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The Earthship Concept

- A Bulding Technique and Subculture Aiming Towards Environmentally Conscious-Change

Earthship-konceptet

- *en byggnadsteknik och subkultur som syftar till en miljömedveten social förändring*

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Abstract

I will in this master thesis study a building concept called Earthship. Designed to be autonomous, built out-of earth, tires and as much reused material as possible in order to be a self-sufficient, environmental friendly building that transcends monthly payments for its inhabitants. The study aims to research the Earthship concept and its consumers from an economic and environmental perspective in relation to conventional buildings in order to enable a more environmental friendly society. It does so by using a qualitative social science research approach, based on a pragmatic and post-positive research view as well as a "flexible" research design strategy. An illustrative case study of the Earthship concept was carried out through a literature review of: 1) sustainable buildings, 2) earth-sheltered housing compared to conventional housing, 3) Earthships and 4) off-grid builder. Four in-depth interviews of Earthship builders was also conducted. Relating the findings to a multiple theoretical view on modern economics and by using Positional Analysis, the Earthship concepts was found to have many favorable qualities compared to conventional buildings, especially when it comes to using used tires as earth building blocks, energy efficiency and water usage. The results from the interviews shows that Earthship consumers are found to be interested in the environment, transcending human grids and monthly bills, they also seem to trust the founder and personification of the Earthship concept, Michael Reynolds. The findings support previous research within sustainable building and Earthships in that the return to investment and the role of the project manager are central for accomplishing socially and environmentally successful building concepts. It further finds that there is a potential monetary business case for the Earthship building concept in terms of monetary profits. But, in order to be able to make such a claim we need to see beyond conventional Neoclassical economic theory and to embrace other economic assumptions.

Keywords: Do it yourself, Earthship, Green construction, Sustainable Buildings.

Abbreviations

As appearing in text:

(GHG)	Green House Gases
(DIY)	Do-it-yourself
(WTP)	Willingness-to-pay
(SB)	Sustainable Buildings
(LEED)	Leadership in Energy and Environmental Design
(PA)	Positional Analysis
(CBA)	Cost Benefit Analyses
(AB)	Adobe blocks
(GsE)	Gypsum-stabilized Earth
(CC)	Concrete construction

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1. Introduction

In order to enable a prosperous world we need to take care of our common environment. The building sector is the largest final energy-consumer, the largest contributor of CO2 emissions (IEA, 2013) and the biggest raw material user in the world (Pacheco-Torgal and Jalali, 2012), as well as one of the biggest reasons for solid waste production in developed countries (UNEP-SBCI, 2010:2). As such, it has a significant part to play in bringing about big changes in reducing negative environmental externalities. To be able to bring about successful change we will need radical changes within the building industry (Burroughs, 2002).

Thus, this master thesis set out to study an alternative building concept called the Earthship in order to enable a more environmental friendly society. The Earthship concept is an alternative building that aims to be as environmentally friendly and autonomous as possible and aims to free its inhabitants from monthly payments.

The Earthship concept will be used as an illustrated case through which we can explain the different economic theories and see how well the explanations from the different economical perspectives actually work in practice and relate to what is happening in our world today. In doing so, it will be relating the Earthship concept to conventional buildings from an economic and environmental perspective

The first chapter will be giving a background to current building industry, alternative ways of building and the Earthship concept; the second defines the aim, research questions and definitions of the thesis; the third gives a pluralistic view of economics. In the fourth chapter describes different methods. The empirical findings are covered within the fifth chapter. The sixth contains the findings, analysis and the discussion section, relating the empirical findings to the different economical perspectives; The seven chapter will be concluding this thesis.

2. Background

"Climate change is one of the most pressing scientific and political challenges of our time" (Bulkeley and Newell, 2015:1). The world population is expected to reach 8.5 billion by 2030, 9.7 billion in 2050 and 11.2 billion in 2100 (UN, 2016). To enable a transition for our growing global population to a climate change resilient society within the limits of our ecosystems and natural resources, we need to provide secure and clean energy as well as an efficient use of our water and raw materials (EU, 2016a). A main objective in doing so is by focusing on designing and constructing buildings that achieve resource efficiency, minimize water and energy consumption, as well as waste generation (UNEP-SBCI, 2010; EU, 2016b). To reach these objectives we need to introduce low carbon alternatives that are affordable and cost-effective (EU, 2016b). Doing so on a mass scale will challenge and revolutionize all investments in the building industry (Burroughs, 2002).

2.1 Buildings and the building sector

The building sector has big potential to bring about deep, quick and long-term cost effective reductions of Green House Gases **(GHG)** (UNEP-SBCI, 2010). The sector is the largest final energy-consumer and the largest contributor of CO2 emissions in the world (IEA, 2013). It is the biggest raw material user (Pacheco-Torgal and Jalali, 2012) and it is responsible for up to 40 % of all solid waste in the developed countries (UNEP-SBCI, 2010:2). It employs, on average, more than 10% of the total workforce (*ibid.,* 2010) and represents 8-10% of the global Gross Domestic Product (GDP) (UNEP, 2011).

Buildings account for more than 40% of the total global energy usage, 38% of all GHG emissions, 12% of the global drinking water use (UNEP-SBCI, 2010:2) and 25% of all wood harvest (Roodman, Lenssen and Peterson, 1995:12). Assuming only marginal changes in building technologies GHG emissions generated by buildings are likely to increase more than 100% in the next 20 years (UNEP, 2009:3). If countries don't build low-carbon and energy-efficient buildings they will not be able to reach the emission reduction targets (UNEP*,* 2009). Thus, "[m]itigation of greenhouse gas emissions from buildings

must be a cornerstone of every national climate change strategy" (UNEP, 2009:3).

Seen over its life span more than 80% of the total amount of the buildings energy consumption occurs in its operation phase (Suzuki and Oka, 1998:39). A much smaller percentage, only 10 to 20 percent, is consumed for its materials manufacturing, transportation, construction, maintenance and demolition. Thus, the energy consumption of a building generates its main GHG emissions (UNEP, 2009). Therefore, reductions of energy consumption in the operating phase of a buildings life can contribute to great savings in GHG emissions (Suzuki and Oka, 1998).

Generally the average household in a developed country uses 60% of the total energy for space heating, 18% for water heating, 6% for refrigeration, 3% for lighting and 13% for other uses (Huovila, 2007:12). But there are variations depending on climate, income level and occupant behavior (UNEP, 2009). It has been estimated that up to 80% of the energy use can be saved by applying designs that relate to buildings as an operating interdependent unit and thus developing them as complete systems (Ürge-Vorsatz, *et al.,* 2007). Thus, using more holistic and environmentally conscious construction techniques and construction materials will contribute to a major change in total GHG emissions and climate change (Pacheco-Torgal, & Jalali, 2012).

2.2 Building with Earth

A lot of energy and non-renewable resources used in 'modern' building materials could be avoided by building with natural and local raw materials (Melià, *et al.,* 2014), as 80 to 90% of all the material waste flows is generated from reinforced concrete and steel (Junnila, 2004).

A great example of how we can minimize the ecological footprint and use a local and natural material is by building with earth. Used for thousands of years as a building material it has many qualities that are attractive for constructing cheap and energy saving buildings (Burroughs, 2002). Not only is it easy to access, it is also interesting from the point of view, that they have a high ability to store and manage heat, e.g. it has a high thermal inertia (Pacheco-Torgal and

Jalali, 2012). Thus, building with earth can be seen as a crucial opportunity for building cheap energy efficient homes for the 21st Century that can be applied all over the world without the need of 'modern' building materials (Burroughs, 2002).

To be able to build with earth the building material needs to be stabilized, which can be done by constructing it into blocks, a process that has been found significantly cheaper and more environmentally suitable as a building material than conventional brick and concrete (Zami and Lee, 2010). The financial benefits of earth stabilized construction depends on the suitability of the soil, additive cost used to manufacture the building units, and transport costs of finished products or raw materials to the building site. But, if produced locally, with available skills and semi-skilled labor, local natural resources and few transports, they have the potential of being very cost effective (Adam and Agib, 2001; Zami and Lee, 2010).

2.3 Houses could be designed to be 'autonomous'

An autonomous building is a building able to "provide their own services (water, heating, cooling, sewage, electricity) from natural sources without the need for fossil fuels and sewage treatment plants" (Vale and Vale, 2002:182). It is a building that is supposed to be built with a minimal ecological footprint. By using as much locally produced materials and resources as possible it aims to minimize the total amount of pollution and waste (Brandon and Lombardi, 2011; 2010). It is also supposed to provide its own water, heating and cooling, as well as sewage, and get all its energy resources from its site, not creating any negative environmental effects downstream (Kerans, 2002). Autonomous buildings should according to Vale and Vale, (2002) be the bottom line for building designers.

2.4 Earthships

Figure 1. Eartship at the Eartship Biotecture visitor center. Taos, New Mexico, late December 2015. Source: Martin Ekwall (2015)

One example of an autonomous building concept is referred to as the Earthship (Figure 1). The Earthship concept originated in the 1970th, a time when Barbara Ward held her speech at the Stockholm "Only one Earth" conference (1972), saying:

> *"This is a time when people's ideas about the planet they live in, about the way they have to live, about the way they can live, are changing in an absolutely monumental fashion [...] people are radically beginning to reconsider how they have to view their life on Earth, and what sense their existence makes to them. It is only when people begin to shake loose from their preconceptions and from the ideas that have dominated them, that you begin to get that sense of new directions which I think we would all agree our poor old planet most desperately needs"*
>
> (Ward, 2013:3).

Built in the remote desert outside of Taos, New Mexico, USA, by a man named Michael Reynolds (Michael Reynolds), described as a "rugged, counter-culture, outlaw American individualist in the tradition of Henry David Thoreau, Hunter S Thomson, Ken Kesey and Bill Hicks" (Hewitt and Telfer, 2012:145-6), the Earthships concept "rebells" against status quo and numerous ways of doing

things. Yet, it can still be seen to be "homage" to the motorcar and to an individualistic lifestyle (Hewitt and Telfer, 2012). Defined in one single sentence, it is a passive solar heated earth-sheltered building built with tire walls, self-reliant on renewable energy, water harvesting and sewerage care.

Most houses that are dependent on the grid will fail to deliver a safe and comfortable shelter as any type of breakdown in the grid will compromise its habitability. The Earthship on the other hand, is a self-sufficient and off the grid building, meant to provide a low-carbon, low cost and safe (in case of system breakdown) self-dependent lifestyle for its inhabitants. But the building is dependent on its newly manufactured products, such as solar panels, to be able to function (*ibid.,*), as well as waste from other productions. "The Earthship, in contrast to the *status quo*, offers an opportunity to form an unmediated connection with the natural resources that are essential for human life […] This arguably enhances both financial self-sufficiency and provides a backup in case of system breakdown" (Hewitt and Telfer, 2012:19).

2.5 Principles of the Earthship concept

The core of the Earthship is the idea of building an "autonomous" building and combine trash and shelter, that is to say, two social needs (Harkness, 2011). Therefore, it can be seen as an extreme building technique that uses as much immediately available resources as possible, and intends to not extend its building footprint beyond its means, enabling it to help its dweller to obtain a green lifestyle (Hewitt and Telfer, 2012). The Earthship could be a universal approach to provide comfortable shelter for its inhabitants and for its building site. Further, the Earthship design (figure 2) uses low-impact materials, passive solar thermal heating and rainwater harvesting as well as plants to treat waste water (*ibid.,*).

Figure 2. Solar panels on the rooftop of an Earthship. Taos, New Mexico, late December 2015. Source: Martin Ekwall (2015)

Built by using re-utilized “waste”, recycled and reclaimed materials, or what others considered to be “garbage” or “waste”, the Earthship concept displays flexibility to the specific needs of each place and time (Harkness, 2011).

The Earthship concept on the other hand views “waste” as a resource, a process, a stage of an ongoing life (Hewitt and Telfer, 2012). It uses everything from used glass bottles and aluminum drinks cans, to all types of automobile tires, and architectural salvage such as windows and doors, to industrial by-products like gravel and sand. Thus, the Earthship concept transcends “waste” as something useless and brings it back into our consciousness as something which is at hand.

Designed to be able to harvest enough water for survival anywhere where annual precipitation is above 200 mm, which is true for most places on earth, the Earthship concept uses close-loop systems wherever possible (Hewitt and Telfer, 2012). First, the water is harvested from the roof and purified to a drinking level standard. Second, greywater from sinks and showers is cleaned in greywater planters. Third, the recycled water then serves as toilet water. Finally, as blackwater, it is fed to a reed bed where reeds and plants treat it and return it as clean water back to nature. Never in the different steps of the system is the greywater in reach for human contact (Hewitt and Telfer, 2012).

2.6 A south-facing artificial cave

The thermal performance is at the heart of the Earthship concept, as it is the key to minimize its space heating and running costs (*ibid.,*). Placed facing the south, half way into the ground, the burmed plan construction is built by massive earth pounded tire walls. Big windows facing south let sun light shine into the building, heating the massive earth pounded tire walls. Thus, the building walls and floor soaks up sun all day, storing the energy in the thermal mass, creating a thermal energy storage. When the evening arrives, as the temperature in the building sinks, the walls start radiating the thermal heat into the indoor space, allowing it to maintain a stable indoor temperature throughout the year (Welch, 2012).

2.7 Built out of earth and used car tires

Building an Earthship is a labor-intensive but technically simple process (Figure 3). A big part of it is to ram earth into used tires, a process that is done by using a sledgehammer, without any framework needed, something anyone can learn in a few hours. Thus, it is a suitable technique as most of the Earthship builders are do-it-yourself **(DIY)** builders that want to build their own home (*ibid.,*).

Figure 3. Stacked car tiers rammed with earth. Taos, New Mexico, late December 2015.

Source: Martin Ekwall (2015)

The great thing about building with earth and tires is that earth does not need to be transported onto the building site and that tires does not require a lot of energy to bring to the building site. Tires functions as an excellent way to easily manage the earth, as any type of earth can be used in the process of making the tires into building blocks. Thus, it is a simple way to create individual building

blocks with great mass and absolute structural integrity, allowing the building to be low-maintenance with a high level of thermal mass and minimal space-heating requirements. Therefore, this simple technique allows the builder to manage a lot of their work on their own, keeping the monetary cost low.

By using reused materials with as little embodied energy as possible (Hewitt and Telfer, 2012), the Earthships concept "is a perfect demonstration of how reusing materials is a more efficient use of resources than recycling them, as it uses less energy" (Hewitt and Telfer, 2012:41) and a great example of a "low-tech approach and the direct reuse of waste without modification, mean that the carbon emissions from the production of these 'bricks' are negligible" (*ibid.,*).

In essence, "the Earthship is almost wholly autonomous, self-reliant building that uses waste materials in its construction and has a negligible carbon footprint in its day to day running, being cheap to run with virtually no utility bills to pay and relatively little maintenance" (Hewitt and Telfer, 2012:5).

But then why is it so few earhtships that has been built and why is it so little known about this concept? Several studies has criticized the Earthship concept for nor being able to deliver thermal comfort only through passive solar heating (Grindley and Hutchinson, 1996; Kruis and Heun, 2007; Ip and Miller's, 2009; Hewitt and Telfer, 2012), and for not being able to providing consistent water supply solely through its gray water and catchwater system (Kruis and Heun, 2007:10).

2.8 Aim, Research Questions and Definitions

2.8.1 Aim

The aim of this master thesis is to identify the Earthship concept from an economic and environmental perspective and compare to conventional buildings in order to enable a more environmental friendly society.

2.8.2 Research questions

1. What is the Earthship concept about?
2. How does the Earthship perform as an autonomous and environmentally friendly building?
3. How does it perform compared to a conventional building technique in financial, qualitative and environmental terms?
4. How well does it function as a vessel which liberates its inhabitants from monthly bills?
5. Is there a potential monetary business case in building Earthships as a environmentally friendly building concept?

2.8.3 Definitions

Conventional building: This study defines a conventional building as a building meant for a *s*ingle-family, it is approximately 90 to 180 square meters of enclosed floor space and is detached from other neighboring houses. The most common way to structure the building is through using materials such as timber and masonry. Generally there are two types of insulation, plastic foams or glass-fiber. The loads of the building is transmuted to a stable stratum of earth through its foundation. Conventional buildings are supplied with water manly through the domestic water-supply system, but in some cases they have their own water supply by having a drilled well connected to the aquifer. They are generally heated through the use of fuel oil, direct electricity or natural gas. The buildings get their electricity from public utility power grids. An underground or overhead cable connects the building to a transformer which reduces the incoming voltage from the high line to a safer level (building construction, 2018).

Earthship: In this study the usage of the term Earthship represents any building inspired by Michel Reynolds Earthship concept. Thus, this thesis does not attempt to make any claim to differentiate between Earthships buildings for example built by Earthship Biotecture, those built by Michel Reynolds

company, and other Earthship inspired buildings. I will view the differentiation between Earthship Biotecture and other Earthship buildings purely as a legal distinction. This, has to do with the fact that Michel Reynolds has been forced to use Earthship Biotecture, after being sued in the past for Earthships that has been built and not worked as “promised” by the concept.

Do-it-yourself (DIY) builder: Is a term used to define people that build their own buildings, with little or no previous or professional building background, on their own.

“fuck-off” when the word fuck-off is being used it is assumed to be a reflection of ignorance and a lack of trust.

3. Theory

Robson (2011) describes how theories try to explain what is "going on in the situation, phenomenon or whatever that we are investigating" (Robson, 2011:65). Theories "provide some assurances that what you are doing is in tune with the attempts of other researchers to understand what is happening" (*ibid.,*). This study delivers a multiple theoretical view on modern economics. With the help of these perspectives I hope to be able to reveal and clarify the underlying structures and dynamics that the study has found relating to Earthships and the built environment.

3.1 A pluralistic view of economics

The reasons behind what causes benefits of goods and what influences economic behavior are two of the most fundamental questions in economics. Below are five perspectives which treat these two areas, they will form the basis of the economic theoretical framework of the present study.

First presented is the Neoclassical perspective and some critic directed towards this perspective. Secondly, Lancaster's further development of the Neoclassical perspective view of what gives rise to products and their benefits. It is followed by the Institutional economic perspective and its assumptions about how consumers are social actors. After that an anthropological perspective of economics will be presented, which focuses on the connection between culture and the economy. Last presented is Schumpeters perspective of the entrepreneur and what drives market development. The prevailing theories aim to develop, clarify and open up new dimensions that try to explain what causes consumers to choose as they do and markets to develop and function according to the economic principles that we think that they do. Thus, the different perspectives are used to complement one another in order to give a more inclusive understanding of how we can relate to economic behavior.

"More than one perspective is often needed and one perspective is perhaps best understood by being compared and assessed relative to another" (Söderbaum, 2008:43). Thus, "[t]he idea is no longer one of defending one particular theory of science or discipline but rather to borrow useful elements from different disciplines" (Söderbaum, 2008:55).

The section concludes with a summary of the theoretical approaches.

3.2 Neoclassical economics

In Neoclassical economics, all actors are assumed to be independent, self-interested, rational maximizers (Helgesson, 2005). Actors are assumed to prefer more rather than less and that in spending energy [or money] on one thing actors lose the opportunity to use it for something else (*ibid*.,). All consumers in a free market, with equal rights, strive to maximize their utility under a resource constraint. Since resources are generally assumed to be scarce, proper allocations of these resources are seen to be essential to maximize social welfare. In the perfect market, supply and demand always provide the right price and optimal allocation of resources, maximizing utility of all consumers. In order for all stakeholders to receive proper compensation, well-defined property rights are essential (Marbuah, 2014).

In relation to environmental issues this can be exemplified by Dahmén (1968), who argues that we need to set a price on the environment. The environment must be included in the price of the rising standard of living, since the standard of living is derived out of degradation of a good environment. Unless the price of the commodity actually covers all costs for the product, so that the price of the product is cost-realistic, the consumer will not know what really is sacrificed by their consumption. Thus, not including the full environmental cost in the price of the good, natural resources are consumed without payment, goods are consumed unrealistically, leading to economic distortions and market failure.

According to Weintraub (2007), there are three central assumptions in Neoclassical economies:

1. Consumers have rational preferences between outcomes that can be identified and associated with values.
2. Consumers maximize utility and firms maximize profits.
3. Consumers act independently on the basis of perfect and relevant information.

3.2.1 Critic of Neoclassical economics

"Do people really always prefer getting more rather than less – and even if they do, does this always affect how they behave? Are economic or other self-directed incentives really all that matters? And if so, exactly in what sense do people work like this? The position of mainstream economics is that people do to the extent that they are rational" (Helgesson, 2005:30).

There are many possible reasons why people may act irrationally. It may be that they are unaware of other alternatives than the one at hand, it may be that they don't want to know of other alternatives, or it may be that they are misjudging their alternatives (Helgesson, 2005).

As mainstream economics assumes that the consumer is rational and shows its preferences by its willingness-to-pay **(WTP)**, it ignores that "[t]here is no direct link between preferences, satisfaction and well-being" (*ibid*.,) and that we can't set a price on all preferences. There are things that we have no preference for because such a preference is so unrealistic to ever be satisfied, or things that we cannot afford (*ibid*.,). This does not mean that there might not be preferences for such a thing. For example; a rich man and a poor man may both have preferences to buy a house. The rich man is able to pay more, because he has more money, thus he is the one that will get the house. This does not mean that he had stronger preference for the house, it only shows that he had more money. For the poor man to buy the house, his preferences must be stronger than the rich man's, his WTP needs to be relatively higher than the rich man's as he is giving up relatively more of his resources (*ibid*.,). There are things that we can't put a price on, or are not even willing to put a price on, such as things that we think should not be handled on the market, or things that would not have the same value if they are not freely given, such as love and friendship (*ibid*.,). Things and choice cannot be understood from a social and cultural perspective if they are all brought together to a single thing, being just a thing or a choice, evaluated by its potential to bring abouts efficiency (Gudeman, 2005). Thus, "mainstream economics fails to distinguish between preferences and needs and between preference and values and thereby fails to grasp central facts of human life" (Helgesson, 2005:58). We need to consider identity formation as well as achievement of well-being (Gudeman, 2005).

3.3 Lancaster's demand theory

Lancaster (1966) modified the traditional Neoclassical demand theory of what consumers desire by assuming that their consumption is not the products themselves, such as a car or a train ride, but the characteristics and life experiences that they give rise to, such as travel experiences from A to B, a comfort feeling or similar. "[I]t is the properties or functions of goods from which utility is derived" (Lancaster, 1966:133). Lancaster gives us the following three assumptions that modify the conventional system (Lancaster, 1966):

Lancaster modifies the conventional system by assuming:

1. The good itself is of no benefit to the consumer, it is its features which can give rise to benefits.
2. Goods have generally more than one property and many properties will be found in more than one good.
3. Goods in combination may have properties different from those belonging to those goods individually; thus synergistic effects can occur.

3.3.1 Critic of Lancaster's modified version of the traditional Neoclassical demand theory

If we ignore Lancaster's enhancing specifications, there is a risk that the analysis of consumption will be too general and therefore tend to explain everything and nothing (Ackerman, 1997). Even though Lancaster's theory contributes to a better understanding of consumer preferences and demand (Mason, 2002), it still needs to be questioned if the characteristics of goods always provide positive satisfaction, do they achieve this satisfaction regardless of how the consumer attain these or in what context they are experienced? (Ackerman, 1997). Is there a linear relationship between the product and its characteristics (Ackerman, 2002) and does the utility belong to the product's infinitely different qualities and separate functions rather than the product as a whole (Levy, 2002)?

Lancaster's theoretical perspective of the Neoclassical view is in this thesis assumed to be a prerequisite for the next presented economic perspective, Institutional economic, and its view of how we can interpret economic activities. Lancaster's point of view will thus not be used as a part of the

analysis, it is only used to describe the “passing over” from Neoclassical economics to economic perspectives that does not assume that economics is strictly based on rational markets, or based on rational consumers and firms.

3.4 Institutional economics

”Institutional economics emphasize the role of habits in economic behavior” (Söderbaum, 2008:99). It seeks to explain human behavior by focusing on institutional contexts that enable markets. The choices that people make are not seen as only causal factors, rather they are made up in a web of contextual structures and norms, factors that all are a part in shaping economies, thus it is attending more particular cases and less abstract ones and thus becomes a lot more complex than Neoclassical economics (Helgesson, 2005). Rather than basing rationality on perfect information, as Neoclassical economics does, Institutional economics relates to rationality as something dependent on the individual worldview or ideological orientation (Söderbaum, 2008). Thus, it refers to “rationality” as the best option available for the individual in relation to its ideological orientation.

From this perspective there is interdependence between the consumer and the social and economic structures. It argues that when basic biological needs to sustain human life are met, other needs out of social constructions arise (Fullbrook, 2004). Consumers are in an interdependent changing relationship with their surrounding world, acting out different roles in different situations, based on current context and on his or her ideological orientations (Fullbrook, 2007). Consumers are not autonomous but in a constant dynamic process of influence, shaped and reshaped, as well as shapers, in our institutions and communities (Fullbrook, 2004; Mayhew, 2002). ”A relationship between two market actors takes place in a social and institutional context and just as the institutional context has its history, the same is true for the relationship” (Söderbaum, 2008:71). Seen from this perspective:

> *"All consumption is conspicuous when it serves to strengthen the role of consumers as part of a group or by selecting which ones are not part of this group"*
>
> (Mayhew, 2002:43).

”Individuals are responsible in all their roles and relationships as professionals, citizens, family members, etc. and have to consider their decisions and lifestyle” (Söderbaum, 2008:75). Behavior and social values reflect the individuals’ common perceptions and norms about how they should interact with each other (Davis, 2002). Consumer choice signals individuals awareness of the group's preferences (Mayhew, 2002) and cannot be understood only with instrumentally rational reflections, but need to be considered on the basis of what is a "principle" behavior in a group (Davis, 2002). Thus, maximizing utility is something that consumers often tend to do based on how they value and classify in accordance with society's prevailing cultural norms, social values, geographical locations, historical conditions, love, ethics, and the institutions that they serve (Fullbrook, 2007).

The interest of institutional economics it thus to recognize ”how individuals differ with respect to utility maximization, or in our language, ideological orientations and lifestyles, we are also interested in ways of influencing the ideological orientations of individuals” ”to make them gradually become more compatible with sustainable development” (Söderbaum, 2008:56). Thus, from this perspective we should ask questions such as: ”Is there a well-functioning, ongoing institutional context that facilitate market activities? What are the background factors of the present relationship between the market actors? Are personal and social experiences involved as part of the market transaction?” (Söderbaum, 2008:71).

3.4.1 Critic of Institutional economics

A critical question to this theoretical approach becomes: how do we, from this Institutional economics perspective, deduce what really is the basis of consumer values, as it seems to be part of constant inter-subjective processes between actors and their context? Does it not risk to certify what Ackerman (1997) described as all or nothing? ”We should be ready to listen and learn from advocates of competing perspectives. More than one perspective is often needed and one perspective is perhaps best understood by being compared and assessed relative to another” (Söderbaum, 2008:42-43).

”It should be made clear that the models or interpretations discussed should not be understood as a matter of 'either or'. Each model can contribute to our understanding. The Neoclassical model, while being reductionist, tells us that there is a monetary aspect to be considered in most organisations. The stake holder model suggest that it is not realistic to assume that all individuals and organisations related to an organization agree about one object function. It is normal for some conflicts of interest to exist, implying that there is a role for dialogue and negotiation. The network model adds a social dimension to this complexity. For example, it assumes that stakeholders or actors are not independent but related to each other in terms of confidence, trust, goodwill etc”

(Söderbaum, 2008:63).

3.5 Economic anthropology

Economic anthropology focuses on the connection of culture and economy and assumes that the economy is made up by “two realms, market and community” (Helgesson, 2005:36), both involved in an interdependent and dialectic play (Löfving, 2005). “[E]conomy has several faces – mutuality and asocial trade – that are separate and mixed” (Gudeman, 2005:126).

According to this perspective economic activities and value can be divided into four categories:

1. Base (locally defined values related to the members of a specific community – land, water, embodied goods, ideology etc.);
2. Social relationships and associations (connections maintained for their own sake, not for the sake of profit, like house economies and nations);
3. Goods and services (traded for production or saving and consumption); and
4. Appropriation and accumulation of wealth (the collecting of value)

(Löfving, 2005:19).

It suggests that mutuality is expressed through the economy, reflecting shared values, cultural stories (Gudeman, 2005). The economy and the individual is "embedded" in a structure made up of dependencies, obligations and creation of meaning (Helgesson, 2005).

Economic anthropology differentiates the concept of well-being and the concept of standard of living. Arguing that the well-being is a "qualitative judgment in relation to a community; it is a local concept about people-in-relationships" (Gudeman, 2005:131), while standard of living is defined by measurements focusing on goods and services that can be compared across economies, such as average purchasing power (Gudeman, 2005:112-152).

At the heart of this theoretical perspective is the notion of the "base" which people share and which partly constitutes their identity, it is the foundation of the community. The base is defined by needs, or what is required to survive in a community. Needs are socially and culturally determined by time and context, examples of these may be "basic services" such as electricity, potable water and proper sewage. By turning the base into private property, it is alienated, and destroyed (Gudeman, 2005).

From this perspective rationality is something that is called "situated reason". Situated reason concerns significant knowledge in relation to maintenance of community life. It aims to improve and protect the well-being dependent on the social resource base (Helgesson, 2005). One example of this is its attitude towards self-sufficiency. Self-sufficiency from this perspective is production for sustenance, e.g. making a living (*ibid*.,), rather than simply "being a means of survival, these products then become symbols of identity and are regarded as intrinsically valuable" (Helgesson, 2005:45).

According to this perspective trust is a mutual relationship that emerges between individuals through trial and error as they trade in the market (Gudeman, 2005). By cooperating and trusting one another they provide a culture that lowers transaction costs and enables a more efficient market (Helgesson, 2005).

This perspective argues that development policies should be aimed at the community, thus strengthening the base and enabling people to become more innovative, since it argues that profit depends on innovation, and that innovation

depends on the functioning of the community (Löfving, 2005), e,g, innovation does not appear in a vacuum, but rather learning by doing in a communal context (Pålsson Syll, 2005).

This approach enhances our understanding of both economic agency and economic change (Löfving, 2005). It is applicable for analyzing contemporary phenomena, such as social fragmentation due to environmental degradation, resulting from the privatization of the base (e.g. land, water, energy etc) to that of accumulation of wealth (*ibid*.,).

3.6 Schumpeter

As the person interested in the Earthship concept in many cases is a DIY builder he/she can be a seen as a firm, consumer or even as an entrepreneur, thus I have chosen to incorporate Schumpeter in the theory part. According to Schumpeter (1883 – 1950), the firm strives to bring about profit through differentiating itself on the market by investments in new innovations, finding new paths and enabling new methods as well as new combinations. It does so through the specific knowledge and skills of the entrepreneur. These new innovations bring about transformation to the market, breaking established structures and enabling temporary "pure" profit for the firm, (e.g. profit based on a "monopoly price", which is set higher than the average cost). Thus, economic development is an "evolutionary process", a "creative destruction", transforming the market structures from within and creating a new one (Pålsson Syll, 2005).

3.7 Summary

The five theories can be summarize as follows. Neoclassical economics assumes that consumers are rational and independently maximizing their utilities by consuming goods in accordance with their resource constraint. According to Lancaster it is the properties or functions of goods that give rise to their benefits, goods can share properties or functions and in synergistic combination with each other they give rise to additional properties. Institutional economics argues that consumers are not rational and autonomous beings but dynamic parts of the mutually dependent conditions that exist between them and the socio-economic structures. Further, goods are considered to be social

markers which derive their value based on how well they reflect individuals' comprehension of group norms and social values. In Economic anthropology the culture and the economy are not separate. Rationality is cultural, related to the maintenance of community life. The cultural stories told by individuals and the economy are “embedded” within and throughout individuals and their cultures. They are represented in the realms of the market and the community, being part of the creation of cultural meaning. The concept of the “base” forms a central part of the theories relation and explanation to the function of the community, representing its socially and culturally determined “basic services”. Schumpeter gives us a dynamic view of how different causes and conditions in the form of the entrepreneur enable new market opportunities. This in turn gives rise to new investments and therefor structural changes that bring about “creative destruction” of the status quo.

4. Method

Social science studies the continuous transformation and reproduction of existing structures and relations within our society, and cannot be reduced to an individual happening. Methodologically, this means that we have to question: what are the fundamental relations without which the studied phenomena ceases to exist? The acting causes and conditions at hand will show us the answer we are looking for[1]. For an explanation to be relevant it needs to illuminate the underlying mechanisms that rule a phenomenon even though we will never be able to reach a complete explanation. Since explanations are fragmentary and incomplete, explanations need to reflect some kind of common ground for us to do research. Individualistic explanations gives us necessary but not sufficient conditions and can only show us the existence of a pattern but not represent an explanation to it. Therefore, we need a structural perspective to be able to explain why something happens at a micro level and thus enable us to manage future outcomes (Pålsson Syll, 2005).

1 I am defining it as “the answer we are looking for”, referring to deconstruction. This will imply that we are co-creators of the knowledge we find and produce.

But is this really the case? Can a structural perspective of individual behavior explain why something happens at a micro level? Can structural pattern be explained without individual actors representing them?

There are three major methodological approaches used in social science that tries to give us their perspective on how we can interpret and explain phenomena, the traditional, hermeneutic and deconstruction. The three perspectives will be described below and used to interpret the knowledge produced in the present study relating to environments and phenomenas.

4.1 Three major methodological approaches

4.1.1 The traditional western interpretations

A traditional western interpretation of the built environment focuses on how humanely produced artifacts relate to their natural and cultural contexts. It does so by using interpretations and analyzes, seeking to understand how the artifact reflects the dimensions that produced it, its past and present causes and conditions. The built environment may thus from this perceptive be interpreted as more or less an anonymous or deliberate product or creation of its time and culture. Thus, the essence of the work becomes to present how the artifact/object at hand represents its origin (Mugerauer, 1995).

4.1.2 The Hermeneutic

A hermeneutic perspective argues it to be impossible to understand another time or an earlier situation as it was understood when it happened. According to hermeneutics, understanding of the environment is ontological (e.g. what we can say exists), based on our understanding as contextual interpretations. Meaning is produced by finite humans, in their specific time and culture. Thus, our understanding begins by recognizing the contextual tradition as a source of meaning (*ibid*.,).

4.1.3 Deconstruction

Deconstruction, finds that there is no “external reality” that is “autonomously there”. Thus, it holds that there is no objective meaning, no either or, no linear history, no transcendent reality or truth. What the world and our experiences are

made up by are systems of signs and absent. Thus, it transcends the hermeneutic view of a shared inherent ontological experience or phenomenal world. As hermeneutics, it argues that there is an endless happening of meaning, but denies its view of such a thing as a final shared tradition, common understanding or interpretation. Rather, plays and signs constitutes the world. "[T]he stabilization of meaning that we achieve results only from the arbitrary preferences and impositions carried out by regimes of power and ideology" (Mugerauer, 1995:xxxvi). The experience of the phenomenal world is mediated through a flow of repetition of signs, "connecting the past to the future and simultaneously undermining the immediacy of the self-presenting. Consequently, the present (what is present in the empty spaces between the past and the future) is, strictly speaking, an illusion" (*ibid*.,). The signs have no inherent meaning in themselves, rather they find meaning in their relation to systems and arrangements. Since the play of interacting signs and structured arrangements are already into play, their effects are beyond logical reasoning and linearity, thus, these assumptions have to be given up (Mugerauer, 1995). In short: every time and space tells its own story by using its own unique plays and signs. This develops within and throughout their situated reasoning, made up by temporary, codependent actors and their norms, dependent on causes and conditions which are appearing and dissolving into "space".

4.1.4 Relating the three methodological approaches to interpret the built environment

Thus, in relating a traditional western interpretation of the built environment to a more hermeneutic and deconstruction perspective, a relevant explanation of what rules a phenomenon needs to be seen from both an individual (e.g sufficient but not necessary conditions) and structural perspective (e.g. explain a micro level and thus enable us to manage future outcomes), since the two are sides of the same coin, and thus they give rise to one another. Structures do not act on their own (Gudeman, 2005), in a vacuum, and neither do individuals. Hence, the two act in an interdependent play with one another, not saying one is more important than the other, rather the two give rise to different aspects and explanations to the phenomenon.

4.2 A qualitative social science approach

As this thesis takes a qualitative social science research approach, it focuses on describing and finding value as well as meaning to the phenomena's, in their context and situation, from the perspectives of the people involved. As such it uses inductive logic, starting with collecting data and letting concepts and theoretical ideas emerge dynamically as the research process develops like a *"snowball"* through time and space. Thus, it does not try to obtain objectivity, rather it views the process of the observed and the observer as a dynamic and interdependent whole. By trying to have an as open approach as possible and focusing on reflexivity[2] (self-awareness), I view my own part as one of many parts involved in writing this small scale thesis (Robson, 2011).

Based on a pragmatic and post-positive research view, it relates to knowledge as a social construction, emerging out of the relationship between the physical as well as the social and psychological world. Not clinging to the idea that one perspective has all the answers, as truth is seen as something relative. It relates to evidence and research conclusions are fallible and imperfect, and seeks to find the best available evidence describing current causal relationships (*ibid.,*). In order to establish rigor and to counter threats to validity, collected data from multiple sources is triangulated, eg compeering the different empirical findings whit one another, thus verifying the information throughout the process, based on trusting first-hand information and guided by repeated observations (Robson, 2011:158).

4.2.1 "Flexible" research design strategy and multi-method approach

An illustrative case study research strategy is applied to describe, explore and identify possible patterns, factors as well as experiences (CSU, 2018) regarding what the Earthship concept is about. The collected evidence from multiple methods, sources and the different views of the participants is acknowledged as possibilities of multiple realities and existence of different traditions. Hence, the research goal is "open ended" and adaptive in its view of itself and in the way it may turn out, not clinging to an idea to turn out as planned (Robson, 2011). Thus, the contemporary phenomenon of sustainable buildings, Earthships and

2 "Reflexivity asks us to revise our world-view, to be aware of taking risks based on misconceptions, to try our best to police this side of our nature" (Sim, S. 2010:94).

off-grid living will be evaluated in relation to its context, and possible conclusions and generalizations will be presented.

4.3 Literature review

The purposes of the literature review is to identify general patterns and definitions used in the researcher's area and context (Robson, 2011) of peer reviewed articles regarding Sustainable buildings, Earthships and off-grid living. Libraries, electronic databases as well as, the Google, and Google scholar search engines have been sources for information regarding: Do it yourself, Earthship, Green construction and Sustainable Buildings.

This literature review aims to identify general patterns and definitions used in the context of the following four research areas:

1. Drivers, barriers and management within Sustainable Buildings **(SB)**
2. Earth-sheltered housing compared to conventional housing
3. Performances of Earthships
4. Characteristics found on Earthship and off-grid builders

4.4 Interviews

In this part of the thesis I will develop empirical findings that are the basis of the interview part of the thesis. I will do so by telling the story, what I heard and experienced, traveling to two different parts of the USA, New Mexico and Colorado, where I ended up having four different interviews with five different Earthship builders.

In this thesis I have interviewed five persons who in one or another way are involved in Earthship building. Gail and Eva, two persons who are on their way of finding a property to be able to finalize their vision of building their own Earthship. Mikael Reynolds, the man who invented the concept. Randy, who with his wife currently live in their own Earthship, which they buildt inspired by hearing about what Mikael Reynolds had been dong. Eric, a constant house builder who lives in a Earthship and has built several buildings inspired by the Earthship concept.

This was done by combining an ethnographic research approach and an unstructured, non-standardized, open-ended and in-depth interview style I aim to describe and interpret the culture and social structure of the people getting involved in building Earthships. By getting closer to an insider perspective, I allow myself to get involved with the group and with the people being studied, trying to understand the culture studied from the "inside", using the cultures own terms to describe and experience what is going on, as well as allowing research questions to emerge and evolve (*ibid*.,). Doing so I will adapt a participant observational method, e.g. seek to become "some kind of member in the observed group" (Robson, 2011:319). Thus, by participating in the observed event I will be able to explain my own experiences and interpretations, as well as the subjective and structural meanings of the experiences of the people being studied (Robson, 2011). The interviews were recorded and transcribed by me. In my transcription of the interviews I have chosen to be as transparent as possible, leaving it to the reader to makes their own interpretation of the person being interviewed, for example, in their use of language. The interviews has been validated by Randy and Eric, I have not been able to get hold of Michael Reynolds nor Eva and Gail.

4.5 In the pursuit of rigor

In order to enable replication and validation, as well as help to develop cumulative knowledge, I aim to conduct my research in as rigorous manner as possible (Gnyawali and Song, 2016). This will be done by me trying to be as clear and as in-depth as possible in my description and explanations of the chosen theories, methods as well as analytical choices made (Gnyawali and Song, 2016). In order to do so I aim to apply Gnyawali and Song (2016) suggestions on how to obtain rigor in the conceptual/theoretical, design and conduct of the empirical research as well as in the reporting of the results.

Gnyawali and Song (2016) suggest four key elements in order to enable conceptual/theoretical rigor:

1) identification and clear definition of key constructs,

2) clarification of the boundary conditions for the constructs and the theory,

3) clear articulation of the relationships among the constructs, and

4) internal coherence of the arguments and the overall theory.

(Gnyawali and Song, 2016:13)

They further state three important aspects in order to enable rigor in the design and conduct of the empirical research:

1) stating the what, why, and how of the methods used,

2) demonstrating that the methodological choices made were informed and appropriate, and

3) providing a strong foundation for replication and future research.

(Gnyawali and Song, 2016:13).

They also argue that rigor, in the analysis and the reporting of the result, is mainly achieved through flowing four following points:

1) Applying the what, why, and how of the analytical procedures,

2) stating the what, why, and how of the analytical procedures,

3) reporting the results clearly, and

4) demonstrating that the findings are credible

(Gnyawali and Song, 2016:14).

These key points are progressive in their nature, i.e. they build up on one another, the rigor increases when the previous aspects of conditions have been satisfied (Gnyawali and Song, 2016).

4.6 A Qualitative content analysis of the empirical findings

This thesis takes an inductive qualitative content analysis focusing on the content of the empirical findings provided by combining the collected findings from the interviews and literature review. In order to simplify the comparison between the different findings, I aim to revile as well as recognizing the main themes in the empirical findings. Thus, through sorting and summarizing the findings, a big part of my analysis was done at the same time. The findings will be displayed and presented by using three different table charts enabling a concise presentation as well as a clearer comprehension and an easier way to

further analyses the findings (Drisko and Maschi, 2016;2015). The first table presents: a qualitative comparison of adobe, gypsum-stabilized earth and concrete, as well as tire-stabilized earth. The second: a monetary and non-monetary comparison between Earthships and conventional houses in which conventional houses are set as standard and the third: the interviewees inspiration for wanting to live in an Earthship. In doing so I will be taking one piece of data from the empirical findings and comparing it to all other data that I interpret as similar or different. In doing so, I attempt to develop a conceptual recognition between possible relations among the different pieces of empirical findings (Thorne, 2000) and similarities within those concepts. The summarized empirical findings will then be analyzed through the different lenses of the economic theories.

It is worth noticing that the empirical findings collected and the analytical processes are closely related. E.g. the collection of the empirical findings is closely related to whatever theoretical lens i may have conducted in the findings and from where i have approached the phenomenon. Thus, whatever I thought might be interesting would have been conditioned by whatever theoretical approach I might have had. In other words, whatever findings I acquired, as well as looked for are related and will be influenced by whatever theoretical approach I had (Thorne, 2000).

4.6.1 Positional Analysis (PA)

In order to find an efficient solution to a choice situation that we are facing we must first identify what is important in the situation at hand (Helgesson, 2005). In this thesis this will be carried out through applying the Positional Analysis **(PA)** method. The purpose and the main features of PA is ”to illuminate a decision situation with respect to historical back-ground, possibly relevant ideological orientations, alternative impacts, irreversibility, uncertainty, conflicts of interest etc” (Söderbaum, 2013:224), ”for interested parties and to concerned actors who differ with respect to their ideological orientation. The analyst is then listening to and cooperating with other actors and the analysis becomes an instrument of learning” (Söderbaum, 2008:103). Thus, ”PA includes system thinking and conflict analysis among interdisciplinary approaches” (Söderbaum, 2008:103). Rather than ”reducing individuals to

consumers and asking them for their ’willingness to pay’” (Söderbaum, 2008:101) the PA differentiates between monetary and non-monetary values. Since ”[n]onmonetary impacts and indicators are at the heart of sustainability analysis and are considered nonreducible to specific sums of money according to at least some citizens/actors […implying that…] [n]onmonetary costs and benefits can be understood as being as economic as monetary ones” (Söderbaum, 2010:185). The PA has, according to me, the possibility to enrich the analysis with many perspectives, and thus bringing many different values to the table, making the value of the final result possibly more significant for more individuals as a ”multidimensional analysis appears to be more relevant than one-dimensional, monetary analysis” (Söderbaum, 2010:185). ”One of the ideas behind PA is to study the alternatives considered with an equal ambition concerning search for impacts” (Söderbaum, 2008:110). By applying the PA approach to the empirical findings I hope to be able to bring about some light to the current situation of Earthship consumption. This is done in two steps, first by comparing the impacts of Earthships and conventional houses, and secondly by illuminating different Earthship consumers and their ideological orientation (Table 1).

Table 1. Defining Positional Analysis	
Role of analyst	Facilitator, actor with specific responsibilities among other actors ('democracy')
Ethical and ideological consideration	Articulation of competing ideological orientations, specific interpretations of SD included
Purpose of analyses	Illuminate an issue with respect to ideological orientations, alternatives and impacts (conditional conclusions)
Role of politician or other decision-maker	Is expected to match his own ideological orientation with expected impacts of each alternative, being helped by the analysis carried out
Strategy to reach purpose	Keeping monetary and non-monetary impacts separate. Impacts upon different groups and organizations kept separate (focus on inertia, path-dependence, irreversibility, conflicts and commonalities of interests)

Adapted after Söderbaum (2008:102)

4.7 Constraints, limitations and delimitations

This master thesis is very limited in its funding and is relating to qualitative material. It is only conducting an qualitative literature review, as well as only

interviewing people that in one or another are closely related to the Earthship concept. As such, the scope of the interviews is very limited to people already involved in the concept. It is also very limited in empirical material as the availability of secondary sources regarding Earthships and Earthship builders. The findings are somewhat restricted in their view of the topic and arguments for and against it. When it comes to the empirical material it is not exploring current ”traditional” ways of building houses and in what manner they could be transformed to be more environmentally friendly, nor is it studying other green building schemes such as the Leadership in Energy and Environmental Design (LEED). The main reason for this is, as I see it, the limitations as well as the inbuilt inertia of the current ”traditional” ways of building houses and of such schemes. Mainly in the sense of them being able to move beyond current building codes as well as current building material and ideas about how to build green buildings. It is important to mention that there is a clear bias in the result of the literature review, since most of the studies being reviewed have a focus on non-conventional buildings, and thus have a tendency to be biased towards their own perspective.

Four qualitative interviews with only five interviewees' can't give answer to these very general questions being handled, they are only perspectives of a few people with similar interests whom I have met along the way in writing this thesis. They may give us some insight in to the topic, but cannot be considered to give us a good representation of the field. Relating to the information given in the interviews from the perspective of the PA, we can assume that, even though all of the interviewees where relating to the same Earthship concept their ideological orientation and previous information framed their personal values regarding the different aspects of the Earthship concept. This is also the case when it comes to me and my interpretations of the information given during the interviews. Therefore, the comparisons made in this thesis will be based on my values and interpretations of the information given in the interviews. Thus, a "truth" in a scientific manner is not going to be obtained. Having said that, the main limitations regarding the empirical material in this thesis lie in its limited sample size. With a bigger sample the reliability of the research would probably increase. Thus, the findings can be assumed not to be generalizable to a larger population. Another limitation is the issue with not being able to validate the

interviews made with Michael Reynolds, Eva and Gail. This is very unfortunate, but maybe a little bit expected with the experience I have since communicating with people with this off-grid mentality. It can be assumed to be a bit complicated e.g. by being conditioned by their interest in the "conventional" world.

Probably another more experienced researcher would have been able to conduct better interviews and thus acquire other types of information. This is also true for the findings produced regarding the literature review. More information could have been given regarding, for example, the geographical as well as environmental conditions that the Earthship concept might be conditioned by.

Methodologically, the work is rather restricted in is possibility to enable clear conclusions. It would have been easier to draw more clear conclusions from semi-structured interviews. But at the same time they might not have been able to give the same insights into the topic, since they would have, in themselves, been restricted to whatever previous knowledge I had acquired regarding the situation and topic, thus restricting me in my openness in conducting the interviews.

As mentioned in the rigor part, Gnyawali and Song (2016), suggests that the methodological choices made in conducting the empirical research were informed and appropriate. I think that the approach has been appropriate although my interviews were rather spontaneous and informal in their nature, allowing for a more relaxed environment. Thus, I have been rather restricted in informing my methodological choices whilst performing the interviews. This rather "informal", "snowball", "open ended" research method also restricts the replication for future research, since it is rather unlikely that someone else will be able to replicate the interviews.

I regard the theoretical choices made as rather significant, but with more time and money as well as a smaller research field I would probably have been able to enable a more in depth knowledge production.

Analytically, this master thesis is applying the PA, mainly because it is as I see it and suits the qualitative research approach of this thesis. One could have expected me to work with the Cost Benefit Analyses (CBA) but since the CBA

is restricted to only monetary values, it would be of little use in this master thesis.

5. Empirical findings

5.1 Drivers and barriers within Sustainable Buildings (SB)

In order to get a picture of what the market for sustainable buildings looks like, this part of the literature review focuses on drivers, barriers and management within SB.

Sustainable buildings (SB) are hindered by the lack of sustainability objectives on the agenda and sustainability awareness in general (Williams and Dair, 2006). According to Pitt *et al.,* (2009) afford-ability is the number one barrier to sustainable construction, with lack of client demand in second and client awareness at third. There seems to be a massive potential for making buildings greener faster, but consumers find it difficult to decide if they really desire greener buildings (Bordass, 2000).

5.1.1 Financial incentives and building regulations

Financial incentives and building regulations are the most important themes in linking demand and supply in achieving sustainable constructions (Pitt *et al.,* 2009). The commercial buildings industry is almost exclusively driven by considerations of capital cost and return on investments (Larsson and Clark, 2000). But, investors lack the evidence that sustainable property investments increase values e.g. rents and yields (Sayce *et al.,* 2007), and that there is an idea that 'going green' increases building costs (Pitt *et al.,* 2009; Sayce *et al.,* 2007).

As sustainability issues are explicitly addressed in construction legislations, construction companies that improve environmental and social performances of their schemes are likely to make more money and have a more robust and successful business (Carter, 2006). By building SB, companies will be able to increase their ability to address market changes as well as improving their reputation and relationship to the local authority, landowners and community – especially to pro-environmental consumers (Carter, 2006; Heerwagen, 2000).

SB are found to reduce legal, insurance and operating costs (Heerwagen, 2000). Thus, SB should be attended to by forward thinking developers (Carter, 2006).

5.1.2 Developers and professionals

There is a lack of expertise in Sustainable building (SB) as well as sustainability options amongst professional groups. Practical barriers related to the availability of sustainable products, materials and technologies need to be addressed. There is a need for better information about the costs of sustainable techniques, materials etc. to reduce the risk that developers might see a risk in deciding to build in a more sustainable way (Williams and Dair, 2006). Yet, Häkkinen, (2011) finds that SB are not hindered by technologies or assessment methods, but by the lack of documentation of the adoption of new methods. This means that developers and consumers might risk unforeseen costs.

5.1.3 Operation and maintenance

Investments in sustainable buildings has the potential of being cheaper or cost neutral in providing increased value that equals any additional costs since it is the lower costs, increased returns and the risk reduction rather than proven financial return advantages that is the dominant criteria in current sustainable property investments. Hence, investments in SB has the potential of being cheaper or cost neutral in providing increased value that equals any additional costs (Sayce *et al.,* 2007). Therefore, the potentially higher initial investment cost should be related to the relative overall cost savings during operation and maintenance (Sterner, 2000).

5.2 Future of SB

As energy prices is one of the main drivers in the interest of designing energy efficient buildings (Tazelaar, 2013), SB is a new product that reveals relevant loss-prevention benefits. It has the potential to differentiate companies' offers from their competitors' offers (Mills, 2003).

Future clients will be inclined to know more about the effects of the design and planning solutions of the overall building performance. Thus, building characteristics and performances are major determinants in measuring the worth

and market value of a property (Lützkendorf and Lorenz, 2005). To increase the awareness about the benefits of SB there needs to be a development and adoption of SB requirements, management and mobilization of SB tools for designers and design teams (Häkkinen, 2011). By considering financial, social, environmental and sustainability issues simultaneously a more profound knowledge about the characteristics and associated performances of a property can be provided, enabling a more cost-effective planning for the development team as well as a clearer picture of the costs and benefits of choosing an SB for the consumer (Carter, 2006). Having said that, the key to an innovative procurement seems to be the project management, the role of which is to integrate project knowledge, experience and creativity with team building, to enable targeted optimisation (Ang *et al.,* 2005).

5.3 Earth-sheltered housing compared to conventional housing

I have chosen to carry out this part of the literature review to be able to understand what drives people to build with earth and what the advantages and disadvantages in doing so may be.

5.3.1 Living space quality

Compared to conventional houses earth-sheltered housing provide a superior thermal comfort in terms of thermal stability (Lee and Shon's, 1988). They also provide more security and privacy (Bartz, 1986), being an excellent protection from tornadoes, high winds, lightning-strikes, fire and other natural disasters such as earthquakes (Al-Temeemi and Harris, 2004).

5.3.2 Energy efficiency and consumption

By using soil and abundant locally supplied materials earth-sheltered housing lowers energy needs compared to the resources used in conventional buildings, such as iron and cement (Hayashi, 1986). Earth-sheltered housing constructions reduce the building's energy consumption (Pacheco-Torgal and Jalali, 2012) and are more energy efficient than conventional houses (Bartz, 1986, Al-Temeemi and Harris, 2004).

5.3.3 Maintenance and operating costs

As most of the buildings envelope is covered with earth mass it is protected from weathering effects and allows it to have smaller temperature fluctuations, resulting in lowers maintenance and operating costs of painting, freezing water pipes, concrete cracks, replacing roof and roof-tiles etc. (Bartz, 1986 and Al-Temeemi and Harris, 2004).

5.3.4 Impact on the landscape

The minimal visual impact of earth-sheltered housing enables building in sensitive landscapes, allowing for increased open and green spaces as well as possible positive effects for people and the environment. The earth surrounding the building functions as an efficient noise redactor by lowering the vibrations, enabling a quieter environment for people and other beings (Al-Temeemi and Harris, 2004). Earth-sheltered housing also enables more natural plantations and by building these houses on a hill side, or rather, in a hill side, they function as a landslide prevention and also become more socially acceptable (Pacheco-Torgal and Jalali, 2012). But the lack of public acceptance and thermal performance data as well as risks of higher excavation and structural costs act to their disadvantage (Al-Temeemi and Harris, 2004).

5.3.5 Summary of earth-sheltered housing compared to conventional housing

Compared to conventional houses earth-sheltered housing provide increased thermal comfort in terms of thermal stability. They also provide more security and privacy, are more energy efficient in the manufacturing phase as well as the operation phase, it also lowers the maintenance and operating costs. Potentially they enable more green spaces and lower noise. Lack of public acceptance and thermal performance data as well as risks of higher excavation costs act to their disadvantage.

5.4 Performances of Earthships

5.4.1 Thermal comfort and water supply

Several studies have found that the Earthship does not achieve thermal comfort through passive solar heating (Grindley and Hutchinson, 1996; Kruis and Heun, 2007; Ip and Miller's, 2009; Hewitt and Telfer, 2012). Even though the

Earthship is predicted it to achieve comfortable thermal conditions during the day time, most of the year, to make the building livable during winter and in the evenings, space heating is needed (Grindley and Hutchinson, 1996). Neither is the Earthship found to be able to provide consistent water supply solely through its catchwater and gray water system (Kruis and Heun, 2007:10).

5.4.2 Building with rammed earth tires

Rammed earth tire walls are a safe and dependable way to build single story homes (Zimmerman, 2011). Since organisms don't feed on rubber, tires will most likely take hundreds if not thousands of years to decompose in a landfill. Thus, if they are re-used in a constructive way they may have economically and environmental advantages over standard building materials. However, since rammed earth tires are not included within current building codes, and thus also often lack formal documented testing procedures as well as guidelines, many building engineers and inspectors in the building community lack faith in the reliability and strength of this construction alternative. This often cause rammed earth tires walls as the main structural wall to be a difficult if not impossible alternative technique to build homes with (Zimmerman, 2011). Hewitt and Telfer, (2012) finds no problems regarding the suitability using rammed tires in the construction due to the risk of them caching fire, since the tires are rammed with earth and covered with a up to 25 mm thick layer of render, as well as the fact that oxygen is not able to circulate between the tires. If the tires are adequately damp-proofed the risk of leaching of chemicals do to exposition to ultraviolet light, high temperature or water in to the ground from the tires is very low. ”One of the best reasons for using tires as a material in Earthships design is to find use for a small fraction of the millions of tires being thrown away globally every day” (Hewitt and Telfer, 2012:41).

5.4.3 Building with waste

Hewitt and Telfer, (2012) finds no legal problems regarding building with waste, and argue that: any planning permission regarding the building of an Earthship should be regarded on the same terms as any other structure.

5.4.4 Building off the grid

The level of autonomy that Earthships deliver makes them suitable for a rural setting, especially where it is difficult to connect to any form of domestic grid. But in an urban landscape with small lots and where the houses are built close together, the existing domestic grids are probably more efficient. Thus, there is little need for off-grid constructions in developed countries, since most needs are covered by the extensive infrastructure (Hewitt and Telfer, 2012).

5.4.5 Future of the Earthships

The main reason for the Earthship probably never being able to become a mass housing concept is the fact that it is unconventional in itself, using different forms of supplies than the established construction supply chains, and different techniques and skill sets, which at the moment are underdeveloped, making it even harder for mass production (Hewitt and Telfer, 2012). In order to deliver Earthships to a wider market Earthship need a more professional approach, they also need to be monitored and evaluated from independent studies, and to be subject to significant design improvements. But, professionalizing the Earthship concept, making it a mass production and another form of mass housing, would most likely result in making it lose the most important part of its philosophy, its intention to give power to its builder, its resident. Thus, there lies the profound paradox of the Earthship concept, resulting in it never becoming a form of mass production housing concept, because it would destroy its attraction. It would take away the possibility of the individual taking control over their own lives, being self-empowered and not being forced to be part of the conventional way of living in a society (*ibid*.,). If Earthships are to be considered as an alternative they must provide standard comfort for its occupants e.g. supply electricity and water for a comparable price (Kruis and Heun, 2007). But, using aspects of the Earthship concept, such as, tire wall construction, back-up water supply and PV power generator, can significantly reduce the human impact on the environment. Thus, contribute to a more conserving usage of resources (*ibid*.,).

5.4.6 Summary of performances of Earthships

Building with rammed earth tires seems to be a preferable way to contain and simplify the process of building with earth, as well as a safe way to build single

story home. It may also be one of the best ways to reuse them. Findings show there is no reason to not build with tires due to risk of them catching fire. But since building with tires is not included within current building codes it is a difficult, if not an impossible, building technique. The Earthship building technique has the potential to be a more environmentally and cost effective compared to standard building materials. It is suitable for rural settings, but where domestic grids exist they are probably more efficient. To professionalize the Earthship it needs significant design improvements. Professionalizing the Earthship concept, making it a form of mass production housing concept, would probably destroy its attraction. But, since the Earthship is unconventional in itself, using different forms of supplies than the established construction supply chains as well as different techniques and skill sets, it will probably never become a mass housing concept. By using aspects of the Earthship concept we can probably significantly reduce the human impact on the environment and contribute to a more conserving usage of resources.

5.5 Characteristics found on Earthship and off-grid builders

> *"It does not seem an extreme position to want to live either an environmantally-friendly life or one free from the most egregius aspects of the financial system, or both together, yet Earthships remain tagged as an alternative brand that appeals to a small minority"*
>
> (Hewitt and Telfer, 2012:157).

Earthship builder-dwellers have been found to have a tendency to share political, environmental and architecture interests. They are inclined to believe in decentralization, taking responsibility, power to the people and making a difference in the world. Building with "trash", Earthship builders are reminded of their interdependent relationship with their surrounding world, helping them to feel part of, rather than opting out of the world. This life style, and the way that these builders live their lives, building with local materials and labor-intensive but simple techniques, brings these people together and helps them to bring about energy efficient building in the hands of the people (Harkness,

2011). Engaged in building their own homes, Earthship builders gain cultural and place specific relations, thus they learn about historical traditions and knowledge of local resources as well as materials that they can utilize. They build on their own dwellings, they find place-based new skills. The building project is about building their own home for themselves, out of passion for building, a home that they can love. Building off-grid allows them to become closer to their environment. A unique, personal and meaningful situation comes to life when people build their own home, as they have the opportunity to infuse it with their own care (Vannini and Taggart, 2014).

5.5.1 Summary characteristics found on Earthship and off-grid builders

Earthship builders seem to care for the environment and decentralization of power. By building their own house, Earthship builders gain love to their home and awareness of the interdependent relationship to its surrounding world. In building their own off-grid home, they gain access and care for the place, environment, local people and culture. In doing so they also develop new place-based skills and knowledge of local resources and materials that they can utilize.

5.6 Interviews

I will now tell the story and share what I heard as well as experienced traveling to New Mexico and Colorado USA interviewing five Earthship builders. New Mexico

Leaving Boulder, CO, USA and driving through the beautiful landscape of southern Colorado. Entering New Mexico, the sun is setting, it's beautiful. I think it is interesting how life many times work out when we leap into faith and just let go (Me, 2015).

In a picturesque little restaurant in Santa Fe with a big oval community table in the middle, I end up sitting between two couples having a conversation. Turns out that they are here in Santa Fe to look at, work with or looking to invest in Earthships. I end up talking to two of them, Eva and Gail (Me, 2015).

5.6.1 Eva and Gail, a ranch mentality

Eva and Gail are interested in building an Earthship of their own and they are here in New Mexico in the search of the place to build it. One of the reasons why they are looking at building an Earthship is because they are preparing to retire and to be able to afford having their horses. Both of them are well educated, have been traveling a lot and grew up, more or less, in other countries. They do not believe that the people are in charge of the government and have no trust in the current system or the government and they are not interested in living in a community. After we have talked about all kinds of things I tell Eva and Gail that I would love to do an interview with the two of them and to hear more about their interest in Earthships and why they are thinking about building one of their own. I ask them if I could have an interview with the two of them, they say yes, and we decide to have breakfast tomorrow morning.

Entering the breakfast diner the next morning Eva and Gail are sitting at a table in the middle of the restaurant, while ordering some breakfast. We start talking (Me, 2015).

How many average Americans do you think would be interested in an Earthship?

"Very few" […] "you probably would need more of a ranch mentality" (Eva, 2015). Eva says that people think that they have to support the government, "the gay sitting there tudeling he's thumbs" and the “unmarried welfare recipient having here fifth child so that she can have more money and food stamps and stuff and they accept that" […] "that is how everyone here is thought to live, and that is not" […] "dumbing down America so that nobody questions" (*ibid*.,).

Their view on society and the government

Gail and Eva do not trust in the government at all. Gail believes that they are all crocked. "No offense, I don't like people, I want my own space, my own home" (Gail, 2015). Gail is tired of having to pay to someone else for working. Tired of other people and that the government is forcing her to give them her money. "Too many on the top is making too much on the bottom" (*ibid*.,).

Eva argues that she wants “live to live and not to pay somebody else's taxes, not to pay some body's else's income, not to support some body's else's kids” (Eva, 2015). Eva points at the food that we are having and says, "you know, this is grown with genetically modified wheat", "it's like, what poison should we try to do today?" [we] "try to get away from that and try to go as natural as possible" [...] "we have chickens but we can't kill any of them" (says Eva and Gail, both having some meet on their plates).

There are two general approaches of the two:

Eva´s approach:

Eva first saw the Earthship on a TV show on the history channel. She found it very interesting and started you-tubing Earthships and Micheal Reynolds (Michael Reynolds). "I have probably spent 20 hours on it" (Eva, 2015). Eva has an architectural degree and wants to learn from Michael Reynolds, and then build their own Earthship. "There is a lot of things that he has learned along the way", […] "he doesn't think in the box" (*ibid*.,). "He [Micheal Reynolds] had electricity, he had water, he had cover, he had no bill's, so, all earth given", […] "He said he had freedom, and that makes sense to me" (Gail, 2015). Reflecting over how grids go out and how, if so, toilets get frozen, Eva argues that if this would happen and you were to live in an Earthship, you could still live there comfortably. She likes that Michael Reynolds thinks outside the box and doesn't necessarily follow the rules. (Eva has, according to me, more of an off the grid approach to living in an Earthship).

"You pay to build it [...] and then once you are in there it wouldn't matter what happens to the economy you would still have water and a roof over your head and electricity, some food" […] "Part of it is to try to go back to basics” (Eva, 2015).

"The Earthship home mentality is not necessarily giving up on the government but avoiding the government a little, to some degree, which is not necessarily a good thing because then you allow the [the government] to become more corrupted" (*ibid*.,).

Gail´s approach:

Gail´s approach on Earthships is that they are supposed to be earth friendly. According to Gail there is no reason to cut a tree for the purpose of building a garage. "I want the Earthship to be friendly to mother earth" [...] "we got to save mother earth" [...] "because without mother earth we are screwed". [But] "truth be told, if I had millions and millions of dollars given to me I probably have a log cabin in the mountains [...] I love wood" (Gail, 2015). Gail would still like to live in an Earthship even if she would believe in the government, because she would want to be earth friendly.

So how did you gays think you ended up the way you are, and at the place which you are in?

"We try to not brush our teeth with fluoride […] "we are just some of the few that are suspicious" (Eva, 2015). "Maybe we have seen a little bit more and everybody here is, you know, they got their little blinkers on, their blinders and all they see is what they are told to see" (*ibid*.,). Eva says that she as a kid spent time with her dad when he was doing business in South America and how he helped extracting minerals out of those countries to the USA, she says that she knew what we (the US) were doing. She also refers to how her dad, said to her that they were trying to take everything away from him and later came to witness how those countries and their communist governments bankrupt his company's. How he hated Eva Peron, and how her father told her about how the English was "basically robbing Argentina blind". "I have known corruption all my life through a lot of different angles and a lot of different reasons" (*ibid*.,).

5.6.2 Michael Reynolds, *"I'm not doing architecture, I'm doing life"*

After breakfast with Eva and Gail I'm "finally" on my way to meet up with Michael Reynolds. Driving through a beautiful rugged mountainous New Mexican landscape on the way to Taos I wonder if Michael Reynolds will show-up? Fifteen long minutes after entering the little pizza place that Michael Reynolds has chosen for the interview, Michael Reynolds arrives. He looks just like on the pictures and on You tube, long white hair, rugged white beard, he

sits down in front of me on the other side of the table and after ordering some food and something to drink (margaritas) we begin the interview (Me, 2015).

What would you like to talk about, I ask Michael Reynolds,

-"I'll talk about the stuff that is on top of my list in any given moment" [e.g.] "making a carving, a path or tunnel through the horseshit of laws, regulations, codes, dogmas, cooperations, government that all of which come stand between people and having a life" (Mikael Reynolds, 2015).

Do you think that there is a possibility to transform the already existing society with these [your Earthship] principles?

"Everybody needs air, everybody needs food, and everybody shits. Give them that, make it your calling in life to give everybody what they need". He continues, "it is available to have a life" "life is available but we are making it unavailable to our selves, to our families, to our kids, to the future". "There is no reason for any man, woman or child to be miserable on this planet. It is not a matter of Oprah Winfrey or Bill Gates sharing their millions. It is a matter of these people getting it themselves, fuck Oprah and Bill". "The earth is sinking in its ability to support humans" (Mikael Reynolds, 2015). If all of the soldiers in all of the armies, in all of the world, put down their weapons, picked up tools and started building sustainable housing for all of the people of the world our problems would be over" (*ibid*.,).

Michael Reynolds view of architecture is that

"I'm not doing architecture, I'm doing life", "there is just no place for what we call architecture in my mind, […] we are looking at staying alive, staying happy with everyone around us and the planet and the animals and the plants, all happy. You know I'm talking heaven here" (Mikael Reynolds, 2015).

According to Michael Reynolds there is no better building material than tiers, garbage, cans and bottles. He argues that tire work is not a big deal, and gives me the example of a typical home, two bedrooms and two and a half baths. He

tells me that it is only two and a half days tier work “if you stage it and execute it properly" (*ibid*.,).

When it comes to water and sewage Michael Reynolds says that "we harvest the water […] how we use it is the thing [and] no sewage leaves your home", "you can “eat” your sewage, produce food [and] your putting nothing into the planet" (*ibid*.,).

"I´m making a vessel that many people can have and it gives them the wings to transcend, to be able to heat themselves in this kind of weather, to be warm and comfortable, have electricity, to have water, to have sewage treatment that doesn't go out into the earth, have food, [...] This building does that to the point where we gotten it to be somewhat affordable relative to the cost of other housing, but other housing is too expensive anyways, so the thing now is to make it real basic, real simple” (*ibid*.,).

He has just released his "The simple survival Earthship" app, which he sells for nine dollars and ninety nine cent, with which he is arguing that he is selling us a life. "I want it to be available to everybody", […] "I want to transcend money" […] "I want to go to the 80 percent [of the world’s population] and I want them to build the rafts, and I want the 20 percent to be bagging to be able to get into the rafts". -”The Titanic is sinking […] if people are out there with life rafts, when it sinks, more and more people will be coming to them” (*ibid*.,).

Arguing that, since most of our built environment already is built, I ask Michael Reynolds what he would think of a retrofit app e.g. an app that would show people how to retrofit their current house into a more Earthship type of house.

"It's got to be so general and universal, […] they are going to be 50 to 60 to 70 percent efficient. If we reduce fossil fuel use [...] with 50 percent on this planet we are home free for another 10000 years. Right now we are home free for another 100 years, if that. Nr 1. how do we buy time. Nr 2. how do we buy the future and it doesn't involve money” (Mikael Reynolds, 2015).

If you could chose, is there any place you would like to build an Earthship today?

"You can learn a lot from animals and plants, they don't have dogma, they don't have ego, they have staying alive" (Mikael Reynolds, 2015). Michael Reynolds argues that, since Earthships relate to the weather system, there is no need to be worried about the altering of the weather systems. "When it's raining you are happy because you are getting water, when it's dry and sunny you are happy because you are getting power" (*ibid*.,).

What do you think of being on-grid / off-grid:

"I think the grid itself is archaic, all grids: power, water, gas. Any kind of a grid makes you dependent, renders you dependent. There is no grid needed when there is the sun, the wind, the rain. All of these things are phenomena's of the planet. Impacting the planet all the time, you just relate to them, they are way bigger than us. A grid is a human net or something that fucks everything up really. Maybe it had some good reason for getting started, but when you look at how hard it is to make power with coal fired power plants and nuclear and what we go through to do that, run it in lines for hundreds of miles, and line resistance cuts it in half. It is so fucking pathetic and archaic that we even do that, you know, when I can walk right up to the sun and interact with it" (Mikael Reynolds, 2015). "You have to show people" […] "I think people need to know how to stay comfortable and happy quick, without depending on any grid, cooperate, government, anything" (*ibid*.,).

The interview is coming to an end,

"Fuck you, fuck architecture, fuck everybody, I think this is the right direction, if you don't I watch you sink in the north Atlantic (referring to the Titanic) cause this is the right direction, "I don't give a shit about anything". "No human on this planet has anything I need" (Mikael Reynolds, 2015).

Paonia

It´s amazing how people are willing to help-out, some people like Steve, whom I was introduced to by my amazing friend Roxana, made it possible for me to be able to go to Paonia, a town in the Rocky Mountains, to interview two Earthship builders, Randy and Eric (Me, 2015).

Paonia is a little town in Colorado with a population of about 1400 residents. It's known for its orchards, alternative people and for having no building-codes. As the saying goes in Paonia, the best thing about Paonia is that you can build however you like, and the worst thing about Paonia is that so can your neighbor.

As we drive up the snowy gravel-rod toward the mesa that Randy Owen lives on, Steve tells me that it hasn't been this cold and snowy in Paonia in the last twelve years. Owen, who has recently retired is a somewhat, to me, eccentric man with long curly hair, a beard and a big smile, he greats us as we pull in on to his driveway. The view is amazing from the hill overlooking Paonia and the surrounding landscape (Me, 2015).

5.6.3 Randy, going off-grid

Sally, Randy's wife, was inspired by Michael Reynolds to build an Earthship. She started building the Earthship back in 1997, which the two of them now lives in, one mile away from the electrical grid. Sally bought the land in 1993 without any water rights or grid connection. According to Randy, to get the power connected to the house at that time would probably had cost about 10000 dollars. They wanted to be off the grid "so to not contribute to the carbon emissions that are going up into the air" (Randy, 2016). So, Sally decided to spend that money on solar panels and battery's instead. It has cost Randy and Sally about the same amount of money to go off-grid that the investment would have been to be on the grid. But if the cost would have been one third, they probably would have chosen to be on the grid, and then worked their way to become off the grid.

Their house is 70 x 40 feet e.g. about 2800 square feet and has no insulation under the floor. "This morning it was cloudy so I built a fire in the wood stove" (*ibid*.,). According to Randy their house has never got below 50 degrees (10 Celsius), "we can walk away and it will never go below 10 centigrade" (*ibid*.,). Randy and Sally uses a swamp color in the summer.

The house has most of its building materials from the dump in Aspen, which, with the building boom back in the 1990´s, used to have an abundance of leftover materials which you could go in and collect. "First we had the door,

then we said, okay this is how we are going to build" (*ibid*.,). Thus, the house is built around what materials that were available from the dump in Aspen as well as soda cans and tiers.

Building the tier walls Sally and Randy used all 16 inch size tiers, "labor of love" (*ibid*.,). When it comes to off-gassing from the tiers, Randy argues that, since the tiers has been sitting outside for years, he is not considering the off-gassing from them, e.g. he is not concerned with it being dangerous.

In bright sunshine the house charges 40 amps, but since it is cloudy at the moment it only charges 7.8 amps. In case there is three cloudy days in a row Randy and Sally have to use a back-up generator. It's a 4000 watt petrol generator and 4 gallons of petrol will last them about 6 hours. Randy and Sally has about 20 golf course car battery's. Randy does the comparison with a car and says that their house is like a car with a strong engine but with a small gas tank. They have had batteries lasting up to ten years.

Randy and Sally has the "butterfly" type roofing style through which they collect rainwater off-owe. According to Randy it rains about 18 inches of rain per year in Paonia. Before Fukushima they used to drink the water from the roof collection, now, Randy argues, the water is radioactive, thus they only use it for showering and dishes. In the summer Randy and Sally have to be conservative with their water usage and they have to buy water from town which cost´s them 1 dollar for 200 gallons.

5.6.4 Eric, on building Earthships

Eric Darby seems to have found his svadharma in life, to build houses. He is tremendously motivated, and spends all his time building alternative-buildings. Eric builds the envelope, the frame, he argues: "I want to see how much it costs and how it performs and then when I'm done [and then] I move on to build another envelop" (Eric, 2016). On the mesa above Paonia Eric has built several different buildings, he has just finished building a dance hall that he built for the community.

Never having been a person with a lot of money Eric had to figure out a way to build in-expansive. After reading Michael Reynolds book on Earthships he found used tiers to be a fascinating idea, he liked the idea of using garbage and

that it was inexpensive. Eric argues that he will use any building method if it is to his advantage. After the interview, Eric sent me an email where he himself defined his work in the fallowing way:

> *"I am continuously in search of the ideal design. I know clearly now that my main objective is to build an energy efficient building, with strong attention to cost and ease of construction" [and that it is] "always exciting to me to work on my constantly evolving idea of the ideal construction design"*
>
> (Eric, 2016).

When I meet up with, Eric he greats me in a blue overall, it looks like that blue overall is what he is wearing most of the time and is most comfortable in. Eric and I start directly to talk about building houses and Earthships in particular. Eric says that he has probably filled 3000 tiers on his own, he has even moved one of his Earthships from his old property to his current one. Eric uses a small tractor, a "skid steer". The skid steer helps Eric to lift the dirt up from the ground, then he shovels it into the tiers. According to Eric, you can´t see that much difference between tiers that have been packed with a sledgehammer and his method.

Ironically Eric lives in an Earthship that he himself did not build. The Earthship Eric lives in, Eric argues, functions perfectly and he seems to have it as a reference point for whatever Earthship inspired building he brings into existence. The floor in the Earthship is not insulated. The Earthship does not have an insulated floor and it is according to Eric probably 70 degrees Fahrenheit (about 21 degrees Celsius) as we are speaking. "If it wasn't for the tiers the building would tend to overheat since there would be no way to store that heat" (*ibid*.,). Eric has never seen the temperature in his house lower than 60 degrees (15.5 degrees Celsius). Eric used to live with heating with a wood stove, but he now thinks it has gotten old. He argues that, why live in a house that needs heating from a wood stove "when you can live in a house that is warm without any effort and no pollution, it makes a lot more sense" (*ibid*.,).

When it comes to energy and water heating Eric´s approach is different from Randy´s. From not wanting anything that needs electricity Eric now only wants

products that runs on it, “no more propane” (*ibid*.,). Having installed 10000 dollars’ worth of solar power, e.g. 12 panels a 250 watts each, enabling some 3000 watts in total and by using a 12 volt refrigerator DC system, Eric is able to produce more electricity than he can use.

Eric´s latest Earthship inspired house project is a “cave with south facing glass” (*ibid*.,). It is about 42 times 24 feet and built so that it is completely underground. Due to the fact that it is completely built underground his idea was that it would be the best Earthship ever, “but it is not” (*ibid*.,). During the last three weeks Eric has measured/monitored the heat of the walls in the house. He feels that he is losing the heat somewhere, but where does it go? “But that is not the case, the whole building is 53 degrees” (*ibid*.,). So why does this building not do so well? According to Eric he has made two mistakes when building this Earthship. First of all it is not facing a southern slope. Secondly the building is sitting in a depression and the sun is gone already at 14.30. Thus, there is a lack of sun to heat the house. Eric thinks that the house will do well in the summer, especially with the 2 feet of insulation that he put in the roof of it.

5.6.5 Interview summary

Eva and Gail are searching for freedom from the system and monthly payments. They want to live close to nature and their animals. They seem to believe in Michael Reynolds and his visions about how life is made possible by living in an Earthship.

According to Michael Reynolds**,** what is enabling us to satisfy our common needs is our common world, and it is sinking. Michael Reynolds wants to make a change by putting the power back into the hands of people and by enabling a comfortable life to people without depending on any human grid, cooperate, government, money or anything. Michael Reynolds does not care about what any other human thinks, according to him they can fuck-off.

To not contribute to the carbon emissions Randy (and Sally) wanted to be off the grid. They were inspired by Michael Reynolds Reynold and have brought most of their building materials from the dump in Aspen and invested in solar panels. In case there is three cloudy days in a row they use a back-up generator. The house has never been below 10 degrees Celsius. Before Fukushima they

used to drink the rain water that they collected; now they only use it for showering and dishes.

Eric was also inspired by Michael Reynolds to build an Earthship, an inexpensive house, ease to construction, by using garbage and tires, that would keep him worm without any effort and no pollution. Eric has probably filled more than 3000 tires by now, on his own and installed 10000 dollars' worth of solar power, which enable him to produce more electricity than he can use. His Earthship that he lives in is producing a minimum temperature of 15.5 degrees Celsius. According to Eric an Earthship building needs to be built on top of a hill, facing a southern slope, and be well insulated.

6. Findings, Analysis and Discussion

This part aims to relate the different empirical findings to one another as well as to the different theoretical perspectives, with their assumptions of what gives rise to monetary or financial behavior.

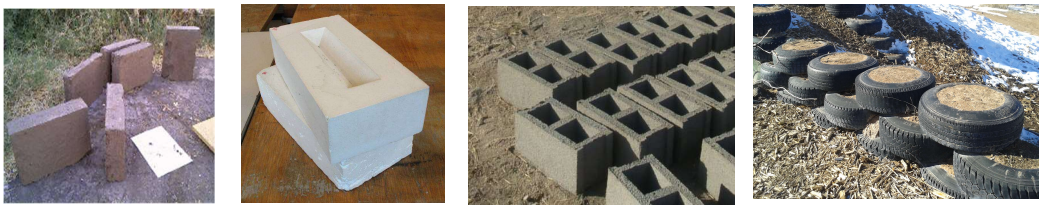
6.1 Comparing Rammed Earth tires (RET) with other earth based building block technique

Table 2. A qualitative comparison of adobe, gypsum-stabilized earth and concrete as well as tire-stabilised earth

Qualities	Adobe blocks (AB)	Gypsum-stabilised Earth (GsE)	Concrete construction (CC)	Rammed Earth Tires (RET)
Material cost	Very low	Low	High	Very low
Labor involved	High	Medium	Medium	High
Durability	Low	Medium	High	Very high
Energy required	Very low	Low	Very high	Very low/none
CO 2 production	None	Very low	Very high	None

Adapted after Vroomen (2007:13)

(AB) **(GsE)** **(CC)** **(RET)**



Source: picture (AB), http://desertphile.org/adobe/brick.htm, (GsE) and (CC), source: Vroomen (2007).

By comparing rammed earth tires (RET) with the three other stabilizing earth production techniques, we can see that RET is relatively preferable in comparison to all the other methods, except when it comes to labor involved, which is the same as adobe block production. Thus, the results show that RET manages to contain earth in a less complex and preferable way too all the other alternatives. Important to note is that by using tires as a way to stabilize earth, there is no need to be forced to find suitable soil, use expensive machinery, have any special skilled or semi-skilled labor, thus the technique has the potential to be very environmentally beneficial and cost effective.

But, as the technique is generally very unknown to the general public it can be assumed that its acceptability is probably very low. In order to enhance the techniques acceptability, showing its relative benefits in accessibility, low material cost, environmental advantages could be of great use. Thus, educating low skilled labor in the technique and implementing management information about its use and environmental as well as monetary cost could be of great service to the environment and to people that are in need of building their own low cost buildings.

6.2 Relating the empirical findings of the Earthship concept to the economic theories by using Positional analysis

To be able to make a significant decision we need to know what is important in the situation at hand. As presented earlier in the method part, this will be done by applying Positional analysis (PA). The analyses will be carried out in two different parts. The first part will focus on comparing pros and cons between Earthships and conventional houses. In the second part the focus is to analyze who the Earthship consumer is.

6.2.1 Analysis part 1, comparing Earthships with conventional houses

Four different analyses will be carried out in order to be able to compare, evaluate and weigh different monetary and non-monetary resources needed: one evaluating the pros and cons for the profit maximizing firm, one for the utility maximizing consumer, one of DIY builder and one from a maximal total societal welfare perspective.

6.2.2 Specification of the chosen variables

To be able to make a comparison between Earthships and conventional houses 19 variables have been selected, in which conventional houses is the standard. The selected variables are based on the empirical findings made in the literature review as well as the interviews and are assumed to have an significant impact on the value and thus the choice of building an environmentally friendly house in monetary and non-monetary terms. The variables are divided into four

different sub-groups, building costs, operational costs, operation phase qualities and environment costs (Table 3).

Table 3. A monetary and non-monetary comparison between Earthships and conventional houses in which conventional houses is set as standard

	Earthship		**Conventional house**
	Monetary	Non-monetary	Standard
Building costs			
Labor hours needed	**Non-preferable**	**Non-preferable**	**0**
Capital	**Preferable**	/	**0**
Material	**Preferable**	**Preferable**	**0**
Energy needed	**Preferable**	/	**0**
Water needed	**Preferable**	/	**0**
Price of final product / building	**0**	**0**	**0**
Operational costs			
Water Efficiency	**Preferable**	/	**0**
Energy Efficiency	**Preferable**	/	**0**
Maintenance	**Preferable**	/	**0**
Safety (Fire risk / Disasters)	**Preferable**	/	**0**
Operation phase qualities			
Thermal stability	/	**Preferable**	**0**
Noise	/	**Preferable**	**0**
Security	/	**Preferable**	**0**
Privacy	/	**Preferable**	**0**
Place connection	/	**Preferable**	**0**
Environment costs			
Total Water use	**Preferable**	**Preferable**	**0**
Total Energy use	**Preferable**	**Preferable**	**0**
Total Material use	**Preferable**	**Preferable**	**0**
Noise	/	**Preferable**	**0**
Definitions No reference or value available = /			

Looking at the empirical findings described in table 3, the different aspects of the building costs tells us that labor hours needed are higher for building the Earthship than conventional houses. We can also see that the monetary capital and material cost, as well as water and energy needed during the construction

phase are judges to be less for the Earthship than for the conventional house. While the price of the final house is assumed to be equal.

The monetary operational costs for water, energy and maintenance, as well as safety costs are judged to be lower for the Earthship than for the conventional house. Continuing with the next set of compared qualities, operation phase qualities, the same pattern arises. All other qualities, e.g. thermal stability, noise, security, privacy and place connection are found to be in favor of the Earthship concept. By looking at the environmental costs we can see that the Earthship concept has less impact on all the costs, e.g. total water, energy and material use as well as noise.

Thus, by comparing all the results of the cost and qualities between the two building concepts in table 3 we can see that the Earthship concept has in total 17 preferable outcomes and 1 non-preferable outcome, while conventional houses have 1 preferable outcome and 18 non-preferable outcomes. It is from this comparison clear that there is one quality that emerge which is worth giving some extra attention to, labor hours needed, as labor hours needed is the only quality that is in disadvantage for the Earthship concept and in favor of conventional houses.

Table 3 shows that Earthships seems to have the potential to lower material, energy and water use in its building phase as well as lowering water, energy and maintenance needs during its operating phase compared to conventional houses. Thus, it also seem to have a "potential for making buildings greener faster" as Bordass, (2000) pointed out. It also seems to have a potential to lower the operational costs as well as being able to increase the operational phase qualities of a building. Its relatively lower risk of fire and risk of being damaged in a disaster should work to the advantage of the Earthship in its potential of lowering insurance, rebuilding, and maintenance costs of the private owner as well as lowering total cost for society in general.

6.3 Relating the empirical findings in table 3 to Neoclassical economic theory

6.3.1 Relating the empirical findings in table 3 to the profit maximizing firm constructing the house for other users

From table 3 we could see that all investment costs / building costs e.g. capital, material, energy and water costs, except labor cost, are lower for building the Earthship than for building the conventional house. As the commercial building industry is said to be almost exclusively driven by capital cost and return on investments (Larsson and Clark, 2000), we can conclude that the difference in labor cost for building an Earthship compared with a conventional house, is that much higher, so that the private firm makes more profit by building conventional houses than building Earthships. Assuming that capital cost is a big part of the total investment, but still secondary in relation to labor cost, it would be interesting to know the relation between the two, as more capital can be assumed to decrease labor needed. In the interview with Eric where he described how he used a small tractor, a skid steer, and thus was able to produce the same quality but with much less effort and time, thus increasing his productivity. Hence, by increasing capital cost in the form of a skid steer there is a big possibility in lowering labor cost and thus the total building cost of the Earthship for the private firm, resulting in an increased return to investment.

6.3.2 Relating the empirical findings in table 3 to the utility maximizing consumer / individual

If the price for the two building concepts is the same, what is it then that makes consumers have doubt about the Earthship concept when so many aspects are in its favor? The literature review showed that consumers find it difficult to decide if they really desire greener buildings (Bordass, 2000) and that they are unsure of how much it would cost them. As consumers are assumed to want to maximize their utilities in relation to their resource constraint (Marbuah, 2014), according to Neoclassical economics, and as most houses that are built today are conventional houses, a simple conclusion from a Neoclassical economic perspective must then be that: consumers find more utility in conventional houses compared with Earthships.

But Lancaster (1966) argues that it is the properties or functions of goods that give rise to their benefits, thus we can assume that there are more than just their

monetary aspects, e.g. non-monetary ones, that give rise to their values. Further, according to Institutional Economics and Economic anthropology, it is the individuals ideological orientation (Söderbaum, 2008) and its experiences of its current and past prevailing cultural "base" (Gudeman, 2005) that defines its choice to consume these properties or functions of goods, such as the Earthship. Therefore, we can assume that there are more than just the monetary aspects of the Earthship concept that makes the Earthship consumers chose to consume Earthships. So, how is the individual's personal, social and cultural experiences involved in their choice to consume Earthship? Since the Earthship builders in this thesis are all DIY builders these dynamics will be related to below.

6.3.3 Relating the empirical findings in table 3 to the DIY builders, another kind of entrepreneur

As the Earthship builders are DIY builders they can be referred to as a kind of entrepreneur which enables and takes advantage of structural changes and therefor seizes a new market opportunity (Pålsson Syll, 2005). When building their Earthship on their own, the cost of doing so can be assumed to be lower than if these consumers where to buy a house from the profit maximizing firm. Hence, altering the relative willingness to pay for the Earthship in comparison with a conventional house.

From a Neoclassical perspective it could be said that, the consumer building its own Earthship find the labor price of doing so that much lower than buying a conventional house, so that it covers the monetary cost of paying a construction firm to do the job.

But the DIY individuals, as Institutional Economics prefers to relate to the consumer concept, have interest based on their worldview or ideological orientation rather than only monetary ones (Söderbaum, 2008). Therefore, we need to relate to the individual's background and current situation to understand their choice of building an Earthship. To be able to do this we need information about the individuals who consumes Earthships, e.g. -who is the Earthship consumer? This information, which was gathered in the interviews, will be related to below in the second part of this economic analysis. But first, let's look at how the Earthship concept relates to total social welfare.

6.3.4 Relating the empirical findings in table 3 to maximization of total social welfare

According to neoclassic economic theory the market is said to, in the case of perfect information, provide the right price and optimal allocation of resources and thus maximize social welfare (Marbuah, 2014 and Weintraub 2007). How is it then that the market provides more conventional houses when Earthships, according to the findings in this thesis, (1) demands, over all, less monetary resources in the building phase as well as in the operational phase, (2) supplies more operational phase qualities, and has less over all environmental impacts? Can it be that there are omitted variables in the empirical findings that place a crucial role for our analyses that are left out, or can it be something else? Can we find some part of this unsettling result in the critique directed towards the theoretical perspective that we have related the findings to?

6.3.5 Relating the analytical findings, from a neoclassic economic perspective, to the critique that has been directed towards this theoretical perspective

Critique has been directed towards the neoclassic assumption that consumers and firms are rational; arguing the opposite, e.g. that consumers and firms are irrational actors in the market, making irrational decisions, based on imperfect, possibly insignificant, or at least insufficient information (Gudeman, 2005 and Helgesson, 2005). Adding up to the very likely assumption that, the market does not always provide the right price and optimal allocation of resources. Therefore, if actors on the market do not have perfect information, e.g. significant information, they will not act rationally. Thus, in the case of Earthships, consumers WTP might be misleading, as they might actually be willing to pay more for the Earthship if they knew of its existence and of its relative advantages compared with the conventional house. Hence, WTP might be argued to be relative to the information that is available. It might even be argued that, with more information about the positive qualities of the Earthship, compared with the conventional house, consumers would be able to find more satisfaction and well-being, and thus, higher utility by changing their preferences in favor of Earthships. But, to be able to make such an assumption, we need to be able to distinguish how it came to be that some consumers find more utility in choosing Earthships than in conventional houses. In doing so, we need to be able to distinguish – what is it that forms the identity and well-being

of the Earthship consumer, as this can be argued to be essential for what shapes consumer preferences. Thus, in order to make a more inclusive analyses of the empirical findings and to learn more about what made, as well as makes, individuals interested in building Earthships, the second part of the positional analysis will be carried out below.

6.4 Analysis part 2, who is the Earthship consumer?

Some people chose to consume Earthships, why is that? What information did the interviews of Earthship consumers give us? Below, in table 4, I have gathered significant reoccurring tendencies for the choice of Earthship consumption. The information will be used to try to understand their Earthship consumption; Michael Reynolds as an entrepreneur and as a project manager; the market development within SB; Earthships and the current building market; the Earthship concept, as well as help us in reflections on the different economic perspectives.

Table 4. Eva and Gail, Owen (and Sally) as well as Eric inspiration for wanting to live in an Earthship

	Eva and Gail	Owen (and Sally)	Eric
Quality Earthship concept			
Trust in Michael Reynolds's idea	**XX**	**XX**	**X**
No monthly payments	**XX**	**XX**	**X**
Care about nature	**XX**	**XX**	**X**
Wish to go off the grid	**XX**	**XX**	**X**
Using “garbage” and tires	**XX**	**XX**	**X**
In-expensive house	**XX**	**XX**	**X**
Michael Reynolds's message / value			
The natural environment is getting destroyed	**XX**	**X**	**X**
Transcend Money	**XX**	**-**	**-**
Transcend human built grids	**XX**	**X**	**-**
People can Fuck-off	**XX**	**-**	**-**
Situation of participants			
Looking to retire	**XX**	**X**	**-**
Retired	**-**	**X**	**X**
Well educated	**XX**	**?**	**?**

From table 4 we can see that all the five participants agreed that they all wanted to consume the qualities that the Earthship concept represents. We can also read that they all shared Michael Reynolds's view that the natural environment is getting destroyed. They all want to transcend human built grids, except Eric, and that Eva and Gail want to transcend money. Eva and Gail also agreed with Michael Reynolds that people can "fuck-off". Further, we can see that three are looking forward to retire, two are already retired, two are known to be well educated and that they all are DIY builders.

6.4.1 Relating the findings done on Earthship builders to the characteristics found on Earthship and off-grid builders

We can see how the five participants in this study correspond with what previous studies have found on Earthship and off-grid builders. E.g. we can see that they care for the environment and decentralization of power, displaying their knowledge of their interdependent relationship with their surrounding world. We can also see how their building of their own home seems to bring them closer to their local environment and a close and loving relationship to their home as well as the local community (Harkness, 2011; Vannini and Taggart, 2014). And how, for example, Eric just finished building a dance hall for the community and how Randy and Sally built their Earthship almost entirely out of utilized waste from local resources, as well as how the awareness about the radioactive waste, assumed to be from Fukushima becomes important as it is polluting their drinking water. Thus, forcing them to relate to and take care of both the local as well as the global environment as it, most likely, will affect them sooner or later.

But, we can also see from the findings in this study how Eva and Gail seem to feel alienated. Can it be that Eva and Gail, as they are looking to build their Earthship, do not have access to local people, a place and environment as well as a culture which they can care for and connect with? That they, at the moment, lack love to their home and other people. Can it be that the rest of the participants have gained these qualities that Eva and Gail are missing through the process of building their home? Maybe the awareness of the interdependent relationship between man and his surrounding world is a prerequisite for Eva

and Gail's search and wish for their own home, a place that they can connect to, in the natural environment, which they care so much for.

6.4.2 Michael Reynolds as the entrepreneur and as a project manager

How can we relate to Michael Reynolds as an entrepreneur and project manager? I think that the key to Michael Reynolds as a project manager is his identity, his passion for transcending money and wanting to be free from monthly bills without destroying nature. It is his role, his charisma, that makes people believe in him and his vision, a vision that they also share, and thus enable them to relate to him. In seeing him, some kind of longing is awakened and they themselves think that they too can build their own off-grid home.

Michael Reynolds speaks to the people that feel left out of society, or believe that society did not or will not provide what they want or need. He shows them that they themselves can build their own home in an environmentally friendly way, to become freed from monthly bills, the grid, and be a part of a self-empowered culture that enable people to transcend money, and not to be dependent on, or part of, a society that is exploiting people and mother earth.

In his own way Michael Reynolds defines his role as a project manager by sharing his vision, experience, knowledge and creativity, most of the time free through YouTube as well as other channels.

As an entrepreneur Michael Reynolds's antagonistic development of the Earthship concept against the current system has probably developed slowly. From being a private building for Michael Reynolds, to becoming a wish for him to help other people and to make a living for himself, as well as for his friends.

Since building codes prevented Michael Reynolds to make a living on his design he was forced to get involved in a dialog with the government and local authority on building with the existing building codes. The antagonism thus grew as Michael Reynolds's building design was not approved. Instead of going with the current system Michael Reynolds opted out and started to become a contra revolutionary, which led him to advance his skills as a leader for a rebellious elite. An elite that in one or another way had the skills and/or

possibility of thinking outside of the box – about, how a life could be for people if they were not forced to think about survival every day.

Thus, Mikeal Reynolds, like the entrepreneur, strives to bring about profit through differentiating himself and the Earthship concept on the market by investments in new innovations, finding new paths and enabling new methods as well as new combinations (Pålsson Syll, 2005).

Hence, the Fuck-you - I don't need anyone - Michael Reynolds "Earthship bubble" world, is something that I think has grown out through its time, place and culture. Michael Reynolds and the Earthship concept does not and has not developed into or out of a vacuum. Therefore, I think it is impossible to say that Michael Reynolds himself is the entrepreneur of this Earthship world and concept, but is its personification. The concept, is thus rather co-dependently brought into existence by its causes and conditions. But then again, maybe it is because of Michael Reynolds's "Fuck-off, fuck the world - I don't need anyone" that makes some consumers drown to him and his building concept. And that in having his attitude Michael Reynolds was able to have his vision, which in the long run, might have given rise to new investments and structural changes that might be a part of a "creative destruction".

6.4.3 Reflections on the market development within SB

As mentioned in the literature review of drivers and barriers to SB, the potentially higher initial investment cost in designing an environmentally progressive building should be related to the relative overall cost savings during operation and maintenance over the buildings life span (Sterner, 2000). In the case of the Earthship concept, Michael Reynolds can be seen to have done the initial design and development investment, even though there might be things that can be further developed as in any design, the findings shows that the Earthship enables both lower monetary operating as well as lower maintenance costs (Bartz, 1986; Al-Temeemi and Harris, 2004).

But the company building and owning the building are seldom the same. If the construction company is only interested in short term profit and return to investment (Larsson and Clark, 2000) in its analysis of the potential business case, the firm will not make more profit by investing in building a more

environmentally progressive building. It will not do so. Thus, there needs to be an overall institutional and cultural change that values and enables firms and consumers to make higher profit and to see the potential of more utility in producing as well as consuming environmentally beneficial goods, such as Earthships. As costs and regulations are said to drive design (Pitt *et al.,* 2009), there must be an opening for a potential financial outcome that allows for firms to make more profit and motivate them to engage in environmental improvements of a building's performance. And, as the firm is part of, and perform within, a cultural and an institutional framework (Söderbaum, 2008 and Gudeman, 2005), driven by profit maximization, based on Neoclassical assumptions (Weintraub, 2007), change can only occur from within the culture (Helgesson, 2005), in which values give rise to structures in an endless, but changing, feedback loop (Pålsson Syll, 2005). Thus, according to me, regulations that allow for alternative and more environmentally efficient buildings need to be improved and developed in order for such a change to occur.

6.4.4 Earthships and the current building market

Wouldn't it be wonderful if Eve, Gail and Michael Reynolds wanted to live among us if they felt belonging with the rest of the world? If we see it from a market perspective, I think that there is a potential monetary business case in building Earthships as an environmentally friendly building concept in relation to the existing profit driven company, for firms, consumers and society. Everything starts with us as a common culture beginning to open up to change our values and cultural behaviors. By doing so we will also carry out a change as a collective, as we, together, are the ones that choose what we want, together with the companies and the temporary system that we maintain as well as transform our values and actions through.

Some firms and consumers really do value and put a “price” on the environment. I think there is a growing culture today that really cares about the environment and that there is a big opportunity for companies to make profit in reaching these interests. If governments were to help out in making it easier for new environmentally beneficial building inventions to become possible and profitable, e.g. by changing laws and building codes and by allowing tax

reductions as well as granting funding's to new projects, there would be a great possibility for market change. Norms and values change, and the environmental subcultures that might have started in the early 1970's are today much more common, thus the "giving up" part, and loss of acceptance might not be a big issue in the near future.

Rather today, it might be the case that firms can make more profit by satisfying consumers with better products that deliver more good qualities and with less environmental impact. By choosing to produce alternative products, like the Earthship, firms can potentially provide the alternative that has the most attractive characteristics possible for its consumers and break new ground. Therefore, firms will make more profit by meting consumer demand, as this will make consumers attracted to the product. It's like the idea of finding that the consumer did not even know that they wanted, and what I think is the essence of the firm's part of the idea of the entrepreneur and creative destruction. Consumer on the other hand needs to become more environmentally aware and bigger risk takers before we can really change the market and our collective environment for the better.

6.4.5 The Earthship concept

Now, we have looked at market and environmental aspects of building sustainable buildings. We have seen, from the limited findings in this study, that it is possible to build environmentally friendly houses and that there is a lot to learn about this from the Earthship concept. But, it will not be enough to build houses adapted to the market available today to get the Earthship consumers on board, they want to live in a different world, where power is decentralized and is with the people, as they are looking to be "free". Even if it is possible to build environmentally friendly houses, they will be as expensive as building conventional houses, thus they will not release people from bank loans and debts that bind them to fat monthly payments. The Earthship concept, if I have understood it right, is more than just to care for the environment, it is about liberation from a system that not only "robs the environment and all the animals" as Gail puts it, it is an action of emancipation from a system and a culture that is controlled by an elite, and where a few people thrive on the big masses. It's about being able to meet their needs in a way that does not destroy

the environment or their fellow sentient beings, to live a life as free citizens, liberated from the slavery that we are unconsciously born into as children, to live free and think free with their friends, neighbors and all people, to interact and live together in nature. That is probably why Michael Reynolds is still not satisfied, he does not live in the world that he wishes to live in, and he is still frustrated about that it does not reflect the way that he envisioned it to be. Rather it is turning in another way, and will thus sink like the Titanic.

If it is better to live off the grid or not is hard to say. In many ways being on the grid, where it already exists, is probably the best, especially if the houses become energy producers. But, if building new building in an area where there is no current energy or sewage grid, the benefits of going for a off the grid solution might be an environmentally friendly and energy efficient choice.

It is certainly true that we need more environmentally friendly technologies, but unless the "technology" with which we, as people together, relate to the world and one another does not change, the environmental problems that we are facing today will not be solved. Probably the best place to start is right here and now with more love and compassion for each other, animals and ourselves. It's probably one of the best ways to change the world, the environment, the systems as well as the cultures that we together make up and represent.

6.4.6 Reflections on the different economic perspectives

The findings in this thesis suggest that the Neoclassical economic perspective cannot explain why the market functions as it does. The behavior of consumer and firms does not seem to be explained by assuming that they are rational and have perfect information. But, neither can this assumption of rational behavior be excluded from the economic analysis, as it has become a part of our collective culture. But, when we ignore interpersonal structures and norms, that make up our different collective cultures and societies, as Neoclassical economics do, we reduce our economic analyses to a very limited and ignorant perspective of the situation at hand.

It is clear from the analysis in this study that leaving market decisions only to the Neoclassical theoretical perspective, optimal consumer utility, firm profit maximization or social welfare will not be achieved. We, who define what this

development of achievement is – and how it should be reached, need to do so from a more inclusive perspective than believing that some fundamental economic view has all the answers.

7. Conclusions

To minimize water and energy consumption, waste generation and to achieve resource efficiency it is clear that we need to transform the current building industry. From the findings done in this study we can see that the building sector is the largest final energy-consumer and the largest contributor of CO2 emissions in the world.

According to the findings made in this thesis the Earthship concept can be seen to be an environmentally friendly technique to build a house when compared to conventional houses. The Earthship is a possible alternative to current building technique. Maybe the Earthship concept does not deliver the autonomy nor freeing its occupants from recurring expenses that it promises. But, it still delivers a lot of favorable qualities for both private consumer and society in general which conventional buildings do not. It does so especially when it comes to energy efficiency and to lower water use. It also seems to have the potential to effectively lower both energy and water bills as well as bills due to building material costs. Building off or on the grid does not seem to have a yes or no answer. Rather, as usually, the answer is dependent on the situation and many levels of interests. In an already existing grid situation it seems to be better to use the current system, e.g. if the system is well functioning, than to build new off grid solution. But, if we are to build new houses in an area that does not already have an existing grid set-up, then houses with their own energy and sewage systems might be the way to go.

The findings made in this thesis also suggest that building with rammed earth tires seems to be a preferable way to contain earth and to simplify the process of building with earth, compared to the other alternatives in this study. The technique also seems to be environmentally and cost effective. It is also the case that the Earthship enables both lower operating as well as lower maintenance costs. But, the relatively high labor cost for Earthships in relation to conventional houses appears to be in favor of the latter. If the owner and the

builder of the house is the same the chances of the investor spending the extra money would probably be a lot bigger, since they would be looking at a long term pay back. If it is the case, that costs and regulations drive design, firms and private investors need to become more monetary and non-monetarily motivated in order to start building environmentally friendly buildings. This can be done by opening up for tax reduction and governmental founding when constructing environmentally friendly buildings. It could also be done by making it easier for companies and private builders to build alternative environmentally friendly buildings by changing laws and building codes.

The findings further suggests that the people consuming Earthships seem to be interested in the environment being restored, transcending human grids and monthly bills. They also seem to trust Michael Reynolds, the founder and personification of the Earthship concept, and to share many of his visions about life in general. Regarding Michael Reynolds and his fuck-off attitude towards people, I think it reflects his disappointment and pain in not being heard.

"It is clear that Earthships offer their inhabitants more than just low-carbon living – they can also provide self-empowerment, self-sufficiency and low cost living as well as meaningful connections with other people that often rise out of community-based building projects" (Hewitt and Telfer, 2012:7).

In another space and time the Earthship concept could have been, and maybe it still will be, very significant and popular. But, as today, building codes and regulations and general norms about human existence seems to work to its disfavor. Thus, to enable more Earthships and alternative building designs, that focuses on transcending similar interests, laws and building codes needs to be altered and norms and cultures need to change.

Having said that, if we truly want to make a change in the world and make it a more environmentally favorable place for us to survive and thrive in, I think we need to start with ourselves and to be the change, we like to see, and in doing so, see that we are all in this together, as one.

Generally, the biggest contribution of this master thesis lies in is its approach to dealing with alternative concepts. I think that the topic of alternative buildings has a lot to offer when it comes to enable a more environmentally friendly built environment and is thus a significant topic for future studies. By producing

generalizable knowledge regarding off grid buildings and living as well as different alternative building concepts we will probably have a better opportunity to enhance the development of a more environmentally friendly built environment.

Future studies regarding the Earthship concept should preferably be aimed at further researching the environmental impacts of building with tires. It could also be aimed at researching different geological, economical as well as social possibilities to build an Earthship. One could for example study how different locations and contexts affect the construction and building possibilities of an Earthship? Eg. socio-economic structures, income, level of education, climate variations such as temperature, precipitate, water, sun hours throughout the year, rain, wind, soil quality, culture and building laws, as well as water collection rules etc. For example, in some places the climate is stable and facilitates a favorably temperature so that we do not need thermal-mass storage of energy for heating our house, for example, in parts of the world close to the equator that are at a higher altitude. But, in changing climate with very high temperature differences, it may be difficult to regulate the temperature of the house. Colorado and New Mexico seem to work relatively well, but in these areas, heating issues and the need to purchase drinking water may still be necessary. It is also very important to study the social context, such as acceptance to build and live in a more “alternative” or “unconventional” lifestyle. Unless people and society accept and allow alternative ways of living, the chances of these are minimal. We also need to look at how differences in human capital, such as: neighbors and friends contribute to the possibility of constructing an alternative building such as the Earthship. Parts of the United States appear to benefit from certain types of alternatively lifestyles, such as parts of Colorado, Paonia and Taos and New Mexico. Future studies of the Earthship concept could be favored to have a more quantitative approach. In doing so this could enable monetary comparisons between the Earthship concept and other alternatives, as well as conventional building methods. I also think it would be interesting for future studies to observe and interview people that would be considering or interested in living an alternative “green” off or on-grid life-style, and thus be able to compare the different styles with one another.

I also think that there is a lot to learn from studying how we can unite centralized power systems with off-grid/decentralized power generation in a dynamic, secure, ethical and environmentally friendly energy system.

Regarding future studies of economics I think that there is a big need and benefit from studying alternative ways of defining value as well as finding common expressions for non-monetary values. Future studies of economics could for example be aimed at researching different definitions and assumptions when it comes to using the concept of value. One could, for instance find new ways to define the concept of words such as value and meaning. Thus, enabling viable alternatives which could help release current economics from its, somewhat limited theoretic assumptions, as they now tend to be restricted to and defined by monetary terms. This is also, according to me, relevant for future use of PA. The PA is a very multifaceted and inclusive analytical method. However, the method tends to be conditioned to monetary references due to current cultural conditions.

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