universal requirements that need to be satisfied in order for people to remain physically, mentally and socially healthy. Manfred Max-Neef identified the nine fundamental human needs as: Affection, Creation, Identity, Idleness, Freedom, Participation, Protection, Subsistence and Understanding (Max-Neef 1991).

Human Capital: The competencies of individuals that facilitate the formation of personal social and economic well-being (Jacobs 2007).

Natural Capital: The ecological stocks and flows that provide a valuable yield of goods and services, as well as critical life support systems (Jacobs 2007).

Permaculture: The use of systems thinking and specific design principles in a conscious way to create communities, landscapes, and buildings which mimic the patterns of nature to yield an abundance of food, fibre and energy (Holmgren 2002).

Prefiguring: The act of representing, suggesting, or imagining in advance. In this context it points to the vision of a global, ecologically sustainable society.

Social Capital: Social capital is a concept used to describe the relationships that exist between people and groups and the social networks that develop from them (Putman, 2000).

Strategic Sustainable Development: Development that follows strategic guidelines based on ‘backcasting from sustainability principles’ to plan and implement actions that assist society to move towards a sustainable future (Robèrt et al. 2002).

Sustainability Challenge: The challenge faced by society as a result of systematically increasing unsustainable practices within the biosphere.

Sustainability Principles: The four system conditions for a sustainable society within the biosphere, based on a scientifically agreed-upon vision of the world (Holmberg and Robèrt 2000).

Reductionism: The process of reducing complex systems down into their basic components to identify the mechanisms by which the parts interact in an attempt to understand these systems.

Transition Town Movement: A network of communities self-organised around the transition model and Permaculture concept, to create initiatives that build resilience in response to peak oil, climate destruction, and economic instability (Hopkins 2008).

List of Abbreviations

BTH Blekinge Tekniska Högskola (Blekinge Institute of Technology)

EDE Ecovillage Design Education

FSSD Framework for Strategic Sustainable Development

GEN Global Ecovillage Network

MSLS Masters in Strategic Leadership towards Sustainability

TNS The Natural Step

WoS Wheel of Sustainability

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1 Introduction

Our global society is currently faced with the greatest collective challenge in human history. Our use of land, energy and natural resources, as well as the production of waste, is challenging and sometimes exceeding nature's capacity to regulate energy and material flows (Biggs et al. 2011; Steffen et al. 2011; Rockström et al. 2009; Vitousek et al. 1997). Since the Industrial Revolution, our technological power has increased exponentially enabling us to harvest, process and consume resources and produce wastes more rapidly while our global population has increased exponentially placing ever greater demands on the Earth's resources and natural systems. A large fraction of the world's current population of seven billion people is already deprived of the basic needs of food, water and energy thus a projected increase of two billion people will further exacerbate the pressure on the biosphere (Steffen et al 2011). Water stress is expected to affect up to two thirds of the world's population by 2025 (Levinson 2008). The speed and scale of our impacts on the biosphere, including biodiversity loss and climate change, is unprecedented and we are now rivalling geophysical processes. This time in our history is now being referred to as the Anthropocene (Steffen et al 2011).

The seriousness of the global situation is illustrated with some alarming statistics. According to WWF, global biodiversity declined by 30 per cent between 1970 and 2008 while the demand on natural resources has doubled since 1966 and humanity's ecological footprint exceeded the Earth's capacity by more than fifty percent in 2008 (WWF 2012). The evidence for global climate change is unequivocal and is strongly linked with human emissions of greenhouse gases, principally carbon dioxide (CO₂), as well as other human-driven changes to the global environment (IPCC 2007). Climate change adds further uncertainty regarding the resilience of the biosphere and its capacity to support human society now and in the future. Clearly, the current trajectory of our global society is unsustainable and changes are needed to avoid collapse.

1.1 The sustainability challenge

This is the global sustainability challenge and it can be viewed in terms of the funnel metaphor (Broman, Holmberg, and Robèrt 2000; Robèrt 2000), with the closing walls of the funnel representing the narrowing of options to solve systemic problems due to declining resources and the loss of opportunities for prosperity (Figure 1-1). Our challenge is to make it to the funnel opening without hitting the funnel walls (i.e. running out of resources) by eliminating society's unsustainable, systemic errors to create a sustainable society where resources are stabilized and opportunities for prosperity have stopped declining.

Global society has become increasingly urbanised with more than half the world's population now living in cities and expected to exceed 70% by 2050 (United Nations Human Settlements Programme 2009). Thus the urban environment is now the dominant human habitat and strongly influences how the narrowing of the funnel walls is expressed at the macro level or experienced by individuals and communities at the micro level.

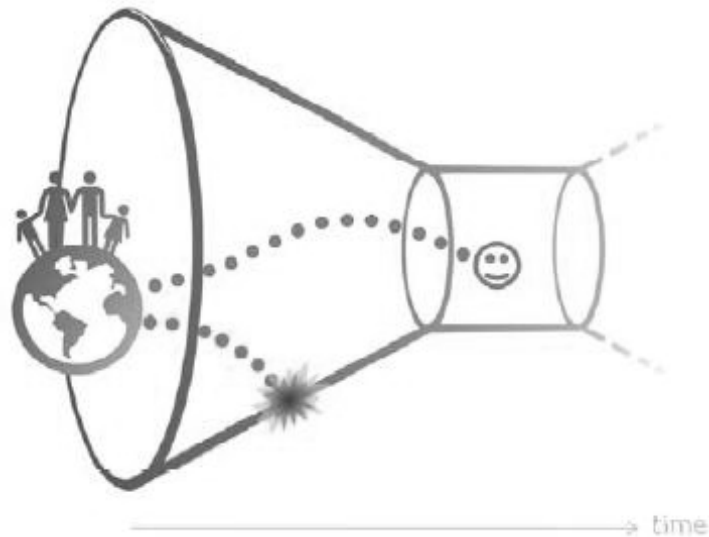


Figure 1-1. The funnel metaphor (Robèrt 2012)

1.1.1 Some current realities of urbanised society

Disruption of natural cyclical systems. Urbanisation is characterised by the spatial separation of food (and other primary resource) production, consumption and decomposition, such that the local, ecological cycling of vital nutrients and other chemical resources has changed into global, linear throughput systems (Rees and Wackernagel 1996 in Rees 2003). The use of artificial fertiliser in parts of Canada for example cannot keep up with the loss of nitrates through manure that cannot be reapplied to farmland (Canada 1991).

Excessive ecological footprints. Analyses of ecological footprints of cities show that the area of land required to support them can be several hundred times the nominal area of the cities themselves. For example, Vancouver, Canada, is estimated to have an aggregate eco-footprint that is 319 times its nominal area (Rees 2003). Urban areas are sustained largely by rural and extra-urban land and global commons all around the world and significantly influence the allocation of land use in these areas to provide resources and services. Such land use represents the most significant alteration of the Earth system (Vitousek et al. 1997). The ecological footprints of high income cities are large due to the high per capita consumption of resources and most high income countries have ecological footprints several times larger than their national territories (Rees 2003).

Contribution to climate change. Reliance on resources from distant lands coupled with reliance on fossil fuels and fertilisers is also contributing to CO₂ emissions that are responsible for climate change. Reducing consumption of resources is the key to reducing ecological as well as carbon footprints, which is essential in mitigating climate change and moving towards sustainability. (Church 2005; Dawson 2006; Rees 2003).

Limitations of consumer choice. Individual choice can collectively influence markets to provide more sustainable and low-carbon products but this choice is often difficult for people to exercise. In Britain for example, it can be challenging to find locally grown organic food as more than three quarters of organic food is imported (Church 2005). “Many people are willing to do their bit for the environment, but they do not always have the opportunity to

consume in environmentally friendly ways, because sustainable low-carbon choices are more expensive and harder to find. They should be affordable and broadly accessible for everybody.” (Kuneva 2009).

Social and economic inequality. Though present throughout history, social and economic inequality has emerged as a significant problem in urbanised societies (Massey 1996; OECD 2008; Wilkinson and Pickett 2010). Housing affordability, availability and location, coupled with the location and availability of employment and the degree of mobility provided by transport networks and infrastructure, have had significant bearing on the choices and affordability of living for many people in urban environments. Trends have been observed in cities in Australia, for example, where there is a correlation between lower household incomes and outer suburbs characterised by cheaper housing and poor connectivity to transport services and employment (Gleeson 2006). These trends result in a growing disparity between the distribution of wealth in society and contribute to crime and civil unrest (Massey 1996).

Community and social connectedness. Technological and economical influences have also contributed to changes in the way people relate to each other, leading to a loss of social connectedness and sense of community, also referred to as social capital (Putnam 2000). Technology (for example television, video and computers) has provided alternatives to traditional forms of social entertainment and networking while longer and unsociable working hours have diverted people’s time from spending it with family and friends or participating in social and civic engagement (Putnam 2000). The loss of social capital has also contributed to a growing list of social ills, such as crime, poverty and social disadvantage.

1.1.2 The benefits of natural, human and social capital in meeting the sustainability challenge

The current reality described above shows a loss of natural, human and social capital that are of particular interest in the context of meeting the sustainability challenge (Mulder, Costanza, and Erickson 2006). Any type of resource invested and capable of producing additional resources is referred to as capital (Flora et al. 2004 in Jacobs 2007).

Natural capital consists of all the natural resources available to a community, such as water, air, soil, biodiversity and landscape. It provides the resources that support the basic requirements of subsistence for communities such as water, food, raw materials and energy. The benefits of natural capital include ecosystem services such as climate regulation, air quality regulation, disease and pest regulation, and water purification and waste treatment (Everard 2013). In contrast to the large ecological footprints caused by urbanisation (Rees 2003), a community that is able to grow its own food and recycle waste, reduces the spatial separation of primary production, consumption and decomposition.

The attributes of individuals that contribute to their ability to support themselves, strengthen community and otherwise contribute to community organisations, to their families and to self improvement are referred to as human capital (Flora et al. 2004 in Jacobs 2007). A significant benefit from developing human capital is the great wealth available from the pool of skills, abilities and knowledge of community members. Communities who recognize the abundance of human capital attract people who are continuously learning and always willing to think differently and creatively. One of the greatest forms of human capital in any community is investment in development of competent leadership. (Jacobs 2007). Competent

leadership is an important skill needed in order to move society towards sustainability (Schwalb 2011).

Social capital is comprised of the relationships that exist between people and groups and the social networks that develop from them. Social capital supports communities by increasing the potential to resolve collective problems, by building trust that facilitates business and social transactions with cost savings, by increasing tolerance, empathy and socially beneficial behaviour, by connecting people to resources such as information and jobs, and by its positive influence on health and well-being for individuals and the community. Social capital, through voluntary associations and networks of civic engagement, promotes the function of democracy by facilitating communication between individual citizens and their political leaders. (Putman, 2000).

1.2 Characteristics of sustainable communities

The natural, human and social capitals discussed above are essential components of a sustainable community (Mulder, Costanza, and Erickson 2006). Kelin (2003) describes in the study *Defining a Sustainable Community*, four characteristics of an ideal sustainable community that are built on these capitals (Kelin 2003 in Irrgang 2005). These are i) Economic security, ii) Ecological integrity, iii) Quality of Life, and iv) Empowerment and Responsibility.

i) Economic security

A more stable community should provide for a variety of business opportunities, industries and institutions that are environmentally sound and financially viable. These should provide training, education and other forms of assistance to ensure adjustment to future needs. Jobs are to be available to community members and they should have a voice in decisions that affect them. In a more sustainable community residents' money remain in the community.

ii) Ecological integrity

A more sustainable community stays in harmony with nature by utilising the natural ability of environmental resources for human needs without undermining their ability to function over time. Such a community also respects natural systems by reducing and converting waste into non-harmful and beneficial products.

iii) Quality of life

A sustainable community recognises and supports people's sense of well-being, which includes a sense of belonging, a sense of place, a sense of self-worth, a sense of safety, and a sense of connection with nature. Goods and services are provided which meets people's needs, but with the ecological integrity of natural systems in mind.

iv) Empowerment and Responsibility

In a sustainable community people are empowered to take responsibility based on a shared vision, equal opportunity, ability to access expertise and knowledge for their own needs and a capacity to affect the outcome of decisions that affect them. In short, a

sustainable society is one that can persist over generations as its physical and social systems of support remains intact. (Kelin 2003 in Irrgang 2005, 23).

Regarding the quality of life in sustainable communities, Max-Neef proposes subsistence as a basic human need that can be satisfied by being in physical health, mental health, equilibrium, with sense of humour and adaptability, gained through the interaction with the living environment and social setting (Max-Neef 1991, see Appendix I). Medical Sociologist, Aaron Antonovsky considers having meaning in life to be the most important component of health and wellbeing (Antonovsky 1996). He describes meaningfulness as 'a belief that things in life are interesting and a source of satisfaction; that things are really worth it and that there is good reason or purpose to care about what happens'.

One model of sustainable community that can demonstrate powerful examples of these characteristics is the ecovillage.

1.3 Ecovillages

The ecovillage movement began back in the 1960s with the rise of the first intentional communities - the term 'sustainable community' was applied back then - as a response to social and ecological issues. The term 'ecovillage' was first coined by Diane and Robert Gilman (1991) in a report for the Gaia Trust in which they defined it as "...a human scale, full-featured settlement, in which human activities are harmlessly integrated into the natural world, in a way that is supportive of healthy human development and can be successfully continued into the indefinite future."

The integration of human and natural systems is based on creating virtuous cycles that "regenerate the land, enliven the community, and sustain its members in a cohesive whole" (Litfin 2012). Simple examples of this include the recycling of graywater into food production, composting of waste into soil, generating power from renewable energy and building local economies based on community resources (Dawson 2006; Leaf Christian 2003; Litfin 2012). One commonly used and recognised concept for developing integrated human and natural systems is called Permaculture.

1.3.1 Permaculture and ecovillages

Permaculture is a practical and holistic approach to the design of integrated human and natural systems that predates and powerfully informs the ecovillage movement (Litfin 2009). Developed by Bill Mollison and David Holmgren in Australia from a vision of small-scale sustainable agriculture and integrated systems inspired by nature, it is based on ethics and design principles that have been adapted to diverse social and ecological contexts around the world, including ecovillages. The Permaculture Flower (Figure 1-2) illustrates the key domains that require transformation to create a sustainable culture. It is through the evolution of the application of the Permaculture Principles and the integration of the domains of the flower that sustainability is achieved. The spiral path connects the domains, initially from the personal and local level to the collective and global level. (Holmgren 2002). Permaculture forms an integral part of the Gaia Foundation's Ecovillage Design Education (EDE) program (Mare 2009).

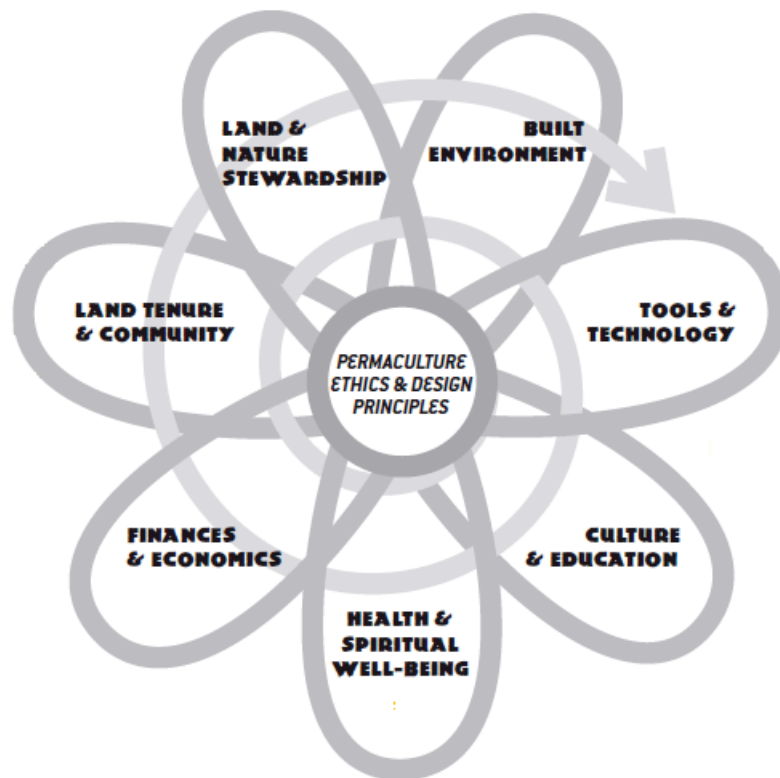


Figure 1-2. Permaculture Flower (adapted from Telford 2013)

1.3.2 The power of example

Ecovillages provide examples of communities successfully moving towards sustainability by focusing on particular aspects. Though demographically similar to people living conventional lifestyles, ecovillage residents consume less energy and resources, and appear to be more content with their lifestyle. Through their shared visions and strong communal bonds, they are often able to reach better solutions to similar problems faced by other people. (Metcalf 2012 in Andreas and Wagner 2012).

For example, a comprehensive study conducted with the inhabitants of Findhorn Community, in Scotland, on areas such as infrastructure, energy, food, waste and travel, found that the community had an ecological footprint half of the Scotland and United Kingdom average (Tinsley and George 2006). At Sieben Linden ecovillage, in Germany, the ecological footprint is only one-third of the German average (Würfel 2012 in Andreas and Wagner 2012). Also, their overall CO₂ emission is only 20 – 30% of the country average, and the emission in housing is even lower, at 10%, because of their sustainable and energy-efficient building techniques (Leafe Christian 2009). At Ithaca Ecovillage, in the USA, the houses consume 40% less energy and resources than the country average, and even more savings are possible and projected for the next settlement (Dawson 2006; Gilmore 2011; Walker 2005).

As well as strong performance in environmental sustainability, ecovillages such as Ithaca in the USA have achieved various forms of connectedness and fulfilment of human needs of inhabitants such as a sense of belonging and communion with life, the awareness of one's place in the whole system, sense of community and supportive association with other humans, strengthened family and social ties, and bonding among different generations (Kirby

2003). As residents of an ecovillage in Russia described “Such an environment gives a person health, confidence in the future, strength and optimism” (Lazutin and Vatolin 2010).

The sense of community and quality of life provided by ecovillages, is recognised and appreciated by residents as it gives meaning in life along with security, sense of belonging, and a feeling that you are appreciated (Kirby 2003; Meijering 2012 in Andreas and Wagner 2012). Ecovillage living is described as being more empowered, comfortable, equitable, secure and interesting (Metcalf 2012 in Andreas and Wagner 2012).

1.3.3 Can ecovillages help society move towards sustainability?

The ecovillage movement is seen by some as ineffective in driving change towards a new democratic and sustainable society (Fotopoulos 2000) in that it is too small, lacks common goals and strategies and is driven by an element of irrationalism, in the form of spirituality, which is claimed to be incompatible with democracy. Not opposing existing systems that foster unsustainable ways of living is also seen as a weakness (Litfin 2009).

However, through their holistic worldview and by prefiguring a viable future, the ecovillage movement has the potential to promote real planetary change, as ecovillages provide living laboratories for experimenting with new models in sustainable community and in finding and disseminating solutions to our many environmental and social problems (Dawson 2006; Dawson 2013; Leafé Christian 2012 in Andreas and Wagner 2012). The key contribution is the power of example as community-based demonstration and teaching centres to provide working models for harmonious and sustainable living (Dawson 2006; Global Ecovillage Network n.d.; Meijering 2012 in Andreas and Wagner 2012; Würfel 2012 in Andreas and Wagner 2012). This potential was increased by the creation of the Global Ecovillage Network (GEN) in 1995 helping to connect ecovillage communities and enabling the sharing and dissemination of information about sustainable living (Dawson 2006; Dawson n.d.; Litfin 2009).

Aspects of sustainable living learnt through the ecovillage experience can be replicated at higher scales of community. Indeed, ecovillages are viewed as necessary elements in the establishment of eco-municipalities to provide experimental nodes for diffusion of sustainability to the wider community (Dawson 2013; Gilman 2013; James and Lahti 2004; Lahti 2013). The Transition Town movement (Hopkins 2008) originating in the UK represents a scaled up version of the ecovillage model (Litfin 2012). Furthermore, as other existing ways of living that are unsustainable become more untenable as resources decline, established viable alternatives will become enormously salient (Litfin 2009). This is the premise of prefiguring.

Gilman (2007) affirms that the future of the ecovillage movement lies in the “growing ‘ecosystem’ of groups playing different roles in the movement – everything from the ‘on-the-ground’ centres of research, demonstration, and training; to specialized consulting groups, to urban neighbourhoods, to towns and villages, and to various networks and associations weaving these together.”

While not the only solution to the sustainability challenge, the ecovillage movement has a significant role to play in helping society move towards sustainability. Countercultural values, such as protecting the environment, authenticity, communal living, and personal growth, that are embraced by ecovillages have become more accepted in the mainstream thus

giving more credence to the ecovillage movement (Meijering 2012 in Andreas and Wagner 2012).

1.3.4 Challenges of the ecovillage movement

There is a lot of diversity in the movement, as each ecovillage has its own design and character, according to location, climate and culture, and varies in size from a cluster of houses to a community of hundreds (Sevier 2008). However, despite the differences in race, religion, culture, and many other aspects, what most ecovillages have in common is a shared passion and purpose to live more meaningful and sustainable lives (Leafe Christian 2003; Joseph and Bates 2003).

As people with different backgrounds and expectations get together there is potential for disagreements and even failure of projects. Most of the challenges faced by ecovillages have to do with agreements on a shared vision and understanding of the planning process, how to make decisions collaboratively and fairly, and economic decisions (Leafe Christian 2003). “Getting a group of people to agree on a common vision, make decisions collaboratively and fairly, and combine their money with others to own property together can bring up deep-seated emotional issues — often survival-level issues — that can knock a community off its foundations” (Leafe Christian 2003). Community life also brings challenges in the social aspect, such as the balance between personal and community life, communication and consensus issues, and difference in income (Kirby 2003).

Gilman (2007) also points out that, as the ecovillage movement broadens, it will encompass a wider diversity and complexity of political, philosophical, and lifestyle points of view. There are also variations in aspirations of ecovillage communities as to their visions of sustainability. For example, some ecovillages aim for self-reliance with respect to energy needs while others like The Village in Cloughjordan, Ireland, are connected to the local power grid (Philip 2013a). This brings many challenges to the movement and also an increasing need to understand how ecovillages individually and collectively relate to sustainability from a whole-systems perspective. This is essential knowledge if ecovillages are to become successful as role models in helping society move towards sustainability.

1.3.5 What is needed to help strengthen the ecovillage movement?

While ecovillages have access to a range of tools and concepts to assist with governance, designing, planning and decision-making, there still seems to be a challenge with the success of moving these communities strategically towards sustainability. More than 90 per cent of aspiring ecovillages and community groups never get off the ground; their envisioned communities never get built (Leafe Christian 2003). Meijering adds that of those that do start, half collapse within two years and half the remainder collapse after five years (Meijering 2012 in Andreas and Wagner 2012).

So what is lacking? One deficiency seems to be a systematic approach to integrating structure, processes and actions based on a systems understanding of sustainability. Ecovillages need tools to assist them in meeting this deficiency (Leafe Christian 2013; Philip 2013b; Wagner 2013a). Currently in ecovillages, planning seems to be more intuitive than structured and based on immediate needs and concerns. In other words, it is reactive more than proactive. It is difficult to get people to think beyond immediate needs because they are too preoccupied with day-to-day tasks (Richards 2013). Most ecovillages don't have thinking

and organising tools for strategic, long-term planning (Leafe Christian 2013). This highlights the need for tools that make planning more appealing and inclusive, to effectively deal with complexity and promote strategic thinking.

A search for current tools or concepts that have been developed specifically to assist ecovillages revealed a paucity of tools. However, it did uncover the Wheel of Sustainability (WoS), designed to help ecovillages promote a culture of sustainability. Recently published in 2012, the WoS is a very visually appealing concept. It visually conveys overall system requirements with human needs through different aspects of the local community.

1.3.6 The Wheel of Sustainability

The Wheel of Sustainability is a concept created by researchers Felix Wagner and Sandra Mende, of Research in Community (RIC), as part of a two-year research project with ecovillages, to help illustrate and understand the dynamics of a culture of sustainability. The authors emphasise the importance of a culture of sustainability, which goes beyond goals or regulations, but is an inherent part of our culture and lifestyles. It is intended to give guidance for the societal change process, at the community level, helping to ask the right questions and inspire reflection. (Wagner 2012 in Andreas and Wagner 2012).

The Wheel has three levels (or rings), as shown in Figure 1-2, which comprise different facets specific to each level. The levels or rings rotate to allow various alignments of the different facets, and in the form that it is presented it allows for as many as 144 different combinations. To do justice to the complexity and dynamics of a culture of sustainability, the mid-level, or *Implementation* level, is considered flexible in that the facets are changeable to suit the needs and understanding of the terminology by the users of the wheel. The intention is to allow for stimulation of creativity in the search for different solutions to address the global sustainability challenge at the community level, keeping the “big picture” in sight.

As the components of the wheel are flexible, more facets can be added or modified to make it more relevant for different social systems and users. The importance of the concept lies in highlighting the different relationships that likely exist and the possible collaborations that could emerge to benefit the whole system. This emergence happens at the level of *Implementation*, and takes into consideration the many possible ways in which human needs can be met or satisfied within the system.

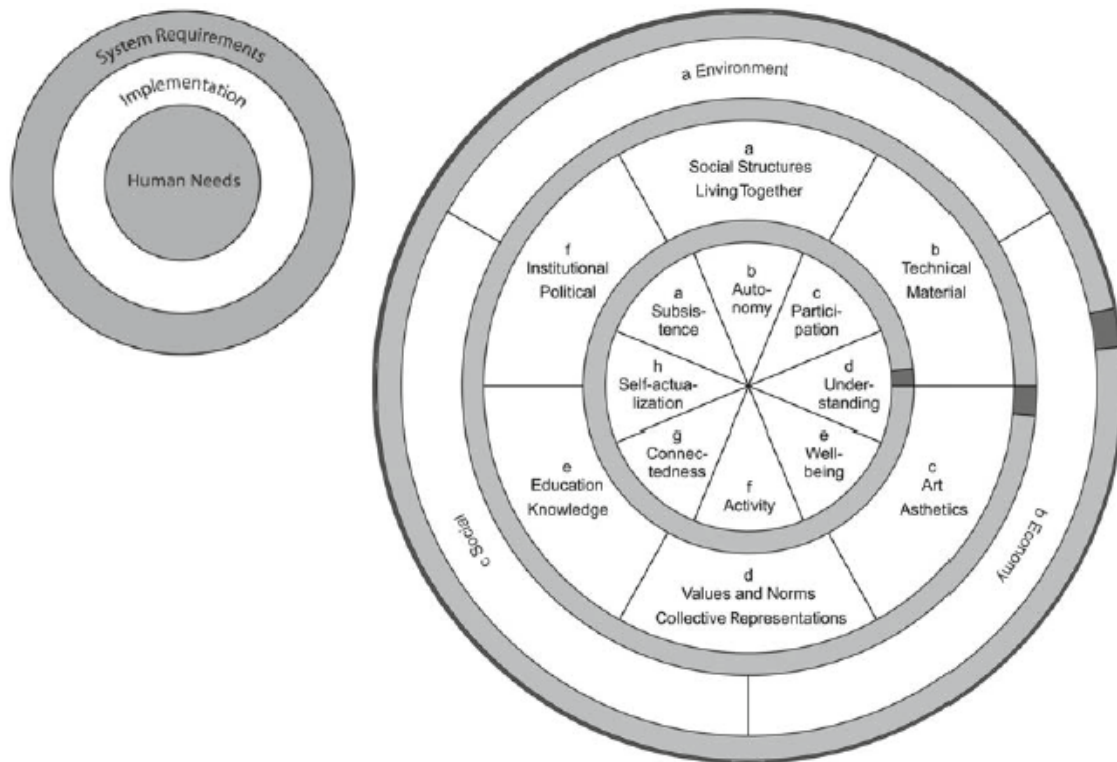


Figure 1-3. *Wheel of Sustainability* (Wagner 2012 in Andreas and Wagner 2012)

The three levels of the wheel represent the different scales of the system, and its relationships, for a sustainable community. The outermost level (*System Requirements*) symbolizes the requirements, and concurrently the objectives, of societal sustainable development, as per the Brundtland Commission definition (United Nations 1987). The innermost level (*Human Needs*) represents, from the individual's perspective, the socially shared human needs and living conditions necessary for a quality of life. Many different theories and authors were studied and the main common aspects were incorporated in this part of the wheel. Connecting the inner and the outer levels, the middle level (*Implementation*), corresponds to the design process towards a culture of sustainability (Wagner 2012 in Andreas and Wagner 2012). These aspects, as stated before, were taken directly from the experience of the work with ecovillages and are relevant for this audience.

The purpose of the Wheel of Sustainability is to help plan and inspire action towards a change to promote a culture of sustainability, in which the pillars of sustainability (economy, society and environment) are inherent and can be implemented in daily life. The developers intend it to be used in a workshop, for example, to encourage reflection on the relationships and stimulate new approaches (Wagner 2013b).

This research is still under development, currently analysing how a culture of sustainability can be constructed (i.e., the identification of relevant elements and dynamics of such a social system) and how such a culture may develop in terms of sustainable development (Wagner 2012 in Andreas and Wagner 2012). To date, it has not been tested yet or applied (Wagner 2013b). While offering valuable guidance for ecovillage communities, this tool has not been developed nor informed from a whole-systems perspective. Such an approach requires the application of a conceptual framework to enable a comprehensive and whole-systems perspective for strategic sustainable development and thereby help ecovillages demonstrate even more effectively the power of their example.

1.4 Framework for Strategic Sustainable Development (FSSD)

The Framework for Strategic Sustainable Development (FSSD) provides a systems perspective that allows us to deal with the complexity of the sustainability challenge by backcasting from a vision of a sustainable future bounded by the four Sustainability Principles (SPs), that define what society must stop doing in order to reach sustainability (Broman, Holmberg, and Robèrt 2000). This is the conceptual framework that ideally lends itself to assessing tools such as the WoS.

The FSSD, which is also known as The Natural Step (TNS) Framework, is a conceptual framework for planning in complex systems (K.-H. Robèrt 1994). It is composed of five distinct and non-overlapping levels: *System, Success, Strategic Guidelines, Actions* and *Tools* (Figure 1-4). It allows for information to be structured in a way that enables the understanding of all the levels and their relationships, avoiding reductionism (Broman, Holmberg, and Robèrt 2000; Robèrt 2000).

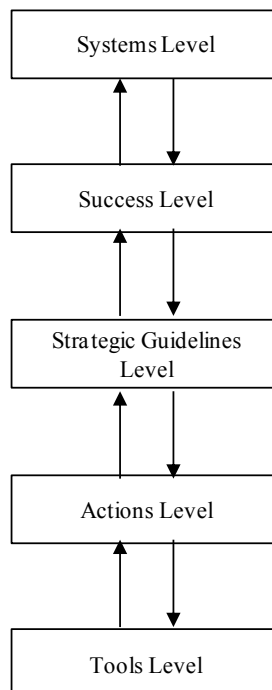


Figure 1-4. Framework for Strategic Sustainable Development

These five levels are described as follows:

1. Principles for the *constitution* of the system (e.g. ecological and social principles).
2. Principles for a favorable *outcome* of planning within the system (e.g. *principles for sustainability*).
3. Principles for the *process* to reach this outcome (e.g. *principles for sustainable development*).

4. Actions, i.e. *concrete measures* that comply with the principles for the process to reach a favorable outcome in the system (e.g. recycling and switching to renewable energy).

5. *Tools* to monitor and audit (i) the relevance of actions with reference to principles for the process (e.g. indicators of flows and key-figures to comply with principles for sustainability), and/or monitoring (ii) the status of the system itself, and impacts (e.g. ecotoxicity and employment), or reduced impacts, as a consequence of strategically planned societal actions. (Robèrt et al 2002, 198)

Information structured through the FSSD can then be used for strategic planning through the ABCD Process that uses the practice of Backcasting (see Appendix II).

The four Sustainability Principles (SPs) encapsulate and form the boundaries of a sustainable socio-ecological system (Robèrt 1994; Broman, Holmberg, and Robèrt 2000; Holmberg and Robèrt 2000). They are taken into consideration in all five levels of the framework, but particularly in the Success level when planning the vision for the future.

They are described as follows:

In a sustainable society, nature is *not* subject to systematically increasing...

...concentrations of substances extracted from the Earth's crust;

...concentrations of substances produced by society;

...degradation by physical means;

and, in that society...

...people are *not* subject to conditions that systematically undermine their capacity to meet their needs (Ny 2006, 5).

The four SPs provide a comprehensive, scientifically agreed-upon vision of how society is currently eliminating its own means to address sustainability. By understanding the basic mechanisms used to destroy the socio-ecological system through the lens of the SPs, it is possible to determine what society must stop doing in order to preserve the socio-ecological system and make it to the opening of the funnel, the metaphor used to describe the global sustainability challenge.

1.5 Research questions

Ecovillages act as role models for different communities within society as they demonstrate how to move towards sustainability through the power of example. A way of engaging ecovillage communities in strategic planning could help them be more effective and better communicate and plan their efforts. Therefore the goal of this research is to investigate how ecovillages might be better supported in demonstrating a strategic approach and fulfil their guiding role. This led to the main research question.

Main research question:

How might ecovillages be better supported in demonstrating a systemic and strategic approach to sustainability?

Supporting questions:

Before the main question could be answered, it was necessary to ask two supporting questions. First, current tools and concepts to help ecovillages plan more strategically were identified and studied. Therefore the first supporting question is as follows:

1. What does the FSSD reveal about current tools and concepts developed for ecovillages to plan towards sustainability?

The answer to the first question the intention is to show where the gaps are with the current tools and concepts. From that, a new prototype tool was developed to link together the different aspects of the whole system, plan strategically and hence be more successful. This led to the second supporting question:

2. What would a tool to facilitate communication and strategic thinking look like?

By answering the two supporting questions, the main question is answered.

2 Methods

In this section we outline the overall design of the research, including its phases and methods, participants and validity. For collecting data, the main methods used were:

1. Document content analysis; and
2. Expert review and feedback in the form of interviews and surveys.

The first supporting question seeks a better understanding of the current situation, by showing the strengths and weaknesses of the analysed concept from a whole-systems, strategic viewpoint, informed by the FSSD. After performing the analysis, the development of a new prototype started, addressing the identified gaps. The second supporting question involved the co-creation and review of the prototype with ecovillage and sustainability experts. The main research question was answered by integrating the knowledge gained in the research performed to answer the two supporting questions. The final prototype is intended to help ecovillages better communicate and plan towards sustainability from a whole-systems perspective.

This study was a qualitative research study based on the model developed by Maxwell (2013). This design was chosen because it is iterative and systemic in nature. The model has five components, one for each area of concern, connected to each other and to the research questions, in the middle, forming an integrated and interacting whole (Figure 2-1).

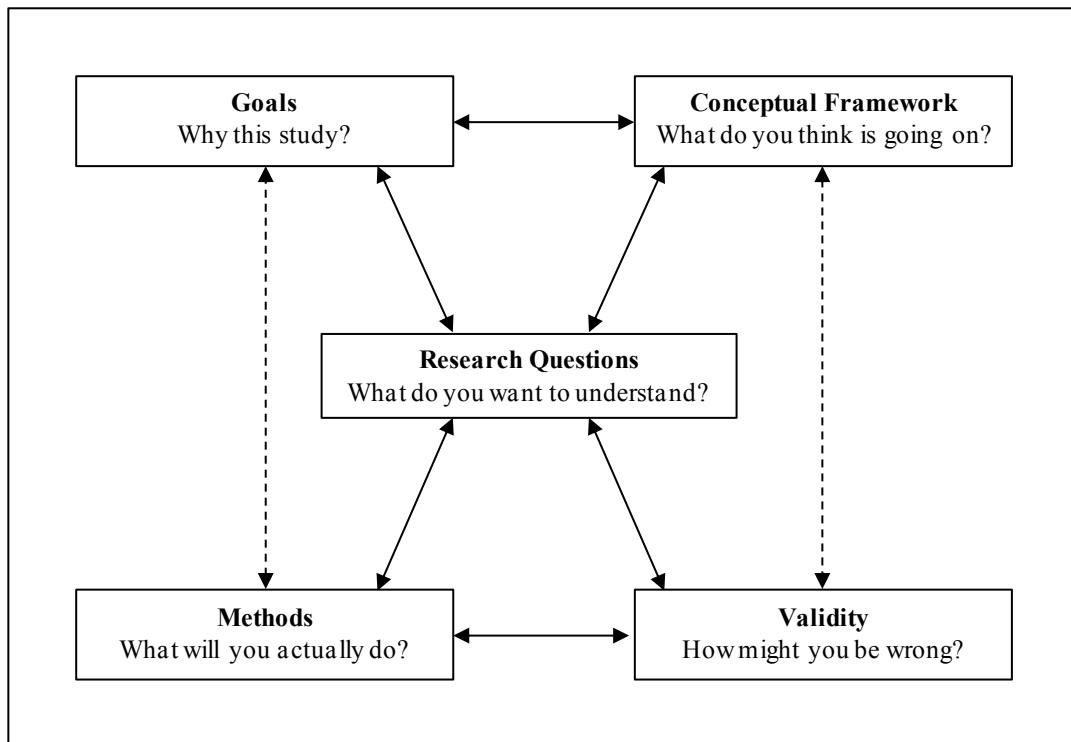


Figure 2-1. Research design (adapted from Maxwell 2013)

The research was divided into two phases, each linked with our research questions and goals as described in Figure 2-2 and sections 2.1 and 2.2 below.

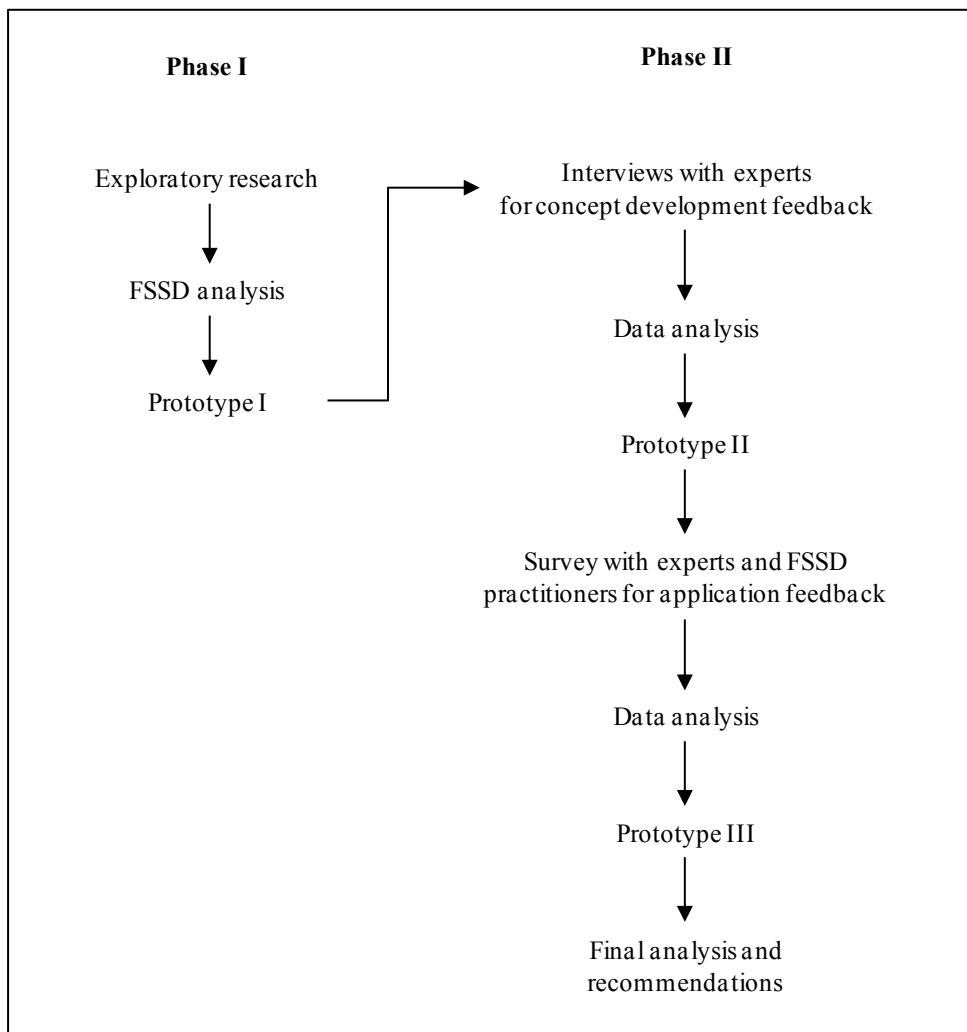


Figure 2-2. Research outline

2.1 Phase I

The first phase aimed to answer the first of our two supporting research questions: What does the FSSD reveal about current tools and concepts developed for ecovillages to plan towards sustainability?

The document content analysis method was used to answer this question. The introductory article on the Wheel of Sustainability (Wagner 2012 in Andreas and Wagner 2012) was analysed in Phase I. Additionally, the developer of the concept was interviewed. The content was analysed by interpreting it through the lens of the five levels of the FSSD as described by Robert (2000) and outlined in section 1.4. The results of this analysis were used to develop the first version of the prototype.

2.2 Phase II

This phase aimed to answer the second supporting research question: What would a tool to facilitate communication and strategic thinking look like?

To answer this question a panel of sustainability and ecovillage experts were selected to review the prototype and provide their feedback and suggestions, in the form of interviews and surveys. Data was collated and analysed, and then integrated to create the final version of the prototype.

2.2.1 Sampling

The experts selected were authors of books about sustainability and planning for ecovillages identified in our literature review. Additionally, ten ecovillages were contacted and invited to join the expert panel. The ecovillages were selected on the basis of the following criteria: fit the definition of an ecovillage (Gilman and Gilman 1991); well-known established exemplars of ecovillages as learning centres for sustainable living; representation of diversity within the ecovillage movement; and collaborative relationships with surrounding communities.

Out of the responses received, a panel of nine experts was formed (listed in alphabetical order by surname):

- Jonathan Dawson – head of economics at Schumacher College, researcher, author and sustainability educator (UK);
- Torbjörn Lahti – founder of the Swedish eco-municipality movement, social planner and author (Sweden);
- Diana Leafé Christian – author, speaker and activist, resident of Earthaven Ecovillage (USA);
- Robert Gilman – astrophysicist, sustainability pioneer and creator of the ecovillage concept (USA);
- Davie Philip – placemaker and facilitator at Cloughjordan Ecovillage (Ireland);
- Simon Richards – architect and consultant, resident of Findhorn Community (Scotland);
- Tony Sirna – development coordinator and founder of Dancing Rabbit Ecovillage (USA);
- Christoph Strünke – ecovillage resident and planner, member of the managing board of the settlement cooperative at Sieben Linden Ecovillage (Germany);
- Felix Wagner – researcher, founder of Research in Community (RIC) and Project Lebensdorf (Germany).

For the last round of feedback (surveys) FSSD practitioners were also invited to collaborate and give their opinion on the concept and its application.

2.2.2 Interviews

Expert review was undertaken in the form of semi-structured, open interviews conducted through Skype, and one of the interviews was conducted in person during an Ecovillage conference in Sweden. The reviewers were sent a prototype package with introductory information about the research, a draft of Prototype I, supporting information (about FSSD and Max-Neef's theory of human needs) and a set of guiding questions for the interview. The guiding questions are presented in Appendix III.

Interview data analysis. The interviews were recorded, transcribed and reviewed. Analysis of the transcriptions started with highlighting all the information from each transcription and gathering by themes. All feedback from all interviews was then grouped to look for patterns.

Feedback and suggestions were thoroughly analysed by the group in the form of discussions and organized in the form of a mind map (Appendix IV). After the discussion and analysis of patterns and suggestions, changes were made to the prototype, keeping the initial research scope and goals in mind.

2.2.3 Surveys

Prototype II was sent as a package to the panel of experts, with additional information, to present the evolved version that had been created with their recommendations. This round of feedback was collected in the form of a structured survey. The survey questions are presented in Appendix V. The structured survey was created online using SurveyMonkey (www.surveymonkey.com) and sent by email to the panel of experts and FSSD practitioners.

Survey data analysis. The final results of the survey were downloaded into a spreadsheet for further qualitative and quantitative analysis. Responses were analysed by all group members and then organized into the document. The results were compared and discussed until consensus was reached, and final adjustments were made to the prototype from the feedback received.

2.3 Validity

Throughout the research, the search has been systematic for supporting evidence to reduce to a minimum any possible assumptions. The search for biases was supported by the diversity of backgrounds and mindsets of the researchers. The range of data collection methods, a combination of document analysis, interviews and surveys, combined with the fact that there were three researchers to study the same topic, also helped to validate the discussions and knowledge integration.

For collating interview data, validity was assured by having one member of the group mainly hosting the interview, while the other two participated and took notes. Additionally, notes were checked against the highlighted interview transcriptions. Validity of the expert feedback was assured by having a second round of feedback (survey) to check for understanding and address any need for further clarification.

3 Results

This chapter includes the results of the research findings per phase as described in the methods section, starting with the results of the two supporting research questions. For the first phase results of the FSSD analysis are presented along with the description of the first prototype, and for the second phase, the feedback received in interviews and surveys to further develop the prototype. The final prototype created is presented in the Discussion (section 4.2.4).

3.1 Phase I

This section includes the main findings of the analysis of the concept using the FSSD and the description of Prototype I.

3.1.1 FSSD analysis of the Wheel of Sustainability

The table below presents a summary of the main findings of the FSSD analysis of the Wheel of Sustainability (WoS) (Table 3-1).

Table 3-1. Summary of results from the FSSD analysis

Systems	<ul style="list-style-type: none"> - Helps its users better understand the systems that they are part of and its relationships as part of a broader context. However, since the system is not described, the boundaries encompassed by this system are dependent on each user’s understanding. - Assumptions are that the users have sufficient understanding to be able to define what the system requirements and human needs are, which might not be correct. - The different components of the wheel were carefully studied to include all relevant aspects of ecovillage life, however, they may still be modified to accommodate different communities’ situations.
Success	<ul style="list-style-type: none"> - The Wheel does not provide a definition of success, however, it can help each community create its own vision of success within the proposed structure. - The different aspects included in the wheel can cover all four sustainability principles to some extent. However, it was not designed to work at this level. - Since the system boundaries are not clearly defined, it is not possible to plan towards sustainability successfully without that understanding. - At this level biases can occur due to the lack of whole-systems perspective and the definitions of success within this system. - As it has the human needs placed at its core, it can be inferred that stronger emphasis is placed on SP4, as it was created from the work with ecovillages.
Strategic	<ul style="list-style-type: none"> - The Wheel is intended only to be a conceptual model, so it does not include the strategic component.
Actions	<ul style="list-style-type: none"> - The “Actions” level is not covered.
Tools	<ul style="list-style-type: none"> - The “Tools” level is not covered.

With respect to the WoS, an analysis informed by the FSSD revealed that it could help its users better understand the social, environmental and economic systems of which members

of an ecovillage community are part of, and the potential inter-relationships in the ecovillages context. However, since the full systems perspective of the ecovillages within society within the biosphere is not definitively described, the boundaries of the system requirements encompassed by WoS at the ecovillages level are dependent on each user's individual understanding, instead of a science-based understanding.

At the Success level, the WoS could foster the move towards a culture of sustainability, and inspire each community to create its own vision of success within the proposed structure. The human needs are placed at its core, placing a strong emphasis on satisfying human needs sustainably. The four sustainability principles are embedded intuitively to some extent, however, since the system boundaries are not clearly defined, it is not possible to backcast and plan towards sustainability successfully meeting these human needs within nature's boundaries. Therefore biases can occur due to the lack of a whole-systems perspective and the various definitions of success that people have. As the WoS is only a conceptual model it does not include components at the Strategic, Actions and Tools levels.

3.1.2 Prototype I

The above information from the FSSD analysis informed the development of Prototype I, which resulted in the replacement of the original WoS categories of human needs with Max-Neef's defined human needs (Max-Neef 1991; Appendix I) and the inclusion of the Sustainability Principles as system boundaries. A five-step process (*Awareness, Vision, Assess, Co-Create and Realize*), based on the ABCD process was created, with guidelines of how the wheel could be used in each step. The prototype description sent to reviewers is presented in Appendix VI.

3.2 Phase II

This section includes the feedback received in both expert review rounds (interviews and surveys), to further develop Prototype II and III.

3.2.1 Interviews

Nine interviews, of approximately one hour each, were conducted for feedback and suggestions for the development of the prototype. Although a set of guiding questions had been sent in advance, the conversations tended to follow a different structure. Since the reviewers had received a prototype package with information about the project, the first minutes of the interviews were dedicated to checking the understanding and further explaining the intentions of the research and the prototype. A brief explanation about the FSSD and WoS was also included, and also about the SPs and Max-Neef's theory of human needs and satisfiers, in case that interviewees were not familiar with these concepts. Once a shared understanding of the intention of the prototype and the proposed collaboration had been achieved, the following six main themes were discussed in conversations:

1. Understanding of the prototype - potential use;
2. Ecovillages - current situation and need;
3. Strengths of the prototype;
4. Weaknesses of the prototype;
5. Suggestions for improvement of the prototype;
6. Barriers, challenges and assumptions.

The set of questions was checked at the end of the conversation for any areas that hadn't been covered and further comments were addressed.

Comments and feedback received are summarised in this section. For the complete assessment please refer to Appendix IV.

Understanding of the prototype - potential use. About the potential use of the prototype, most of the reviewers affirmed that it could be used for communication and creating a shared understanding (Gilman 2013; Lahti 2013; Richards 2013; Wagner 2013a; Philip 2013b; Sirna 2013). The potential for communicating with different audiences and levels of society was also mentioned (Philip 2013b; Wagner 2013a; Gilman 2013; Strünke 2013). As Dawson (2013) said, "ecovillages are the interface between the municipality and transition (towards a sustainable society)". Gilman (2013) highlights the potential of the prototype to act as a framework for communications, both internally and externally. "You can get to planning more easily by focusing on tools for communication." (Gilman 2013).

Most reviewers also agreed that it could help ecovillages plan and move towards their vision (Gilman 2013; Wagner 2013a; Sirna 2013; Leafe Christian 2013; Dawson 2013; Strünke 2013). It visually supports an understanding of the human needs and a broader vision of sustainability linked to community-level activities (Gilman 2013; Sirna 2013). It was also described as "the winning relationship between the three systems that actually defines the necessary rules for a society" (Lahti 2013).

Some reviewers mentioned that ecovillages already have a vision of sustainability (Strünke 2013; Wagner 2013a; Sirna 2013), so the concept could help them foster it and make it more clear (Wagner 2013a). While keeping the vision in mind (Strünke 2013), it also vitalizes and facilitates it within the community (Richards 2013). It was also said that it could help to facilitate a co-created journey, acting as a compass to help the community navigate towards success and move in the right direction (Philip 2013b; Leafe Christian 2013; Wagner 2013a).

Since some ecovillages are already planning for sustainability, Dawson (2013) stated that it could be "seen as something that helps communities be more conscious of the ways that they are working on the strategic level, and to distinguish between the different types of strategic plan they're developing". As Gilman (2013) concluded, it should be there to support what they are already doing.

It was also mentioned that the concept could be helpful to keep conversations grounded and focused (Gilman 2013; Philip 2013b), stimulate creativity (Gilman 2013; Wagner 2013a) and help ask the right questions (Sirna 2013; Wagner 2013a).

Ecovillages - current situation and need. As regards the current situation, the need for more effective and clear communication was mentioned (Wagner 2013a; Gilman 2013; Richards 2013), as people usually have different understandings of sustainability and how it could be achieved (Wagner 2013a).

Some of the reviewers also affirmed that most ecovillages don't have a structured planning process (Wagner 2013a; Philip 2013b; Sirna 2013; Leafe Christian; Dawson 2013; Gilman 2013). Dawson (2013) explained ecovillages as being a complex adaptive system, where there is nobody in charge but somehow it works. Strünke (2013), who lives in Sieben Linden, said that they have many projects happening simultaneously, and that the community spends most of the time in discussions and making decisions about proceeding steps.

Reviewers mentioned the following tools and concepts as being related to the prototype and also familiar to ecovillages: Permaculture (Philip 2013b; Sirna 2013; Leafe Christian 2013), Chaordic Stepping Stones (Philip 2013b), Dragon Dreaming (Philip 2013b; Strünke 2013), Community Sustainability Assessment – CSA (Dawson 2013; Wagner 2013a), Ecovillage Design Education – EDE (Wagner 2013a), 8 Shields Method (Sirna 2013).

Strengths of the prototype. The main strength identified by the reviewers was the inclusion of Max-Neef's theory of human needs (Sirna 2013; Dawson 2013; Lahti 2013; Strünke 2013). The whole-systems approach was also mentioned, in helping people keep the “big picture” in sight (Sirna 2013; Philip 2013b). Also, some reviewers reaffirmed the prototype's strength in that it can provide grounding and shared understanding of sustainability linked to community level activities (Gilman 2013; Sirna 2013), encouraging people to co-create together (Wagner 2013a). It was also mentioned that the concept helps to nurture a balanced approach in meeting community needs in relation to society (Sirna 2013; Philip 2013b). Lahti (2013) commented on the relationship between the micro level (human needs) and macro level (biosphere).

The prioritization questions were a strength pointed out by Leafe Christian (2013). Gilman (2013) mentioned the broader, societal, planetary scope, and Richards (2013) liked that the concept was “not bound by time” as “it was outside time and space”.

Regarding the graphic representation of the prototype, two reviewers mentioned that the wheel was an effective form of representation (Richards 2013; Gilman 2013). Philip (2013b) said “it helps you see in one picture all the things you need to think about”. Richards (2013) mentioned that it was a simple representation of complexity and that this was a strength but could also be a weakness at the same time. Strünke (2013) liked the placement of the vision and core values in the middle.

Weaknesses of the prototype. The main weakness mentioned was the complexity, that it could be difficult for people to understand (Wagner 2013a; Dawson 2013; Leafe Christian 2013). From the complexity and the necessity of further explanations, it was mentioned that it would need a facilitator (Richards 2013). Lathi (2013) also pointed out that the model itself is not enough to promote creative solutions, and that the concept of the middle wheel (Implementation) was not clear enough.

Suggestions for improvement of the prototype. Suggestions of improvements were given in three main areas: language, concept and design. For the language, two reviewers suggested using permaculture language and concepts, and they also suggested using more concrete language and examples (Leafe Christian 2013; Philip 2013b). Philip suggested to use appreciative inquiry (Philip 2013b).

More detailed explanation about the concept was recommended (Wagner 2013a; Richards 2013; Lahti 2013). Lahti (2013) commented that the SPs are not enough, suggesting that it should also include the spiritual connection to nature. Reviewers also suggested including a set of instructions or process steps to guide users in its application (Philip 2013b; Lahti 2013; Wagner 2013a; Sirna 2013). For the proposed process, Philip (2013b) suggested starting with the purpose step, Sirna (2013) suggested including a monitoring step and Strünke (2013) a celebration step.

Wagner (2013a) suggested to start with simple ideas and give people examples, Dawson (2013) also recommended more simplicity. For the design, simplicity was further

recommended, so that people can quickly understand the graphic (Dawson 2013). Richards (2013) said that it needed to be more user-friendly, and suggested the use of technology (apps, youtube, etc.).

Barriers, challenges and assumptions. One challenge mentioned was that the time for planning endeavours can be limited in ecovillages (Leafe Christian 2013; Dawson 2013). Richards (2013) affirmed that it is difficult to get people to think about long-term issues, because they are always thinking about their immediate needs. Leafe Christian (2013) said that most ecovillages don't use this level of sophistication of organizing thinking. Sirna (2013) cautioned not to overwhelm people, because a change process can be challenging and takes time.

Dawson (2013) pointed out that many ecovillages are concerned with commercial strategies and for this reason, may attract people whose mind-sets are not aligned with the values of the community, and that the model should be flexible enough to consider these trade-offs. This diversity of people living in ecovillages was also mentioned by Richards (2013). Dawson (2013) continued saying that some ecovillages have different intentions, for example, healing or spiritual, and that they might not be interested in this kind of sustainability planning. In this sense, it should be made clear who the audience is and what scale of ecovillage could use the prototype (Dawson 2013; Philip 2013b).

Lahti (2013) said that the people who intend to live in the ecovillage should be involved in the planning as soon as possible, and not only when they move in. Furthermore, for established communities, care should be taken “not to come across as if you're trying to instruct them what to do” (Gilman 2013).

Other recommendations were to be accurate with the language (Dawson 2013) and be clear about the definition of the system (Sirna 2013). Finally, about the model, Lahti (2013) said that it couldn't all be explained in one picture and that perhaps we needed more than one graphic.

3.2.2 Prototype II

Based on the feedback received, the second version of the prototype placed the vision and values of the community in the middle, surrounded by Max-Neef's human needs, with a ring around them representing SP4. The *Implementation* (middle) level was changed to comprise the seven petals of the Permaculture Flower. SPs 1, 2, and 3 remained in the outer part of the wheel representing the biosphere and the ecological system boundaries. Guiding questions to help integrate the use of the prototype within planning processes were included. The prototype description sent to reviewers is presented in Appendix VII.

3.2.3 Surveys

A total of ten responses were received, three from the expert group and seven FSSD practitioners. Results were combined as the same set of questions were given to both groups. A summary of the feedback follows in this section and the complete list of questions and answers is provided in Appendix V.

The first question asked if Prototype II was easy to understand and most of the respondents answered positively – ‘yes mostly’ and ‘definitely’ (80% combined). The next question sought to further probe the respondents' understanding by asking if the prototype visually

conveyed the concept of the whole system (the ecovillage within society within the biosphere) and the majority of the responses were also positive (60% combined). Regarding the prototype graphic, the result was split evenly between positive and negative in response to the question of whether an outer ring should be added to represent the biosphere.

Regarding implementation, 62.5% agreed that the prototype is generic enough to be used at different stages of planning and with different audiences, and 55.5% agreed that the guiding questions were helpful with implementation and integration within existing planning processes. Most respondents only agreed ‘to some extent’ about the suggested uses of the prototype. As a communication tool, 50% of respondents agreed ‘to some extent’ that the prototype could improve communication. As for brainstorming, 44.4% answered that it could help ‘to some extent’, while 33.3% thought that it ‘definitely’ could. With respect to prioritizing actions and planning strategically, 66.7% of respondents said that the prototype could help ‘to some extent’. When asked if the prototype could help communities identify their gaps and strengths in relation to sustainability, 55.6% said that it could ‘to some extent’.

In response to the last question of the survey, most respondents (66.7%) agreed on the need for preparatory questions and information to be included in the prototype.

3.2.4 Prototype III

Surveys results informed improvements in the design and concept of the prototype and also in the creation of a prototype introduction. To enhance the understanding of the concept, the SP boundary rings were renamed as “Ecological Sustainability Principles” and “Social Sustainability Principle”, and an outer ring was added to represent the biosphere. Introductory information to the prototype was created in order to further clarify the prototype concept, intention, and use. The final prototype is presented in section 4.2.4.

4 Discussion

This section begins by discussing the findings for the supporting research questions and is concluded by answering our main research question and presenting the final prototype.

The analysis of the WoS using the FSSD inspired enhancement of the original wheel by filling in what was missing to create Prototype I. The development phase also involved interviews with a selected panel of experts who were invited to co-develop Prototype II. Discussion of the expert feedback received is included below. A last round of feedback was obtained through a structured survey, which helped to validate certain aspects about the design, the possible ways the tool can be used and overall understanding of the function of the prototype. Finally, Prototype III is presented and described.

4.1 Phase I

4.1.1 FSSD analysis of the Wheel of Sustainability

The main recommendations that emerged from the FSSD analysis of the WoS are summarised in Table 4-1 below.

Table 4-1. Summary of recommendations from the FSSD analysis

Systems	<ul style="list-style-type: none"> - The Wheel provides a structure for creating a shared understanding of a community's transition to a culture of sustainability, the dynamics and its relationships, both internal and external. Once the definitions and the boundaries of each section are clearly stated, it can be used as a starting point for sustainability planning. It would complement the FSSD, to describe the Systems level. - It is a powerful visual tool and could be appealing to an ecovillage audience.
Success	<ul style="list-style-type: none"> - Enhance the concept by introducing the scientifically agreed-upon description of the system and its boundaries, the Sustainability Principles.
Strategic	<ul style="list-style-type: none"> - Needs complimentary baseline analysis and prioritization questions.
Actions	<ul style="list-style-type: none"> - Wheel can be incorporated in the brainstorming stage, to ensure all aspects of community life will be covered and invite co-creation.
Tools	<ul style="list-style-type: none"> - The WoS needs to be included in a broader, generic planning process, such as the ABCD process, to ensure its full strategic implementation and continuation. - Since it intentionally allows for modification and flexibility, other sorts of tools were identified to be complimentary to the WoS: visioning tools, engagement, planning, measurement, monitoring, etc.

The FSSD analysis of the WoS identified gaps in the presentation of the ecovillage system from the whole-systems perspective. What is missing from the wheel is a clear definition of sustainability, the scientific boundaries of the system, and a clear strategy on how to move towards a sustainable community.

4.1.2 Prototype I

Therefore, the initial prototype was designed to include these missing parts. Two main conceptual modifications were made to the WoS; addition of a visual representation of the boundaries of the Sustainability Principles (SPs 1-4) and Max-Neef's scientific definition of human needs.

The original system definition of the WoS referred to as *System Requirements* was replaced by scientifically established system boundaries defined by SPs 1-4 to provide a view of the whole system.

The human needs used by Wagner and Mende in the WoS were replaced by Max-Neef's list of nine fundamental human needs (see Appendix I), because they are a scientific concept that give a universal definition of human needs and also make the distinction between human needs and the satisfiers of those needs.

4.2 Phase II

This phase led to further development of the prototype through conducting interviews with selected experts and obtaining validation of the prototype through a survey. The interviews led to the development of Prototype II and the survey led to the development of Prototype III.

4.2.1 Interviews

To summarise and discuss the results presented previously, expert feedback indicated that there is a general lack of understanding of the whole-systems perspective and a lack of a strategic approach. In addition, it indicated a need for a reminder of clear common vision and values that pull them forward. This is the creative tension referred to in the concept of Backcasting. In other words there is a need for the deliberate use of the creative tension in Backcasting originating from a clear vision of success and a clear understanding of the sustainability principles.

Feedback on the prototype is discussed in this section under the same six themes as presented in section 3.2.1. Interpretation of the feedback is incorporated and explained by what emerged from this iterative process.

Understanding of the prototype – potential use. It was clear from the experts who reviewed the prototype that it was interpreted to be a tool for communicating on different levels of the system, such as communicating with the surrounding communities and local governments. Communication is also the basis for other processes such as planning. It was noted that the prototype served as a very visual communication tool that could help in discussions to keep people focused and talking about the same thing. It was described as a good compass and could be used at different levels or for different reasons i.e. to foster or invigorate existing vision and values, to facilitate common understanding and to guide them to being more conscious of the whole system. With some more guiding questions it could also be very useful as a tool to integrate strategy in planning processes.

Ecovillages – current situation and need. The primary goal of ecovillage residents is to live more sustainably. Ecovillages, as living laboratories, can play an important role in moving society towards sustainability. The challenge is that there is a need for effective and clear communication about what sustainability actually means. Many are talking about the need for

transformation but there is no clear common understanding of what it means or how to achieve it. There is a clear need for guidance on a structured planning process, one that is strategic so they know what steps to take and in what order. The prototype highlights these aspects whereby the complexity of the sustainability challenge and meeting human needs within the limits of nature are now emphasised and easier to discuss and communicate.

Feedback also showed that ecovillages already have processes in place to help them plan (sometimes intuitive) so the prototype was intentionally designed to be flexible enough to be integrated with these different existing processes or tools, enhancing them by bringing the whole-systems, strategic approach.

Strengths of the prototype. The experts liked that Max-Neef's human needs were the driving force in the centre of the wheel and that the prototype stimulates discussion on how to satisfy these needs within the boundaries of nature. It helped them to see the big picture, grounded in a shared understanding. The prioritisation questions made it useful as a tool to guide communication around how to make a strategic plan.

Weakness of the prototype. The concept of the prototype was not clear enough to some of the experts. It was difficult to understand without more supporting information and instructions on how to use it. It was not clear where someone would begin, indicating the need for more guidance or an integrated process.

Suggestions for improvement of the prototype. These were mainly on the design, language and concept. The main challenge is to keep the concept simple enough to understand yet also represent the complexity of the system. Language used in the prototype must relate to ecovillage community life and other concepts and tools that they are already familiar with. The design is key in order to be an effective communication tool so it needs to be more user-friendly or use modern 3D technology like YouTube, have a set of instructions or steps explaining how to use it and a more detailed explanation of principles behind the concept.

Barriers, challenges and assumptions. The experts cautioned about the barriers and challenges mostly related to ecovillages having limited time or interest for strategic planning. In addition, the audience is further limited to those few who like to think strategically, as the majority of people living in ecovillages are not interested in this level of planning. Often they have different intentions for being in the community in the first place. There is often a conflict of interest with vision and values being compromised, as commercial strategy is placed in front of sustainable strategies for economic reasons. It can be a challenge for ecovillages to integrate commercial and sustainability strategies.

It is often assumed that most people understand the boundaries of the whole system, when that is not the case. Language is also an important factor to consider as not everyone understands academic language and scientific terms. Therefore translation of scientific terms and principles relating to the concept into familiar terms and descriptors that are being used by the ecovillage community is important.

4.2.2 Prototype II

Overall what emerged from this co-creative process is that the prototype addresses the need for a visual communication tool by bringing together the aspects required for a vision of success and showed a potential as a tool for strategic guidance, like a compass showing how to get there. Most of the reviewers said that ecovillages already have a vision and values

established and that our prototype could help them to foster, energize or vitalize it. So the early visioning stage is out of the scope of this prototype. The specific feedback from each expert was taken into consideration and the prototype was modified to address the following three main areas:

The Sustainability Principles. Supporting information on the Sustainability Principles to better explain the system boundaries was requested. Furthermore, instead of placing the four sustainability principles on the outer ring as in the original prototype, what emerged from the feedback is that the three ecological boundaries should remain on the outer ring of the wheel while SP4 encloses the human needs in the centre. This immediately gives a different perspective and is intended to help communicate and facilitate solutions to the main question about how to meet human needs within the ecovillage community according to the vision and values while also considering the system boundaries (i.e. other peoples' needs globally while remaining within the ecological limits of the earth).

Visual design and concept. The core vision and values of the community were missing in the WoS. These were added to the prototype by placing them in the centre of the wheel, drawing more focused attention to the Success level of the system.

The Permaculture Flower with its seven domains replaced the previous *Implementation* ring. It is a well-established and recognized concept and covers all relevant aspect of community life and at different levels. The advantage of using the permaculture language is that it facilitates shared understanding at the implementation level of the community, as most ecovillages are familiar with these terms and descriptors.

Use of the prototype. A more extensive list of questions was specifically designed to help integrate the prototype and provide guidance on where to start using it. The questions were inspired by The Weave (Meisterheim, Cretney and Cretney 2011) and organized in four categories, aligning with the steps of the ABCD process. They were also checked against the steps of the Chaordic Stepping Stones and Dragon Dreaming, to ensure that they could also be relevant to these planning processes, already familiar to ecovillages. The questions are not supposed to be used as a process per se but rather as an invitation to start creative, grounded and meaningful conversations. The list of questions is provided in the final description of Prototype III (section 4.2.4).

4.2.3 Surveys

The purpose of the survey was to validate Prototype II that evolved from our interpretation of the information that emerged from the interview sessions with our experts. The following is a discussion of the survey results under the three main areas as addressed previously:

The Sustainability Principles. The first three questions in the survey were directed at the general understanding of the prototype with respect to the ecovillage community, within society and the biosphere. Taken in its entirety, what emerged from responses to the first three questions indicated that understanding of the prototype can be further enhanced by depicting the Sustainability Principles as Ecological Sustainability Principles with no separating lines on the wheel between them, as all three ecological SPs are equally important, and it is thought that this will make it easier to understand for those who are not familiar with the terminology. For consistency, SP4 could be referred to as the Societal Sustainability Principle.

Visual design and concept. The survey results suggest that, even though respondents were evenly split on the question of whether to visually represent the biosphere, adding a representation of the biosphere might aid in the understanding of the system represented by the graphic. The biosphere could be easily included in the graphic by representing it as an additional ring on the outside of the wheel. By adding the biosphere in the graphic the three layers are represented: the individual; the ecovillage community and its interface with society; and the biosphere.

Use of the prototype. The remaining seven questions were generally related to the usefulness of the prototype and can be roughly divided into two functional areas: communication and strategic planning. Three of the questions were related to the ability of the prototype to facilitate shared understanding and better communication (questions 6, 7 & 9); three of the questions were specifically related to implementation and planning processes (questions 4, 5, and 8); and the last question (10) sought to find out if more preparation was necessary in advance of using the prototype.

Our discussion regarding the collective responses to questions 6, 7, and 9 of the survey confirmed that prototype seems to function well as a communication tool up to a point. To further enhance the effectiveness of the prototype as a communication tool, other facilitation tools, like Art of Hosting, and information tools could be helpful when facilitating planning towards sustainability with communities using the prototype.

After discussion about the collective responses to the questions on the strategic planning functionality of the tool, it was apparent that despite it being generic enough, more explanation was needed on how and when to use the prioritization questions accompanying the prototype to make the planning effectively strategic. The prioritization questions are listed under the section called *Realisation*. Reiteration of the importance of the prioritisation questions and a clear explanation of the relevance and application of each of the sections *Awareness*, *Evaluation*, *Co-Creation* and *Realisation* could also support facilitation of the use of the prototype.

To address the need for preparatory questions, the instructions for using the Wheel should explain the relevance of starting with the section on Awareness. It is essential for a community to have a clearly defined vision along with core purpose and values to enable backcasting in order to move strategically towards sustainability.

4.2.4 Prototype III

FSSD analysis, interviews and surveys informed the development and enhancement of the prototype to its final version, the Direction Indicator for Sustainable Communities (DISC).



Figure 4-1. Direction Indicator for Sustainable Communities (DISC)

Visual description. The inner ring has the vision and values of the community placed in the core surrounded by Max-Neef’s nine fundamental human needs. These are encircled by the boundary ring of the Societal Sustainability Principle (SP4).

The middle ring represents different aspects of how a community, and society, can satisfy their needs within the system, encircled by the boundary ring of the Ecological Sustainability Principles (SPs 1, 2 and 3). The outer ring represents the biosphere.

Using DISC. The Direction Indicator for Sustainable Communities is designed to act as a communication tool to bring a whole-systems perspective and sustainability principles into community planning processes, particularly at points in processes where the relationship between needs, satisfiers and the system boundaries is important. The set of guiding questions helps ecovillages to host these conversations and co-create ideas in order to generate a plan that is strategic. The prototype is designed to be generic enough to fit within, and enhance, current planning processes.

The concept was designed to link the relationship between human needs, possible satisfiers and the societal and ecological system boundaries. With regard to making strategic decisions that result in actions intended to satisfy the needs of the people in the community, a set of guiding questions are suggested for consideration when using the wheel.

The questions are organized in four categories, inspired by the steps of the ABCD process, in order to follow a logical sequence. These four categories are described as follows:

Awareness: Creating a shared understanding of the sustainability challenge and how the various ways of satisfying human needs are affecting the biosphere. Creating or assessing the community's vision and values to align with the principles of sustainability to ensure that human needs are met sustainably. The questions in this section can also be used to re-assess, or monitor, the planning process.

Evaluation: Learning about the strengths and weaknesses of the community and relating these to the vision and values of the community aligned with the Sustainability Principles. Includes monitoring.

Co-creation: The collaborative process where all participants gather to develop steps and actions in alignment with the vision.

Realisation: Selecting and prioritising steps and actions to move strategically towards the vision.

The questions are to be used as an invitation to start creative, grounded and meaningful conversations at different stages of community planning and decision-making.

Not part of the scope. The research showed that ecovillages already have a vision and determined values for their community, and for this reason, the steps to create them are not included in the scope of the prototype. Also, as ecovillages are already using different processes for planning and decision-making, a specific process is not offered as part of the prototype.

Table 4-2. Guiding questions

Awareness	<p>What is going on in the world that invites us to get together and find new, creative, innovative ways to satisfy our needs?</p> <p>What is our current vision? How is it aligned with the four Sustainability Principles (SPs)?</p> <p>What are the core values that we share and nurture in this community?</p> <p>What do we know about our ecological system, our biodiversity?</p> <p>How can we help society become more sustainable?</p> <p>How do we reach the world? How far can we reach? And who are we reaching?</p> <p>What do we want to contribute towards creating a sustainable society?</p>
Evaluation	<p>What are we doing well in this community in regards to sustainability?</p> <p>How can we expand and build from these best practices?</p> <p>What do we know about our community, what are our talents, our strengths, and our challenges?</p> <p>What aspects of community living do we wish to improve to achieve success according to our vision?</p>
Co-creation	<p>What are the multiple ways in which our true needs can be satisfied, while being mindful of others'?</p> <p>What aspects of the Permaculture Flower should be considered? Where should we focus our efforts?</p> <p>What do we need to practice as individuals, and as a collective, to make our vision come alive?</p>
Realisation	<p>Does the action or decision match our vision and values?</p> <p>Have we considered the implications of these actions for ourselves and others living beyond our community?</p> <p>Does this action take us in the right direction towards our vision?</p> <p>Is it a stepping stone for future projects and improvements?</p> <p>Will it bring a reasonable yield for our efforts?</p> <p>How can we prioritize these actions into short, middle, and long term?</p> <p>What aspects of the community are important to include in the implementation and delegation?</p> <p>What skills or resources do we have within our community to support these actions?</p> <p>What tools do we need to implement, manage, and monitor our plan?</p>

4.3 Limitations of the study

The validation survey yielded only a small amount of data due to the limitations of time and the availability of invited experts to respond. Furthermore, the prototype could not be field-tested due to time constraints. This would need to be undertaken to test its practicality and to refine the tool if necessary.

Due to the complexity of strategic planning in the context of the sustainability challenge, it is recommended that experienced facilitators assist in the application of the tool in ecovillages. The involvement of facilitators could also enhance the field-testing and further development of this tool.

4.4 Recommendations for further research

Further research is needed to explore the application of the tool. This research may require a collection of data over time and could involve facilitators in the application of the tool. The following focus areas are suggested:

Audience. Testing is needed within the ecovillage community itself. Research is recommended to determine the type of person in the ecovillage that is most attracted to facilitating the use of the prototype. Furthermore, this testing could also inform the appropriateness of language used in the prototype or whether it needs to be modified to improve understanding.

Intended purpose. The tool could be tested on ecovillages at different stages of development. The prototype is intended as both a strategic guidance tool and a communication tool. Research could also determine at what stage it functions better as a guidance tool or as a communication tool. Feedback could be collected via survey to inform improvements to the prototype.

Scale of application. Additional research is also recommended to test if the developed tool is generic enough to be applied at larger scales, such as regional or national governments, or in other types of communities planning towards sustainability, such as Transition Towns and Eco-municipalities.

5 Conclusions

As living laboratories, the purpose of the ecovillage movement is to test out and present viable options to society for sustainable living. The goal of this research project was to answer the question as to how ecovillages might be better supported in demonstrating a systemic and strategic approach to sustainability.

To answer the main research question, the following supporting questions were asked:

1. What does the FSSD reveal about current tools and concepts developed for ecovillages to plan towards sustainability?
2. What would a tool to facilitate communication and strategic thinking look like?

To answer the first supporting question a search of the literature was undertaken which led to the discovery of the WoS. This was the only recently developed tool for ecovillages that provided a flexible systems-based concept presented in a visually appealing form.

Analysis of the WoS informed by the FSSD showed that it is deficient in that it does not have a whole-systems definition of sustainability. This includes not having a vision bounded by clear scientific principles that would allow a strategic approach to planning through backcasting. It was Lahti's opinion that if there is no clear definition of sustainability with a defined goal then there is a risk of choosing solutions that will run into dead-ends or not move the community towards the desired reality (Lahti 2013).

To answer the second supporting question as to what a tool to promote shared understanding and facilitate strategic thinking would look like, a new prototype tool was developed from the WoS. The final prototype embodies a whole-systems perspective that incorporates a scientifically agreed-upon definition of sustainability. Inclusion of vision and values along with guiding questions allows the possibility of backcasting and a strategic approach to community development.

Through the integration of the conclusions of the two phases of research the main question has been answered. Prototyping a new tool through our research fulfils the intention to help ecovillages be more successful at what they set out to do and therefore fulfil their role in moving society towards sustainability.

The new prototype tool can act as a navigation tool, strategically guiding ecovillages in the direction of a sustainable society. It provides a shared mental model for ecovillages and supports improved communication and orientation in community planning and decision-making processes, both within and outside their communities. Through application of this tool it is intended that ecovillages can be better supported in their ability to communicate and plan ways of satisfying a community's human needs within ecological and societal boundaries.

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Appendices

Appendix I - Human needs and satisfiers

Manfred Max-Neef has identified the need for Human Scale Development that is “based on the satisfaction of fundamental human needs, on the generation of growing levels of self-reliance, and on the construction of organic articulations of people with nature and technology, of global processes with local activity, of the personal with the social, of planning with autonomy and of civil society with the state” (Max-Neef 1991).

His theory proposes a multi-dimensional taxonomy to establish the difference between needs and satisfiers as a useful and feasible tool:

1. The classification must be understandable. The needs listed must be readily recognizable and identifiable as one's own.
2. The classification must combine scope with specificity. It must arrive at a limited number of needs which can be clearly yet simply labelled but, at the same time, be comprehensive enough to incorporate any fundamental felt need.
3. The classification must be operational. For every existing or conceivable satisfier, one or more of the needs stated must appear as a target-need of the satisfier; the classification should allow for an analysis of the relationship between needs and the ways in which they are satisfied.
4. The classification must be critical. It is not sufficient for the categorization to relate satisfiers to needs. It is essential to detect needs for which no desirable satisfier exists. Also, it is to identify and restrain those satisfiers that inhibit the actualization of needs.
5. The classification must be propositional. To the extent that it is critical and capable of detecting inadequacies in the relation between the existing satisfiers and the fulfilment of needs, classification should serve as a trigger mechanism to work out an alternative order capable of generating and encouraging satisfiers for the needs of every man and woman as integral beings. It should also replace non-inclusive satisfiers by others of a more comprehensive nature, thus attempting to actualize several needs. (Max-Neef 1991, 29).

Human needs are defined as constant and unchanging through time, culture and context. In other words, the same fundamental human needs apply today in any part of the world as they did hundreds of years ago and will also apply into the future. What changes over time, between different cultures and in different contexts, are the ways in which people choose to satisfy their needs. These are called ‘satisfiers’ and are defined as individual or collective forms of *being*, *having*, *doing* and *interacting*, in order to actualize needs. For example, the fundamental human need of ‘subsistence’ can be satisfied by *being* physically and mentally healthy, *having* food and shelter, (*doing*) eating or working, and *interacting* in a social setting (Max-Neef 1991).

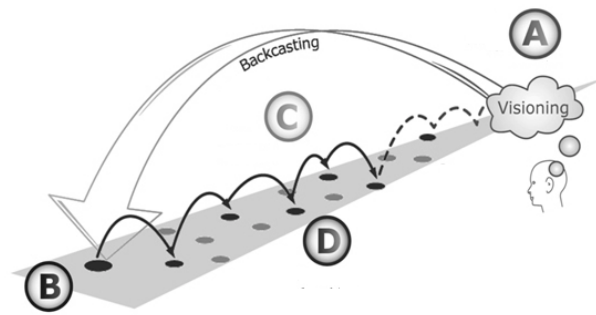
A summarized matrix of needs and examples of satisfiers is presented as follows:

	Being	Having	Doing	Interacting
Subsistence	Physical health, mental health, equilibrium, sense of humour, adaptability	Food, shelter, work	Feed, procreate, rest, work	Living environment, social setting
Protection	Care, adaptability, autonomy, equilibrium, solidarity	Insurance, savings, social security, health systems, rights, family, work	Cooperate, prevent, plan, take care of, cure, help	Living space, social environment,
Affection	Self -esteem, solidarity, respect, tolerance, generosity, receptiveness, sensuality, sense of humor	Friendships, family, partnerships, relationships with nature	Make love, caress, express emotions, share, take care of, cultivate, appreciate	Privacy, intimacy, home, space of togetherness
Understanding	Critical conscience, receptiveness, curiosity, discipline, intuition, rationality	Literature, teachers, method, educational policies, communication policies	Investigate, study, experiment, educate, analyse, meditate	Schools, universities, academies, groups, communities, family
Participation	Adaptability, receptiveness, solidarity, willingness, determination, dedication, respect	Rights, responsibilities, duties, privileges, work	Become affiliated, cooperate, propose, share, dissent, obey, interact , agree on, express opinions	Interaction, parties, associations, churches, communities, neighbourhoods, family
Idleness	Curiosity, receptiveness, imagination, sense of humour, tranquillity	Games, spectacles, clubs, parties, peace of mind	Daydream, brood, remember, relax, have fun, play	Privacy, intimacy, free time, surroundings
Creation	Passion, determination, intuition, imagination, boldness, autonomy	Abilities, skills, method, work	Work, invent, build, design, compose, interpret	Productive settings, workshops, cultural groups, audiences, spaces for expression, temporal freedom
Identity	Sense of belonging, consistency, differentiation, self-esteem, assertiveness	Symbols, language, religion, habits, customs, reference groups, sexuality, values, norms, history, work	Commit, integrate, recognize, actualise and get to know oneself, confront, decide on, grow	Social rhythms, everyday settings, settings which one belongs to, maturation stages
Freedom	Autonomy, self-esteem, determination, passion, assertiveness, open-mindedness, tolerance	Equal rights	Dissent, choose, be different from, run risks, develop awareness, commit oneself, disobey	Temporal/spatial plasticity

Source: Max-Neef 1991

Appendix II - ABCD process

The FSSD is a conceptual framework for planning towards sustainability. The ABCD process is a strategic planning process that has been specifically designed to implement the FSSD at different levels and within different contexts. It is intended to be used in team-based workshops to stimulate creativity and assist with planning. The four steps of the process were designed to help guide the team to backcast from a vision of success complying with the Sustainability Principles (SPs) (Ny 2006; Karl-Henrik Robèrt 2000).



Source: adapted from The Natural Step 2011

The steps are described as follows:

A step – Shared understanding and vision. The process starts with creating a shared understanding of the system and the sustainability challenge, and the overall concept of backcasting from SPs. A vision of a sustainable future in compliance with the 4 SPs is created in this step.

B step – Current reality assessment. An assessment of the current activities through the lens of the 4 SPs (contributions and violations).

C step – Brainstorming. Brainstorming a list of possible actions to help the organization move towards the vision.

D step – Prioritization. Analyse and prioritize the list of actions to create a strategic plan to move towards the vision. The prioritization questions below should be used to prioritize the actions, along with additional questions created according to each organization's situation and needs.

Does the action or investment move you in the right direction?

Does the action or investment provide a stepping stone for future improvements?

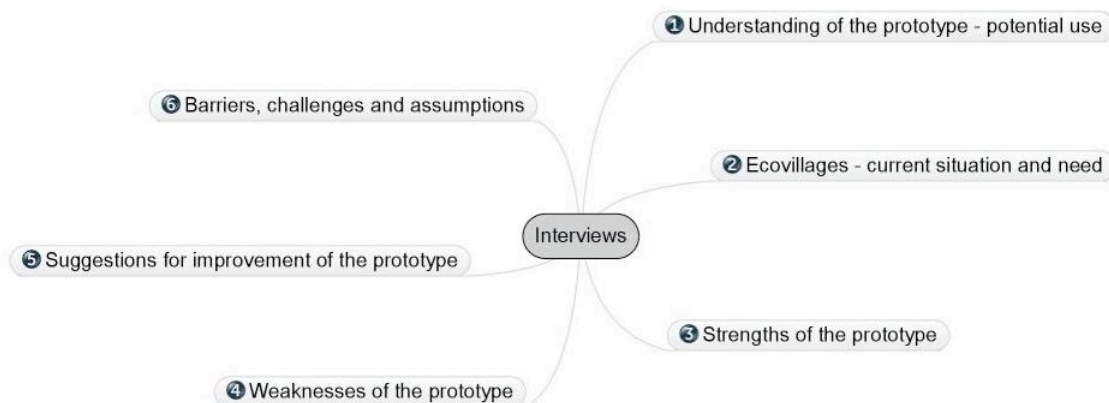
Does this action provide an adequate return on investment?

Appendix III - Interview guiding questions

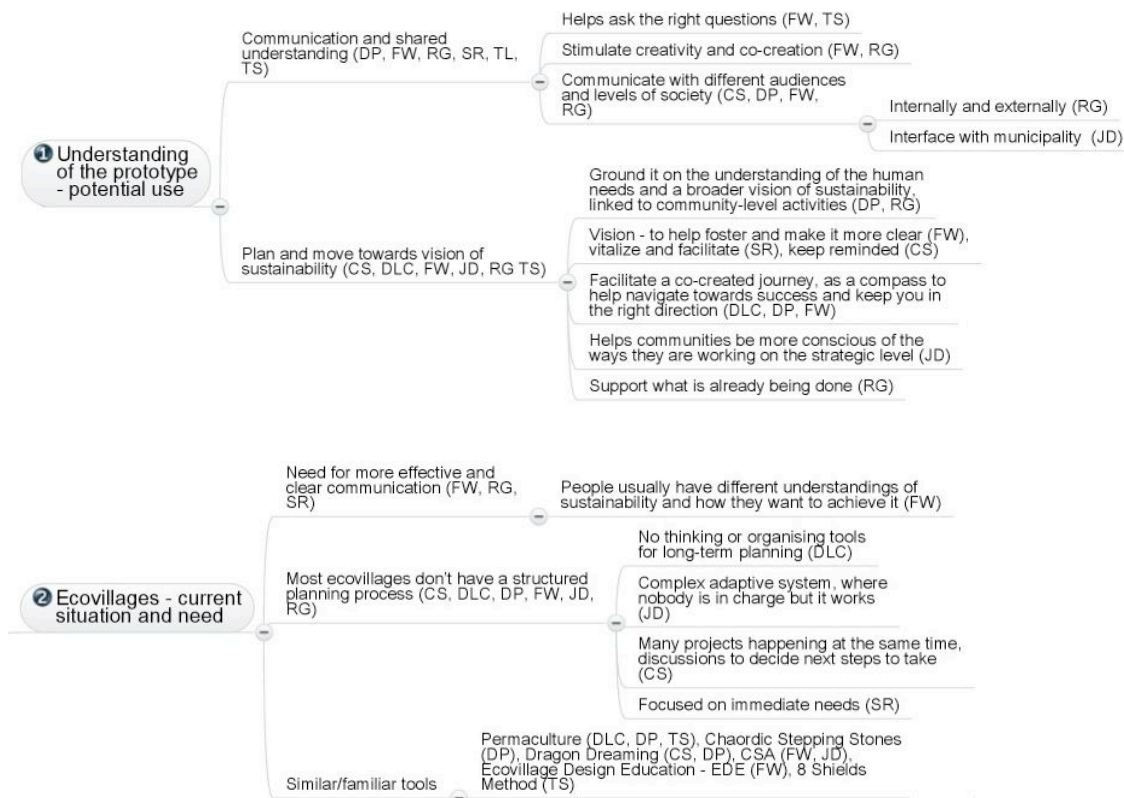
1. What is your understanding of the prototype? What are its strengths and weaknesses?
2. What do you know about ecovillages planning towards sustainability? And if they don't, how do you see this prototype helping them?
3. How does it help ecovillages be strategic in planning towards sustainability?
4. Is the intention of creating a shared understanding of sustainability clearly explained by the prototype?
5. How does it help ecovillages to create a shared vision aligned with sustainability?
6. How does it help promote a shared understanding of the relationship between meeting human needs and the whole-system?
7. In what way does it promote creative solutions in seeking to satisfying human needs sustainably?
8. Does it help ecovillages identify their strengths and gaps?
9. What do you feel is missing in this prototype?
10. Have you ever come across a similar planning process for ecovillages? If yes, please describe.
11. Is there anything else that you would like to comment on or contribute that we haven't covered in these questions?

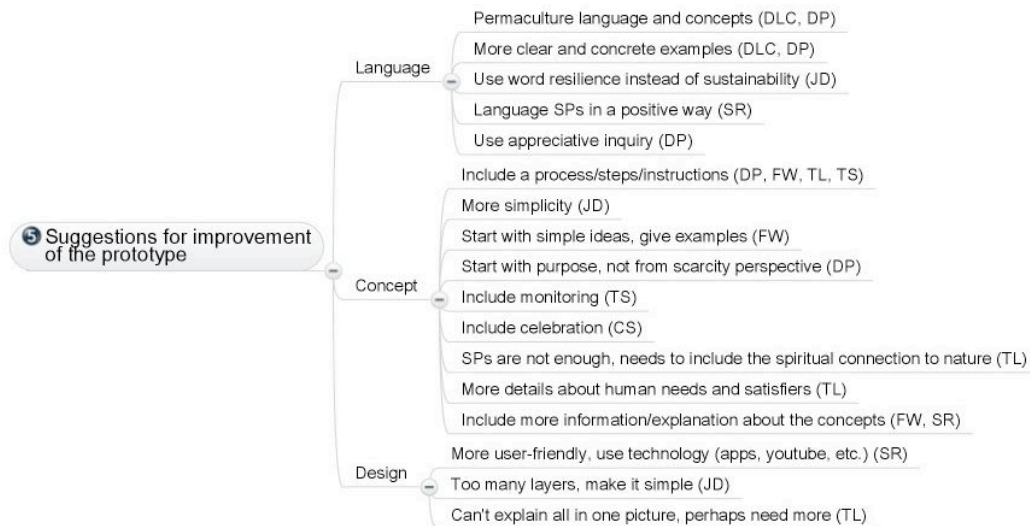
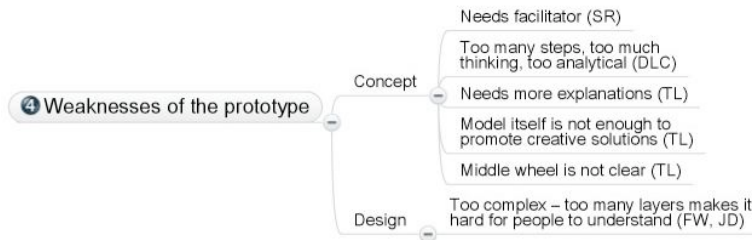
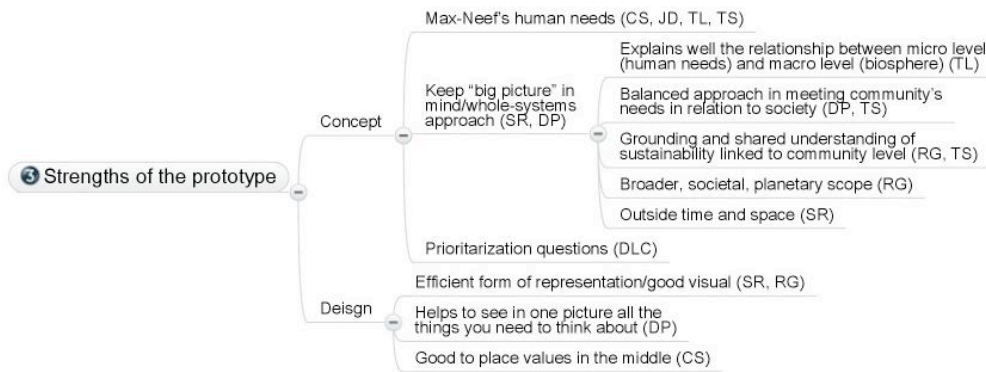
Appendix IV - Mind map of interview results

Abbreviated mind map of interview results, showing categories only:



Expanded mind map of interview results per category:





Panel of experts are as follows: Christoph Strünke (CS); Davie Philip (DP); Diana Leafé Christian (DLC); Felix Wagner (FW); Jonathan Dawson (JD); Robert Gilman (RG); Simon Richards (SR); Tony Sirna (TS); Torbjörn Lahti (TL).

Appendix V - Survey questions and answers

1. Is the prototype easy to understand? (10/10 respondents)

Definitely not (0%)	Not really (10%)	To some extent (10%)	Yes mostly (60%)	Definitely (20%)
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2. Does the prototype visually convey the concept of the whole system i.e. the ecovillage within society within the biosphere, to create shared understanding? (10/10 respondents)

Definitely not (0%)	Not really (0%)	To some extent (40%)	Yes mostly (30%)	Definitely (30%)
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3. Does the graphic need a representation of the biosphere outside the boundary ring of the ecological principles (SPs 1 - 3)? (10/10 respondents)

Yes (40%)	No (40%)	Don't know (20%)
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4. Is it generic enough to be used at different stages of planning and with different audiences? (8/10 respondents)

Definitely not (0%)	Not really (25%)	To some extent (12,5%)	Yes mostly (50%)	Definitely (12.5%)
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5. Do the questions help to integrate the wheel with community planning and implementation processes? (9/10 respondents)

Definitely not (0%)	Not really (11.1%)	To some extent (33.3%)	Yes mostly (44.4%)	Definitely (11.1%)
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6. Does this tool help better communicate within communities and with their different stakeholders? (8/10 respondents)

Definitely not (0%)	Not really (12.5%)	To some extent (50%)	Yes mostly (25%)	Definitely (12.5%)
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7. Could it help promote or facilitate a co-creation journey towards sustainability, in brainstorming creative solutions? (9/10 respondents)

Definitely not (0%)	Not really (11.1%)	To some extent (44.4%)	Yes mostly (11.1%)	Definitely (33.3%)
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8. Could it help a community select and prioritize actions and tools to help them plan strategically? (9/10 respondents)

Definitely not (0%)	Not really (11.1%)	To some extent (66.7%)	Yes mostly (22.2%)	Definitely (0%)
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9. Could it help a community identify its strengths and gaps in relation to sustainability?
(9/10 respondents)

Definitely not (0%)	Not really (11.1%)	To some extent (55.6%)	Yes mostly (11.1%)	Definitely (22.2%)
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10. Is there a need for preparatory questions? (9/10 respondents)

Yes (66.7%)	No (33.3%)
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Appendix VI - Description of Prototype I sent for reviewers (interviews)

The description of Prototype I sent to reviewers is presented below. It was accompanied by an introduction about the research and complementary information about the FSSD, SPs and Max-Neef's theory of human needs.

Introduction

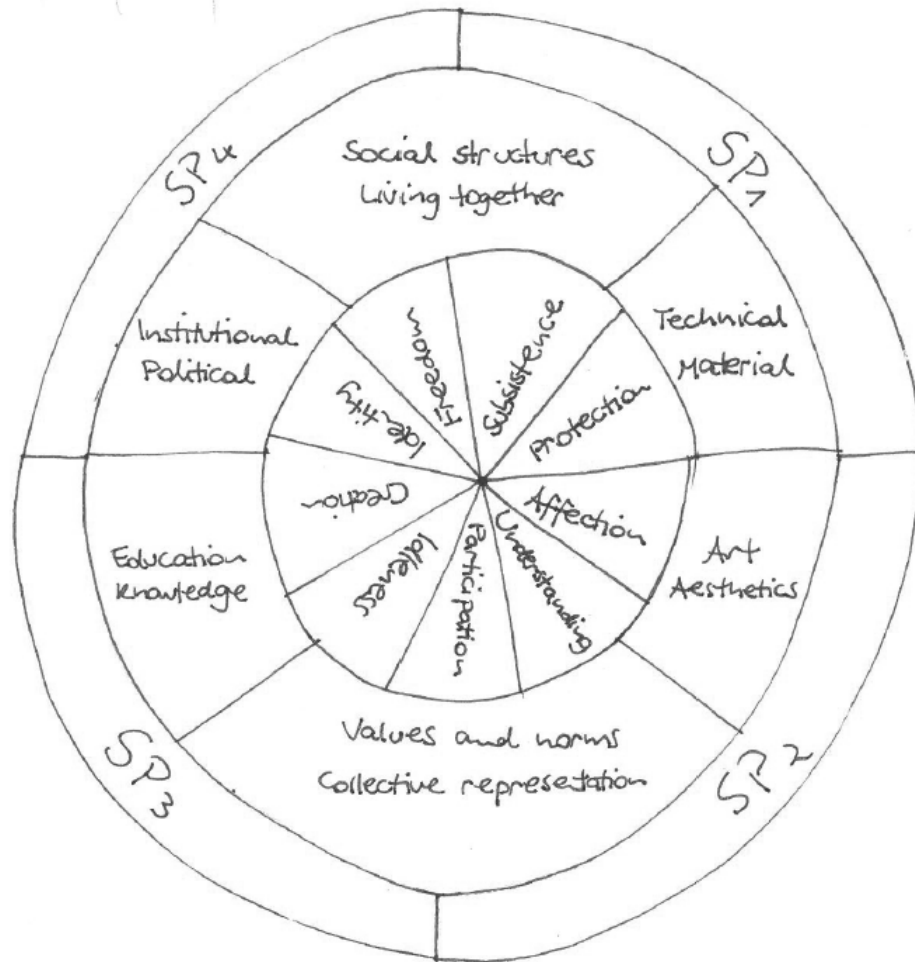
By analysing the Wheel of Sustainability with the help of a systemic, science-based framework - the FSSD - we have identified the gaps and strengths, which showed that it could be enhanced by being included in a more holistic and, more importantly, strategic planning process. Therefore, we have worked on a prototype of a planning process that is based on the FSSD and places the WoS at its core.

The prototype presents a generic planning process to help ecovillages plan towards sustainability, which is both practical and relevant for this audience. The components of the process are presented in an iterative way, with complimentary information and questions, in order to serve as a compass to help ecovillages envision and plan towards their desired future.

The WoS is used for specific purposes during the planning and is placed at the core of the planning process. This is intentional so that it is taken into account in all the stages of the process to ensure that all aspects of ecovillage life are included, and that human needs are being met in a fair and sustainable way.

Description of the prototype

From the WoS designed by Felix Wagner and Sandra Mende, some modifications were made to incorporate the whole-systems perspective, with the four Sustainability Principles as boundary conditions. We have also enhanced the core of the WoS by replacing Wagner's human needs with those of Max-Neef (1991). We did this to better differentiate between 'needs' and 'satisfiers' (as described by Max-Neef 1991).



The following components have also been incorporated in order to enhance the concept, modifying it so that it can act as a tool that looks at sustainable development of ecovillages with respect to society within and around it and the natural environment. For the purposes of this study the system is defined as the ecovillage within society which in turn is within the biosphere (natural environment).

Awareness

The additional components begin with the need for an awareness of the global sustainability challenge and a shared understanding and definition of sustainability that includes the four Sustainability Principles (SPs). The WoS can be used to create a shared understanding of how various ways of satisfying human needs is affecting the biosphere.

Vision of success

For ecovillage planning, we propose that the prototype be used to help create the shared vision, as it helps people to ask the right questions to be able to move towards this vision. By integrating with the 4SPs, it ensures that satisfying human needs is done in a sustainable way.

Assess

Use full permutations of prototype to help identify these aspects and ask pertinent questions to assess current reality. Evaluate each aspect/question against the 4SPs and use these as checklist.

Co-create

The WoS encourages co-creativity. For this stage, as many members of the community as possible should be involved. The full permutations of the prototype can be used to stimulate discussion. All brainstormed actions should be listed and, if necessary, categorized according to the permutations of the WoS. If necessary, it can also be used in the brainstorming to ensure all areas are covered.

Realize

Plan short, medium and long term actions with respect to the vision. To prioritize actions three prioritization questions asked are:

- Does this action move us in the right direction towards our vision?
- Is it a flexible platform for future improvements?
- Does it provide a return on investment (economic, social ecological)?

For this specific audience it may be appropriate to ask further questions about satisfying human needs.

Appendix VII - Description of Prototype II sent for reviewers (surveys)

A compiled version of the prototype description sent to reviewers is presented below. There were two slightly different versions of the file, since the panel of experts was already familiar with Prototype I, and the FSSD practitioners were only included in the second round. The package sent to FSSD practitioners included more background information about the research. The panel of experts received more information about how the comments from the interviews had been addressed in the new version of the prototype.

Introduction

Our intention with this new prototype is to offer ecovillages a communication tool to help create shared understanding and stimulate strategic thinking. The primary intention is for it to be used within the community but we believe it can also be used to communicate with other stakeholders, for example, surrounding communities and local governments.



Visual description of the wheel

Center: The vision and values of the community are placed in the core.

Inner ring: The ring surrounding the center represents the nine human needs, as defined by Max-Neef (1991). These are encircled by the boundary ring of the fourth Sustainability Principle, SP4.

Outer ring: This ring represents different aspects of how a community, and society, can satisfy their needs within the system, and these are now represented by the different domains of the permaculture flower. We are using this concept because it is familiar to ecovillagers and it better facilitates their understanding.

Outer boundary ring: SPs 1, 2 and 3 remain in the outer part of the wheel representing the biosphere and the ecological system boundaries.

Note: An explanation of the SPs will be provided with the final version of the prototype.

Changes to the original prototype

One of the main changes made to this version is in the implementation section of the wheel, by incorporating the seven petals of the permaculture flower as the community aspects. We received this suggestion from experts and decided to incorporate this concept, instead of the six aspects originally listed by Andreas and Wagner (2012). There were two main reasons that led us to adopt this concept; because we believe that they can better represent the different aspects of community life and, most importantly, because the audience is already very familiar with the language of the permaculture flower and therefore, it facilitates the understanding.

On the feedback we received most of the reviewers said that ecovillages already have a vision and values and so, that our prototype could help them to foster, energize or vitalize it. So the visioning stage is out of the scope of this prototype.

Using the wheel

From the feedback we received we have understood that most ecovillages are already using different processes for planning and decision-making, sometimes intuitive and sometimes with the help of tools like Dragon Dreaming, Chaordic Stepping Stones, etc. For this reason we are not offering, as part of this prototype, a structured process to implement the concept. However, we see the wheel as a communication tool to bring a whole-systems perspective and sustainability principles into other processes, particularly at points in processes where the relationship between needs, satisfiers and the system boundaries is important. So we are offering a set of questions to help ecovillages host these conversations and co-create ideas in order to generate a plan that is strategic. We hope that the prototype will be generic enough to fit within, and enhance, the current processes, by bringing the whole-system, strategic approach.

Guiding questions

The prototype is designed to link the relationship between human needs, possible satisfiers and the societal and ecological system boundaries. With regard to making strategic decisions that result in actions intended to satisfy the needs of the people in the community, a set of guiding questions is suggested for consideration when using the wheel.

The questions were inspired by The Weave (Meisterheim, Cretney and Cretney 2011) and are organized in four categories, as the steps of the ABCD, a generic planning process. They were also checked against the steps of the Chaordic Stepping Stones and Dragon Dreaming, to ensure that they could also be relevant to these planning processes. The questions are not supposed to be used as a process but rather as an invitation to start creative, grounded and meaningful conversations.

Awareness	What is going on in the world that invites us to get together and find new creative, innovative ways to satisfy our needs?
	What is our current vision? How is it aligned with the four Sustainability Principles (SPs)?
	What are the core values that we share and nurture in this community?
	What do we know about our ecological system, our biodiversity?
	How can we help society become more sustainable?
	How do we reach the world? How far can we reach? Who are we reaching?
	What do we want to contribute towards creating a sustainable society?
Evaluation	What are we doing well in this community in regards to sustainability?
	How can we expand and build from these best practices?
	What do we know about our community, what are our talents, our strengths, and our challenges?
Co-creation	What aspects of community living do we wish to improve to achieve success according to our vision?
	What are the multiple ways in which our true needs can be satisfied, while being mindful of others'?
	What aspects of the permaculture flower should be considered? Where should we focus our efforts?
Realization	What do we need to practice as individuals, and as a collective, to make our vision come alive?
	Does the action or decision match our vision and values?
	Have we considered the implications of the actions for ourselves and others living beyond our community?
	Does this action take us in the right direction towards our vision?
	Is it a stepping-stone towards our vision and flexible enough in case of future needed changes?
	Will it bring a reasonable yield for our efforts?
	How can we prioritize our actions into short, middle, and long term?
	What aspects of the community are important to include in the implementation and delegation?
	What skills or resources do we have within our community to support these actions?
	What tools do we need to implement, manage and monitor our plan?



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