

Resilience of Rural Scottish Communities – Community strengths within a complex adaptive systems framework

ABSTRACT

Traditionally rural communities are characterized by resources such as community spirit and high place attachment. Currently rural communities across the globe are facing several demographic challenges which raised interest in the concept of community resilience by scholars and policy makers. Strikingly, however, is that those traditional community characteristics are found to foster resilience. This study aims to better understand the process of resilience building so that rural communities can become more resilient through effective use of their strengths. To this end insights from complex adaptive system theory are used which makes resilience an ongoing process of experiencing adversities to which communities adapt through co-evolution and self-organization. A key theme in this perspective is human agency which helps explain how and why community members respond to changes the way they do. Adopting this perspective comes with several methodological implications and has resulted into a comparative research design that through a mixed-methods approach analyzes the resilience of the communities Edinbane and Dunvegan located in the Scottish highlands. The central argument that arises out of the findings is that in rural communities small changes can have large (un)desired consequences.

Keywords: Community resilience, Community strengths, Complex adaptive systems, Co-evolution, Human agency

INTRODUCTION

In today's world, many rural places across the globe are facing social, economic and environmental challenges such as depopulation, loss of local services, ageing and extreme weather (Adger, 2000; Simms, 2016; A. Steiner & Markantoni, 2013; van der Vaart, 2017). Simultaneously there has been a rise of interest in the concept of resilience in rural studies which refers to responding to challenges through adaptation (Christopherson et al., 2010; Meerow et al., 2016). Resilience is regarded as a promising concept to deal with uncertain challenges and is applicable to the communal level (Wilson, 2012). The interest in resilience is not purely academic. Resilience has also been a recurring topic in governmental policies such as the EU-funded LEADER program, the Scottish RESAS program and community empowerment act in the UK (Government, 2018; Kleinert, 2018; Notes, 2015).

Academics have produced several frameworks that highlight community characteristics important to community resilience. For instance, Emery & Flora (2006) developed a list of community capitals, Berkes & Ross (2013) talk about community strengths, whereas Magis (2010) speaks of resilience dimensions with a focus on community resources. Based on the aforementioned authors such resilience characteristics can refer to: social networks, diversified economy, collective action and cultural capital. In a rural context, the majority of those characteristics are social of nature and interestingly, traditionally characteristic to rural communities (Harley et al., 2018). Furthermore, there exist several examples in which social characteristics are even found to foster resilience (Beel et al., 2017; Li et al., 2019; Mcmanus et al., 2012; Zwiers et al., 2016). So rural communities are typically characterized by a set of resources that are beneficial to resilience and yet, there is such a thing globally known as 'rural decline' (Li et al., 2019). This raises questions such as, are communities struggling to effectively utilize the resources at their disposal, or are those traditional resources simply not enough?

According to Bristow & Healy (2015) there is a problematic over-focus on resilience structures and its generic features whereas the role of agency, which is central in adaptation capacity of communities, receives much less attention (Bristow & Healy, 2015; Skerratt, 2013; Vaneekhaute et al., 2017). So rather than describing a resilient rural community and contribute to an even longer list of resilience characteristics, this study seeks to advance the field differently. By zooming in on the relationship between agency, which lies at the heart of community resilience, and a list of established resilience characteristics this study aims to provide a better understanding how rural communities can *develop* resilience through their 'typical' and largely social characteristics.. The community strengths of Berkes & Ross (2013) form the basis for understanding to what extend resilience characteristics are affecting the agency of community members in the face of change. These community strengths were chosen as they are specifically designed for fostering resilience in rural communities. To achieve the aim of the paper, insights from Complex Adaptive System (CAS) theory are used. CAS-theory tries to understand *how* and *why* the agents (community members) of a system are responding the way they do which gives agency automatically a central position in the conceptualization of the resilience-building process (Bristow & Healy, 2015; Sanders, 2009). It has resulted in the

following research questions: 1) *How are community strengths affecting agency?* 2) *How can community strengths eventually help create a more resilient community?*

The literature review starts with a brief discussion on community resilience as a concept. To finalize the conceptual framework several concepts of CAS-theory are introduced while simultaneously discussing community strengths within this perspective. The methodology section highlights implications of CAS-theory and explains how these are accounted for during data collection and analysis. The findings are presented through several quotes from the fieldwork and are structured around the community strengths from the theory. The final section discusses, among other things, how concepts such as co-evolution and self-organization shaped the results and ends with a small policy advice.

LITERATURE REVIEW

Resilience debate and community strengths

There exist many understandings of resilience which vary across the multiple fields it is applied to. Christopherson et al (2010) describes how in ecological studies resilience is often described as the system's capacity to withstand shocks until it gets pushed into a new state (Ives, 1995; C. F. Steiner et al., 2006). The literature review of Pfefferbaum et al. (2008, col. 1) shows how resilience in social studies is characterized by *adaptation* to changes rather than withstanding or absorbing them. Although resilience has been applied in social studies, Berkes & Ross (2013) argue its application to the communal level has not been developed properly. To this end the authors developed an 'integrated approach' by combining insights from two strands of literature, social-ecological systems (SES) and mental health (MH). SES and MH-studies are chosen as the common ground between these two streams is very productive for applying resilience to rural communities (Berkes & Ross, 2013). Insights from SES-studies help understand resilience on a system level i.e. community, whereas MH-studies provides insights for understanding resilience at the individual level of community members themselves.

The concept of resilience finds its roots in ecological systems (ES) literature where in a first application Holling (1973) described how a forest maintains itself through renewal cycles in the face of abrupt changes. Later researchers started acknowledging the role of humans and, by adding a social aspect to ES-studies, introduced the concept of co-evolution between social systems and their environment. One insight from SES-literature is that the external environment of a social system should be understood as ever-changing and unpredictable (Folke, 2006). When challenges are uncertain, characteristics that *generally* increase resilience are highlighted (Marohn, 2019). This is different as opposed to disaster studies in which characteristics are highlighted that increase resilience towards a *specified* disturbance such as hurricanes (Simms, 2017). In disaster studies the concept of resilience finds its origin in MH-studies (Berkes & Ross, 2013) and, interestingly, this 'general-vs-specified' discussion resembles how mental health studies generally have a different perspective on resilience. MH-studies do not focus on a system and its dynamics, but rather the outcome for an individual

as it tries to explain why some individuals can cope better with a disturbance than others (Sameroff et al., 2003). According to Berkes & Ross (2013) a distinctive principle in MH-studies is that it focusses on identifying and utilizing strengths that make an individual resilient. Berkes & Ross (2013) have applied this principle to the communal level and derived a set of strengths that foster resilience: Social networks, Values & beliefs, Knowledge, skills and learning, Positive outlook, People-place relationships, Engaged government, Diverse and innovative economy, Infrastructure and lastly, Leadership.

Several authors have raised the issue that in order to fully understand how rural communities adapt to changes, human agency, as the capacity to act independently, should be included (Bristow & Healy, 2015; Lebel et al., 2006; Magis, 2010; Skerratt, 2013; Vaneeckhaute et al., 2017). After all, the way a community responds to a disturbance is determined by the way community members *chooses* to respond. Some argue agency is the main driver for developing resilience in rural communities (Skerratt, 2013; Vaneeckhaute et al., 2017). Bristow & Healy (2015) advocate a focus on human agency since it reveals more about the process of resilience building as opposed to the dominant way of describing resilient structures and their characteristics. Magis (2010) emphasizes agency as she observed how rural communities can take preventive actions to purposely enhance their community's resilience. Clearly there are different and complex ways how agency is contributing to community resilience. While multiple researchers have highlighted various characteristics/resources of rural communities that foster resilience (Beel et al., 2017; Emery & Flora, 2006; Magis, 2010; Mcmanus et al., 2012; A. Steiner & Atterton, 2014; Zwiers et al., 2016) this study seeks to not contribute to what Bristow & Healy (2015, p. 2) describe as an "*overt emphasis on structures*". Instead this dissertation zooms in on the relationship between resilience characteristics Berkes & Ross (2013) labeled as 'community strengths' and agency. By using insights from CAS-theory this study puts the theoretical model of Berkes & Ross (2013) to practice and advances the field of community resilience by trying to better understand the process through which rural communities can achieve resilience.

Complex Adaptive System Theory

In CAS theory the world is comprised of many interrelated physical, ecological or social systems and is way of thinking that moves away from a linear view of the world (Sanders, 2009). These systems are characterized by components (agents) that have adaptive capacities which enables the system to self-organize into a different state through complex and non-linear relationships (Chan, 2001; Sanders, 2009). In this dissertation the community is conceptualized as the system and the community members are the agents. It has recently been applied in geography to understand regional economies (Bristow & Healy, 2015) and American cities (Marohn, 2019) but not as often to rural communities. Regardless, it is a method that gained support for understanding the development of geographic entities (Bristow & Healy, 2015; Helbing et al., 2007; Berkes & Ross, 2013; Sanders, 2009).

The goal of CAS-theory is to understand system dynamics by revealing principles of change (Chan, 2001; Holland, 2006). These principles are theorized to guide change and form the basis

of agents' interactions. Understanding why agents interact the way they do automatically puts agency central in describing how a system responds to change. Furthermore, CAS recognizes relationships between agents are complex and influenced by a large variety of social, economic and physical factors (Holden, 2005; Sanders, 2009). Therefore this study argues that CAS is a useful method for highlighting the relationship between community strengths and agency.

Co-evolution and adaptive capacities: CAS are capable of evolving because the agents are conceptualized to have adaptive capacities which enables them to alter and form new interactions. Although non-linear and unpredictable, new agent interactions do not appear at random but are based on past experiences (Holland, 2006). At this stage it is important to address the fact that resilience is often seen as something dynamic and developed over a timespan (Adger, 2000; Beel et al., 2017; Magis, 2010; Martin & Sunley, 2015; Sameroff et al., 2003). For instance, Martin & Sunley (2014) explain how economic structures are not changing overnight but rather that resilience is a complex process with many changing. Chan (2001) describes how a CAS cannot be separated from their environment because they are understood to co-evolve over time. For instance, coastal Louisiana is often tormented by hurricanes and the study by Simms (2016) is a vivid example of co-evolution between a local community and severe environmental adversities. Through interviews residents explained how past hurricanes forced them to repair and construct their own homes resulting in place-based skills and a strong people-place relationship presented in the article's title 'Why would I live anywhere else?' (Simms, 2016). So communities as a CAS evolve not as a response to, but rather evolve *with* their unpredictable environment as agents have the capacity to adapt to external changes. Co-evolution is also a term familiar to evolutionary geography where a system's behavior is sometimes seen as an outcome of their own history (Boschma & Martin, 2010). This reflects to the fact that systems are often understood to learn from past experiences. Smith et al. (2016) state social learning is an important aspect of community resilience and have shown how active participation by youth in ecological practices is beneficial for developing a social environment with a lot of knowledge useful in the face of environmental disturbances. Marohn (2019) take it even further and argues the combination of exposure to external and learning to respond to them is essential to effective resilience building.

Clearly social learning and co-evolution are key aspects to resilience building, however, referring to resilience simply as a process of learning would be too short-sighted. Beel et al. (2017, p. 461) describe it as follows "*continuing entities within a locality who have their own agency to develop which is not necessarily stimulated by shocks*". Skerratt (2013) would advocate this quote and explains how since the year 2008 a shift occurred out of frustration with reactive conceptualizations of resilience. When acknowledging the environment is constantly changing, she suggests communities are making decisions that enables them to pro-actively respond to their environment. Her findings on community land trusts confirm this suggestion (Skerratt, 2013). Berkes & Ross (2013) theorize agents can influence resilience of their system through the combination of agency and their adaptive capacities. "*We view adaptive capacity as a latent property, which can be activated when people exercise their agency.*" (Berkes & Ross, 2013, p. 15). Christopherson et al. (2010) adds how capacity to adapt can be increased by, and its inevitably linked to, effective governance.

So far it is clear that community resilience is a very complex phenomenon and that there are various approaches to analyze the concept. This study uses a CAS framework, meaning that agents (community members) have adaptive capacities enabling the system to develop itself. This system-level development is referred to as co-evolution which implicates that CAS and their environment are inseparable. In this context resilience becomes an ongoing process of experiencing, learning and adaptation to external disturbances. An important side note, however, is that in a CAS agents are besides adaptive capacities also conceptualized to have agency. Agency refers to the fact that agents individually choose a certain response to a given change as they can act independently from their environment which is demonstrated by studies such as Beel et al. (2017) and Skerratt (2013). The following section dives deeper in the role of agency as it seeks to elaborate on what drives such purposeful actions that increase resilience but are not necessarily stimulated by shocks. Given that agents are part of a system it is argued their agency is influenced by characteristics of the system. In this dissertation the community strengths provided by Berkes & Ross (2013) are the system characteristics of interest.

Increasing Resilience through Community Strengths

A Complex Adaptive System is comprised of single elements. The agents, and their connection to each other, form the structure of the system. Chan (2001) describes the ultimate behavior of the system cannot be explained by merely looking at the individual parts. This introduces a key concept of CAS theory, emergence. Boschetti et al. (2005, p. 575) define it as *“a property which is not displayed by the lower level entities”*. It resembles how distinctive community characteristics are created through agent interactions which are more than the sum of individual community members. An example of an emergent property in social systems could be culture. Standardized forms of greeting and acting emerges as a distinctive culture that is not fully displayed by a separate individual. As stated earlier, the community strengths from (Berkes & Ross, 2013) form the basis of this conceptual model. Community strengths are conceptualized as emerging properties that arises out of the interaction between agents. Assuming that a community where a lot of community strengths have emerged is more resilient, suggests community members can increase resilience through interactions that lead to the emergence of new community strengths.

Theory suggests that simply increasing the frequency of interaction between agents is already a good place to start. So is a strong social network and community participation widely considered as an important resilience fostering factor (Manzo & Perkins, 2006; Markantoni et al., 2018, 2019). For instance, Mcmanus et al. (2012) found during a case study in rural Australia that active engagement to the community is essential to survival of farmers. The authors continue that active engagement is not only fostering social factors such as community spirit, but that it is also important for maintaining a healthy local economy, job opportunities and population (Mcmanus et al., 2012). Another example how a social community strength is beneficial to resilience is the study conducted by Beel et al. (2017). The researchers approach community resilience through a cultural heritage lens and explain how a historical narrative

created a stronger social network between volunteers that eventually mobilized community members. One of the discussed locations is the old fishing village Portsoy. A festival celebrating traditional fishing boats evolved into an event with music and crafts eventually leading to the opening of a museum that embodied the local identity (Beel et al., 2017). There is also evidence that supports the suggestion of Magis (2010) and Skerratt (2013) where community resilience can be increased purposely. According to Skerratt & Steiner (2013) rural communities with local leaders capable of making decisions 'become increasingly empowered'. Leadership is deemed important as leaders help implement local changes that foster the development of the community. Uncompleted projects, however, are found to have lower social resilience compared to those with completed projects (Markantoni et al., 2018). This is an interesting insight, apparently there can also be emergent properties that reduce resilience.

What we can take away from these examples is that interactions between community members can indeed foster resilience through the emergence of additional community strengths. It is also clear the level of resilience is dependent upon a large variety of factors as a community's evolvment goes through several stages before a new community strength emerges. E.g. Beel et al. (2017): cultural heritage → increased social interaction → scaling up an existing festival → emergence of a museum that diversifies the local economy. This is much in line with the community capital framework of Emery & Flora (2006) which investigates the connection between various community capitals. It is illustrated through a spiral of capitals in which success builds upon success. The authors conclude social capital, both bridging and linking, to be most critical in getting communities to 'spiral-up' (Emery & Flora, 2006)

Self-organization

Whereas Emery & Flora (2006) talk about spiraling community capitals in a CAS-framework these 'spiraling' community strengths can be explained through the self-organizing nature of CAS. According to Chan (2001) self-organization is a property inherent to any CAS. Lebel et al. (2006, p. 4) defines it as "*a capacity for self-organization means that a system has ways to maintain and re-create its identity*". It is also, besides human agency, one of the two main themes in community resilience literature (Berkes & Ross, 2013). In this study self-organization refers to the interplay between a CAS and the randomness it experiences from their environment. Self-organization has two essential ingredients 1) feedback loops and 2) randomness.

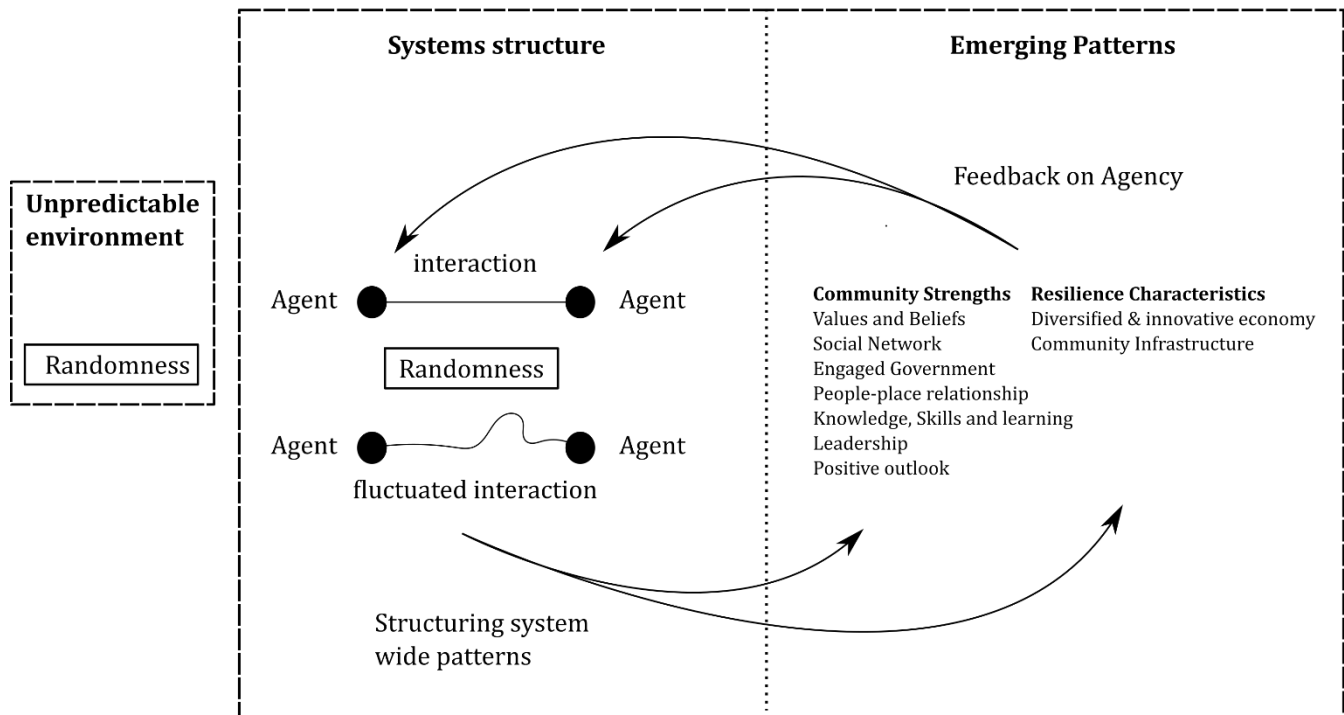
Feedback loops: Whereas on one hand community strengths are properties that have emerged out of the interaction between agents, so is the way an agent reacts, simultaneously influenced by those same emerging properties, i.e. community strengths. In CAS community strengths are not spiraling, instead they should be seen as part of a large feedback loop. To clarify, the relationship between agency and community strengths is two-sided: 1) community strengths emerge out of agent-interactions and 2) emerged properties are feeding back on agents. Zwiers et al. (2016) have demonstrate how a community strength (place attachment) can influence agency. The authors conclude in rural areas attachments can differ, especially between locals and incomers to the community. Zwiers et al. (2016) frame these different attachments as

stability and change-oriented and that each of them are determinant factors in attitudes towards changes to the local community. Agency can also be influenced by changes to the physical environment. According to Callaghan & Colton (2008) human capital is created in infrastructure where locals can meet and list amenities such as schools, churches and quiet park benches. This is backed by the findings of Meador et al. (2020) in which community members stated community halls to be the most important infrastructures for their community's resilience. Several authors agree that resilience draws upon a several domains both economic, social and physical. For instance, diversified economic amenities are often deemed important for resilience (Antonietti & Boschma, 2018.; Magis, 2010; Simmie & Martin, 2010). Taking such a focus A. Steiner & Atterton (2014) identified several positive effects of rural businesses. Direct effects are job opportunities, sources of income and availability of services, that indirectly help to counter socio-economic challenges such as depopulation. It reflects how an economic community strength can help tackle a challenge in another domain. *"progress in one of the areas brings progress to the other"* (A. Steiner & Atterton, 2014, p. 241).

Randomness: The second part essential to self-organization are random events which occur in- or externally. Due to the adaptive capacities such an event can create fluctuations in agent interaction (Systems Innovation, 2015). As stated, resilience is often seen as something dynamic, Beel et al. (2017) describe it as a process of constantly responding to in- and external changes which makes it difficult to ascribe one 'resilient' response to a certain shock (Beel et al., 2017). After all, one small action by an agent affects all other connected agents and therefore *"There is constant action and reaction to what other agents are doing, thus nothing is essentially fixed"* (Chan, 2001, p. 5). In a CAS-framework this means that each tiny fluctuation in agent interaction, is a small alteration to the structure which eventually has a slightly different feedback on the agent. If a fluctuation gains enough traction through positive feedback loops, it can eventually restructure the system in such a way that new properties emerge (Systems Innovation, 2015). In summary, there are two effects at play. Firstly, the agents and their interactions form the structure of a system which ultimately give the system its properties through emergence. Secondly, those emerged properties are also influential factors on the decision-making process of those agents. It creates an ever-going feedback loop. It has resulted in the following conceptual model.

Figure.1

Resilience feedback loop within Complex Adaptive Systems (CAS)



Insights and implications from Complex Adaptive System Theory

- Agents have adaptive capacities enabling them to respond to in- and external random events
- Random event can thus create fluctuations in agent interaction
- If a fluctuation gains enough traction, new patterns can emerge
- Community Strengths and Resilience Characteristics are derived from Berkes & Ross (2014)

METHODOLOGY

In a CAS-perspective a system is constantly changing. Methodologically this means, a snapshot of a community's resilience cannot be taken. Having a bad night's sleep might make you less resilient, but it does not automatically make you an unstable person. According to Martin & Sunley (2015) this dynamism is a key issue in operationalizing resilience. The researchers put the inclusion of a reference state against which the system can be compared as the analytical solution (Martin & Sunley, 2015, Table 3). In this dissertation is argued a reference state can be incorporated in two ways, one that compares a single system *over* time and one that compares two similar communities *in* time.

A comparison *over* time refers to comparing resilience characteristics of a single system across different points in time whereby older states of the system act as the reference point. This could be especially useful in quantitative research methods as longitudinal data can give an indication how a resilience characteristic has developed throughout the history of the system (Wickes et al., 2015). According to Chuang et al. (2018), however, quantitative methods do not reflect the dynamic characteristics of social-ecological systems. So while this is a relatively easy

method for describing a system's resilience, it is less likely to provide in-depth insights that contribute to a better understanding of the resilience building process. Alternatively, a qualitative study would be a more suitable method for discovering system dynamics such as the relationship between community strengths and agency. A qualitative study, on the other hand, raises some practical issues. Including a reference state over time would require conducting multiple interviews with the same participants on a timely basis and unfortunately, such a method would be beyond the scope of this paper. Therefore this dissertation used a mixed-methods approach. Considering the dynamism issues in a qualitative approach, this study argues to include a reference state *in* time. A reference state in time refers to comparing the current state of two similar communities whereby each of the communities act as a reference state to the other. The key underlying assumption for this argument was based on co-evolution between agents and their environment and goes as follows: geographically close communities have experienced the same external environment and thus were in a position to develop similar community strengths. Differences in community strengths can then be explained by looking at the endogenous factors of the system which, in this study's context, refers to the agency of community members. If one of the two communities has more resilience characteristics, the agents of that community have apparently adapted differently to the same shock. A resilient and a less resilient community were identified as these could potentially highlight more favorable responses to a given external change.

Suitable locations: Population change figures between 2006 – 2018 from the Scottish Index of Deprivation (SIMD) were used as the quantitative resilience characteristic that indicates a community is resilient. This idea stems from ecological studies where resilience of a population was operationalized as total biomass (C. F. Steiner et al., 2006) but also as the stability of population numbers after disturbances (Ivy, 1995). Translating this into a social context, according to Sherrieb et al. (2010) a shrinking population can lead to a loss of human capital. Since community strengths mostly fall under the umbrella of human capital, population change figures are argued to be an adequate *indicator* of community resilience. It has resulted into the identification of the community of Edinbane and Dunvegan. The highest population increase (S0101681; figure 2), and largest decrease (S01010680; figure 2) were found in the smallest data zones (figure 3). Since these data zones are both located in the island's largest town called Portree, were they expected to be non-fitting for this study as participants would be very likely to be part of the same community. Outside of Portree the highest increase is located in data zone S01010682 (purple) which covers the town of Edinbane. The largest decrease in population outside of Portree is found in S01010684 (dark-orange) and covers the community of Dunvegan. Edinbane has been chosen as the community that is most likely to be resilient and Dunvegan as the community that is less resilient. The statistics from the SIMD database (table.1) show, besides population growth, Edinbane and Dunvegan are similar as there are no major differences in terms of working population nor employment- and income deprivation (SIMD, 2012).

<i>Table.1</i>	Edinbane	Dunvegan
total_population	1042	771
%_working_age_of_total_pop	61,52%	56,81%
income_rate	0,04	0,05
employment_rate	0,04	0,04

Ilse of Skye - Low level population change overtime 2005 - 2018
SOURCE: National Records of Scotland*

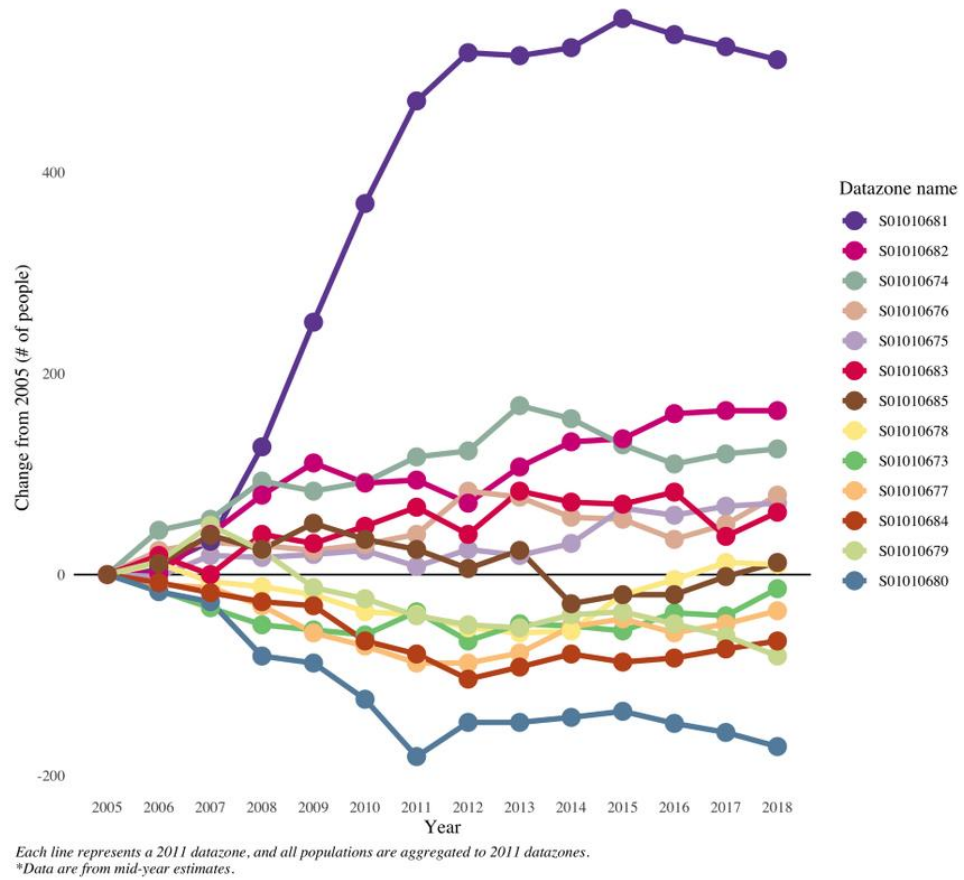


Figure.2

Ilse of Skye - Population change
SOURCE: National Records of Scotland

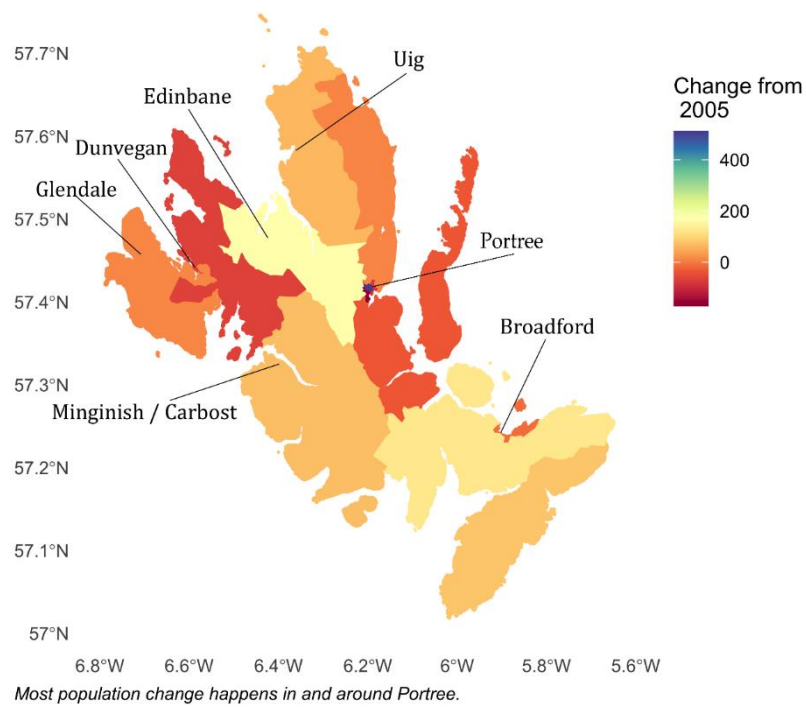


Figure3

Interviews in a CAS-framework: According to Gear et al. (2018) the combination of a qualitative method and a CAS-framework allows the researcher to explore the agents and their interactions at a deeper level which makes it a useful method to grasp the relationship between agency and community strengths. To interpret how and when community strengths were affecting the agents was chosen for interviews in retrospect. Talking about the past goes against ‘taking a snapshot’ as the interviewer was able to identify changes in behavior and the evolvement of community strengths. Community strengths are ‘the factors of interest’ around which the interviews were semi-structured. A potential downside of this method is that, according to Brayda & Boyce (2014), researchers should see interview responses as an experience of the participant. Especially retrospective interviews might produce selective answers as memories in rural places can be quite strong and influential (Zwiers et al., 2016). To cope with this a researcher can use triangulation (Brayda & Boyce, 2014). Therefore, interviewees were asked to comment on events that also came forward out of previous interviews. By acquiring multiple accounts of the same event the researcher was able to see to what extent those memories were ‘colored’. Lastly, because the Isle of Skye was divided into data zones, which are the smallest spatial output areas in Scotland (SNS, 2011), it is important to note that these data zones are nested within local authorities’ boundaries from 2011. As a result, they might not represent the social community boundaries. To ensure participants were connected to the right community each participant was, regardless of geographic location, asked whether there existed such a thing as the community of Edinbane and Dunvegan and if they felt a connection to it.

Participant recruitment: According to Gear et al. (2018) also in a CAS-framework sample diversity is necessary to account for different groups of agents. Contacting the voluntarily-run Edinbane Community Company (ECC) and the Dunvegan Community Trust Fund (DCT) proved useful method for getting initial contact with community members. Since a diversified economy is generally considered advantageous to resilience several entrepreneurs from different branches of the economy were also contacted. Their motivations for running a

business in a rural community as opposed to a city would be a valuable contribution to this study. Table.2 displays how by applying the snowball-method sample diversity was further increased with a mix of locals and incomers as they have different types of attachment (Zwiers et al., 2016) and also different age groups since ‘sense of community’ can differ per life phase (Pretty et al., 2003). This resulted in 14 in depth interview with 17 participants. There are more participants than interviews as in some cases, partners/parents were present during the interview who were also invited to participate. One of participants was too busy for a personal meeting and responded by email.

<i>Table.2</i>	Edinbane	Dunvegan
Interviews	6	8
Local	4	7
Incomer	2	4
Business owner	4	3
Teenager (15 - 20)	0	1
Young Adult (21-35)	1	2
Adult (36 - 60)	3	4
Elderly (60+)	2	3
Participants	6	11

Data Analysis: According to Gear, Eppel, & Koziol-mclain (2018) little is known about the benefits of combining a CAS-framework and a qualitative research method. Therefore this dissertation aimed to develop a slightly new way of analysing the data. This was based on an important implication of a complexity-led interview: the researcher himself is a factor of change to the participant, meaning, the interviewer and participant are constantly adapting to each other (Gear, Eppel, & Koziol-mclain, 2018). In this manner the data itself is not static but rather a continuous discourse that has emerged out of the interactions between researcher and participant. So instead of coding words separately, the researcher argues it was more appropriate to code larger strings of text (approximately 1 – 5 sentences) that surround a specific topic as larger code emphasizes the discourse and thus better reflects how the data was created out of the interaction between agent and researcher. So, when revisiting the transcribed data it was not only read but also simultaneously relistened to observe the intonations of the participant throughout the interview. Continuingly, these tiny discourses i.e. large codes, were placed under each of the community strengths of the analysis sheet (Appendix A) after which the researcher additionally used handwritten notes from the interview to reflect on the gained insights. In the end the coded data was thus structured in such a way that for each community strengths separately, the answers of different participants could be easily compared. Since this dissertation pays particular attention towards community strengths the findings section is, as well as the interviews, structured around them.

FINDINGS

The quantitative analysis (figure.2) showed how the population of Edinbane has been more stable in the 1.5 decade compared to Dunvegan which indicates the former is more resilient. Strikingly, however, is that in terms of emerging community strengths no real differences were found. Although participants from both locations indicated Dunvegan might have been in a lesser shape in the past few years, a finding that supports the quantitative analysis, the capacity to overcome challenges seems similar in the two communities. Mainly because in both locations community members have taken pro-active and purposeful actions to increase their community's resilience. Furthermore, not only the same type of community have emerged in both communities, they were also found to similarly feedback on the agency of community members. The findings are presented in three sections. The first section focusses on the upper part of the community resilience feedback loop (figure.1) and describes how community strengths are feeding back on agency. In this relationship the participants from Edinbane showed no differences compared to those of Dunvegan. Interestingly, however, community strengths were found to be expressed differently when comparing locals with incomers to the community. Zooming in on factors that influence agency comes with acknowledging that, besides community strengths, changes from the external environment are also an influential factor. Therefore the first section started with demonstrating how communities on the Isle of Skye have co-evolved with their distinctive environment. The second section is aimed at completing the feedback loop (figure.1) and shows how small random events can eventually

lead to the emergence of desirable as well as undesirable characteristics. It does so by putting forward several anecdotes that display the interconnectivity between social community strengths and physical resilience characteristics. The third and final section demonstrates undesirable feedback loops can be broken through purposeful actions. Lastly this section also shows how (small) governmental decisions can have major consequences for a community's resilience.

Community strengths affecting agency

"The harsh environment is the glue that holds people together" ~ incomer Dunvegan

This quote beautifully reflects how the community and their environment are inseparable. It shows how community members have adapted to the relatively harsh natural environment on Skye. It supports the idea of co-evolution between community and environment as participants hinted there is a certain shared mentality across the island. For instance, none of the participants identified themselves with their community in particular but rather as Scottish or Highlander with some even speaking about a 'Highland way of life'. When asked to describe this mentality participants from both locations stated their community is helpful, accepting and friendly, yet also shy and cautious.

"People keep to themselves but are always looking out for you." ~ local Edinbane

People-place relationship: The relationship between the participants to their community, and on a broader scale Skye itself, seems to be strengthened because of the rough landscape and its accompanying bad weather. For example both incomers and locals stated the environment of Skye is not for everyone. Several participants gave anecdotes of people who decided to move to Skye based upon a few holidays. Apparently some had an utopian idea of life and moved out after experiencing a few winters. The participating incomers in this study have been staying for at least 7 years on Skye from half of which were retirees from elsewhere in the UK. Examples of their motivations for moving to Skye are, affiliation with the island's natural beauty, the solitude, tranquillity and one participant even spoke of 'a lifestyle choice'. Several local participants of the young adult group returned to Skye after college. One participant explained he tried to live in London but it just 'didn't click'. It seems the participants who are living on Skye have made a very conscious decision to stay/move to Skye and are very happy to have done so. It also seems that all that comes with this decision of living in a rural area is the reason community members connect with each other.

Knowledge, skills and learning: The co-evolution between the communities and their environment is not only visible socially seeing that the findings also illustrate community members have adopted certain knowledge and skills over the course of their history. When asked what characterizes their community many of the interviewees referred to the crofting history of the island. A traditional crofting businesses is one where the crofter works a small piece of land, often owned by a landlord, for small scale food production to sustain themselves. A crofter is typically involved with various activities such as vegetable production, keeping livestock, fishing, etc. This specific set of activities depends on the natural landscape and

requires practical skills and local knowledge that is still used today. A participant who started a croft several years ago proudly stated how all the buildings on the plot were self-constructed. Another participant puts it as 'having faith in your own abilities' is typically Skye. These findings fit very well in evolutionary geography where the behaviour of a system explained to be embedded in its own history (Bristow & Healy, 2015; Simmie & Martin, 2010). Returning to the effect of community strengths on agency, these particular skills have proven useful in the face of an island-wide challenge. Due to the increase tourism there has been an enormous rise in tourist accommodation such as B&B's and Airbnb rooms. As a result many residents of especially younger generations are having trouble to find affordable housing. It is here where place-based skills that originate from the crofting history become useful.

Yeah, a lot of people I know, have to build their own houses, you know, because they can't afford to pay someone to do it. (...) And a lot of people like my dad's age, did exactly the same thing. The people I worked for when I was younger, learning carpentry, some of them lived in caravans for 10 years while they saved money to build a house. ~ local Edinbane

Values & Belief: Just as communities are systems embedded in their history, so are people. Obviously someone living the majority of their life in a major city has had a different life compared to someone growing up in a rural area. Consequentially some participants described incomers were not always used to the ways of a rural community.

"They're not used to that kind of community spirit. (...) You know, they're quite private. They're not used to talking to your neighbours, inviting them over the weekend for a few drinks. ~ local Edinbane

As stated, the biggest differences in effect of community strengths on agency were found between incomers and locals. These differences are mostly visible regarding changes to the natural landscape. These findings are very similar to those of Zwiers et al. (2016) where place-attachment is portrayed as stability and change-oriented. In this study on Skye incomers were found to be more stability-oriented as they generally were not in favour of tourism-supporting developments such as parking lots, streetlights, etc. Locals on the other hand, are generally more enthusiastic towards such changes and tend to be more focussed on the economic benefits. Even so, it is important to note that despite their attitude also incomers realize tourism is essential to the survival of Skye.

"The people that didn't want it to happen predominantly have moved here and had a different idea of the community. They didn't have an idea of a working community, they had an idea of a sort of, I don't know, some picture postcard place or something" – incomer Edinbane, *construction of a windfarm*

Whereas incomers initially might have different ways and opinions one active community member from Dunvegan saw it as a benefit. This person explained how a highland community can be quite set in its ways and that it sometimes can even be experienced as a bit oppressive. In this person's eyes new people in the community are good for development as they can help to 'update' the mindset. This could be interpreted as the system being dynamic. Every time a new agent enters the system, interactions alter, eventually leading to a slightly different emerging pattern, i.e. more openminded attitudes.

And now we've got a couple of young people in the trust, which is brilliant. And they're really open minded about things ~ Local Dunvegan

Positive outlook: The historical path of communities is not only visible in mentality, skills or personality but also in prospects towards the future. Through anecdotes one local from Edinbane explained how the knowledge that his community has been able to overcome adversities in the past creates a healthy amount of trust towards the future. This is in line with the suggestion of Marohn (2019) that experiencing adversity is essential for developing resilience. At any rate, this optimism was largely shared amongst the participants from both communities. Even so, the youngest interviewee stated their community is not as well-connected as it used to be and therefore did not share this optimism towards the future as, in this person's eyes, a strong social network is essential to rural communities. This slight scepticism exemplifies how a slight change in one community strength, i.e. social network, is feeding back on a community member which in turn alters another, i.e. positive outlook.

Emergence of community characteristics

Where the previous section mostly demonstrated how community strengths are feeding back on agency this section describes how in- and external changes can lead to the emergence of new community characteristics. The theorized feedback loop (figure.1) is demonstrated by highlighting the interconnectivity between physical infrastructure and social community strengths. Before stating such examples it is important to highlight that many participants indicated active engagement and community spirit are highly valued. It seemed a key and distinctive characteristic to the 'highland way of life'. For instance, some incomers indicated they did not always feel entirely accepted upon entering the local community. Luckily these participants described such tensions could also be quickly overcome simply through participating and actively engaging with the community. Ultimately each participant, locals and incomers alike, stated to be accepted by, and feel a strong connection to their respective communities.

Social network: The social network is mostly formed through shared interests, similar professions, family and old schoolfriends. Frequent interaction proved important to feel a sense of community. For instance, a local from Dunvegan argued social meeting places are essential for the community's development as 'without a pub there is no discussion'. It is a similar findings to Meador et al. (2020) in which community halls were also put forward as essential to keeping the community alive.

"The villages here they're all most of them on roads, so they don't have a centre. Yeah, like if you go to Spain or somewhere everyone's always got a plaza.. place where people go and sit wherever (...) The hall, if they don't do things like, whatever music events or things, then it doesn't happen ~ local Edinbane

Next to community halls one of the most important for resilience piece of infrastructure seems to be local primary schools. First off, participants from Dunvegan and Edinbane stated the importance of attracting new young families to the local community. As stated, new young

people can help to 'update the mindset'. Furthermore, young families also seem to positively affect community life as two community members from Edinbane indicated their children, for whom they want a nice and safe environment, drove them to become more involved in the community. Besides being a driver for community spirit, schools also function as social meeting places. A local teenager, though not in primary school anymore, noticed whereas in public people are keeping more to themselves such things do not happen as much in school. After all, 'you're in the same building all day and thus forced to talk with each other'. It suggests that schools are fostering social ties at young ages too. Returning to the interconnection between community strengths, the social network is an example of a social factors that influences agency in such a way it fosters community resilience in other domains too. This finding supports the conclusion of Antonietti & Boschma (2018) who suggested bridging human capital is beneficial for the economy.

*We will go to Edinbane first like, we will go to *name* if we need the roof done, some joinery work? We go to *name* (...) ~ incomer Edinbane*

Feedback loops: Up to this point the findings indicate the physical environment is largely beneficial to resilience as it serves as a place where social community strengths can be fostered. It should be noted this was not always the case. Interestingly physical characteristics such as the maintenance level of the community hall, appearance of local restaurants, presence of local shops, etc, were used as a measure of success/welfare. Since several participants of both communities indicated that the physical state of Dunvegan was not as it used to be it was interesting to dive deeper into the reason for this 'rundown' state.

"To be honest it was a laundering, money laundering. (...) A guy from Glasgow bought and put in a manager, put in folk and just really, it was a pretty dire place.. It got shut down by the police, thankfully, about two years ago. And now this lads taken a lease on it. So it's not a pub. It's a piece. I think you can have a good glass of wine there" (...) So the biggest challenges to the community is it just looks a bit rundown and led to hotels being so bad didn't help that. And the pavement set eroding and it's just and so people are beginning to feel, feel it, this just a bit sense of loss of hope ~ incomer Dunvegan

Whatever the initial 'disturbance' was that lead to the undesirable state of Dunvegan, this sequence of events can be explained through the theorized self-organizing capacity of CAS. Through a feedback loop a change in one area i.e. local hotel, can seemingly lead to further undesirable knock-on effects to the physical environment which eventually developed into, what the quoted participant described as, a 'sense of loss of hope'. Interestingly such a feedback loop can also be broken. Another participant from Dunvegan stated how the bad shape resulted in a lot of moaning and complaining within the community until some locals set up an initiative 'let's make Dunvegan big and beautiful again'. Furthermore, ownership of the local hotel and restaurant has relatively recently shifted towards people from the community and every participant indicated this has been for the better. Apparently Dunvegan was capable of overcoming this challenge through a purposeful decision.

Purposeful actions

As demonstrated earlier community resilience can be intentionally influenced. Similar to the findings of Skerratt (2013) and Bristow & Healy (2015) this mainly happens through certain people. Coming back to the initiative 'Let's make Dunvegan beautiful again' several participants used this as an example to demonstrate the value of someone who decides to take action. One interviewee described her as 'the main woman'.

I kind of think it was part of the hotel getting done up and people began to think "ooh there is a point", you know we can do this. Because it was just after that she did it". ~ incomer Dunvegan

The quote above exemplifies how a single person's decision to take action is capable of positively influencing the way a community self-organizes into a more desired state. Other examples come from the Edinbane Community Company (ECC) and the Dunvegan Community Trust Fund (DCT) which are two groups that concern themselves with the funds that have been generated by the windfarms. Members of the board of the ECC and DCT are community members who are trying to serve the interests of the community and the funds can be used at the discretion of the local board. Examples are, apprenticeship grants, new sport facilities, a local shop and a playpark. While not all of the aforementioned grants have been realized they give a good indication of usage of those funds. A member of the ECC used the word 'enabler' to describe the actions of the ECC. Whereas budget cuts were put forward by the interviewees as the main challenges their community has been facing, the construction of the windfarm was often mentioned as one of the most impactful events to the community. Perhaps not so surprisingly there were also examples in which purposeful decisions initiated offset a undesirable feedback loop.

Engaged government and Leadership: For instance, whereas Berkes & Ross (2013) list engaged government as a community strength, in this study rather its absence has been found. In fact the following quote describes how Highland council decided the by the local community much appreciated primary school in Edinbane.

*Well the council was trying to save money, on schools, but they're not allowed to shut the school down for that reason. So they produced a whole load of false information or skewed information. And unfortunately for them, there are people that live here that got the confidence to say, you can't do it. So we've got a retired lawyer who just said, okay.. * (...) When the school goes on Skye, normally the children go, so then you lose your age range, and we don't have a perfect spread of ages at all. ~ incomer Edinbane *refers to challenging this decision*

Whereas, on paper, closing a school with a limited amount of students might be easily justified it is evident the council misunderstood the school's value to the local community. As the quotes above indicate, there is a certain distance between the local communities and regional government. It is a feeling that is fuelled by budget cuts, lack of investment and a misunderstanding of local needs. It is also a feeling that is shared across the majority of participants. This feeling surfaced through anecdotes in which the funds that highland council receives are blamed to be Inverness-centric, as this is where the council is located. One participant exclaimed 'we need roads on Skye, not Wifi in Inverness!'.

*So before our councillor lived two houses away, so you would meet them on the road and say, "ooh".
Or you meet him at the shop, or wherever. (...) But now, you don't, you never bump into
a counsellor because the most of them live at the south end. ~ incomer Dunvegan*

Lastly, it is important to note that, as a researcher, it was somewhat difficult to find local leaders, none of the participants has refereed to themselves as a 'local leader' and could only be found through snowballing. Anyhow, leadership can be very beneficial to resilience and raises the question what is driving the agency of such people. When interviewees that made a purposeful decision such as, starting an initiative, join a board, volunteer or participate with a community service, were asked about their motivation it was largely explained through personal trait such as, 'you just do it', 'sense of duty' or having an entrepreneurial mindset. It seems that leadership is not necessarily a community strength such as social network that emerges out of agent interaction but rather that it just happens to be there.

Sense of duty.. You also do it, do it as a sense of community, you know, to get something back into the community. The thing is, for here, because if we don't do it. Who else are you're gonna get? If you know what I mean." ~ local Dunvegan

DISCUSSION AND CONCLUSION

This dissertation aimed to create a better understanding of how rural communities can develop resilience through their strengths by zooming in on the relationship between agency and community strengths. This originated out of the paradoxical observation that rural communities possess resilience characteristics and yet seem to struggle in becoming resilient. This study has argued CAS is a suitable perspective to reach this aim as it pays particular attention towards agency, which, is an important theme in community resilience (Bristow & Healy, 2001; Magis, 2010; Skerratt, 2013; Vaneeckhaute et al., 2017). Adopting CAS-theory has introduced several concepts such as co-evolution and self-organization through randomness and feedback loops. In the community resilience feedback loop (figure.1) the relationship between agency and community strengths is two sided. Whereas on one hand community strengths and other community characteristics are affecting agency, simultaneously have those same strengths and characteristics emerged out of the interactions of community members themselves.

However, it is important to acknowledge agency is not only affected by emerging properties, but also by changes from the system's environment. This brings us to the concept of co-evolution; throughout its history a community has developed characteristics, skills and knowledge that have emerged out agents and the way they adapted to their environment. That is to say, communities are understood to evolve *with* their environment and makes resilience a process of experiencing adversity and consequentially learning how to adapt to them. This sits well within mental health and disaster studies where social learning is also an often recurring aspect of achieving resilience (Sameroff et al., 2003; Simms, 2017). Another important attribute of CAS is that they are constantly changing (Chan, 2001) meaning that this process of

resilience building is continuous. Several other researchers (Adger, 2000; Beel et al., 2017; Magis, 2010; Pfefferbaum et al., 2008; Sameroff et al., 2003) have already portrayed resilience as a highly dynamic phenomenon which has according to Martin & Sunley (2014) a methodical implication: to determine a systems resilience a reference state for comparison should be included.

This dissertation has suggested a reference state can be incorporated in two ways 1) a reference state *over* time to compare a system with older states of itself and 2) a reference state *in* time to compares two geographically close communities. Each of the two methods has its up- and downsides. A reference state over time could be relatively easily incorporated through longitudinal data of a predetermined resilience characteristic. This dissertation made use of population change figures and identified Edinbane to be more resilient as compared to Dunvegan (figures 2 & 3). Reflecting on this outcome, several participants referred to Dunvegan as 'begin rundown' which makes the findings supportive of the quantitative display of resilience. However, while a quantitative methods might provide an indication of resilience, it remains mostly descriptive. It tells us little about the process of resilience building nor does it help understand how community strengths can be utilized through agency. A qualitative method on the other hand, dives deeper into this process and can highlight what drives agents to make certain decisions (Bristow & Healy, 2015; Berkes & Ross, 2013). Since the combination of a qualitative method in a CAS-framework is fairly uncommon (Gear, Eppel, & Koziol-Mclain, 2018) this dissertation conducted retrospective interviews to incorporate of reference state over time. While in some cases retrospective interviews helped to understand the community's evolvement, there were also instances in which events were described differently by various participants. To this end the researcher decided not to present certain data as the number of participants (table.2) was too low to effectively triangulate between the different stories. In contrast, coding larger strings of text proved an useful implication of CAS-theory as capturing the discourse helped to better display the complex relationship between community strengths and the choices agents made. Additionally CAS-theory also offered an analytical solution for the qualitative reference state. The findings suggest the assumption of two geographically close communities co-evolve similarly to the same external changes was accurate. Mainly because participants referred to a 'highland way of life' and stated this was shared across the island. Furthermore the crofting history is still visible in skills and knowledge of participants as well as in the physical appearance of the communities. Coming back to the reference state *in* time, when comparing Dunvegan and Edinbane the same community strengths were found to have emerged. Furthermore both communities seem to have responded similarly to external challenges such as constructing houses to deal with limited housing and the fact that in both communities there is an operating windfarm. Despite the current physical state of the community being different, the capacity to overcome challenges is found to be equally high. In conclusion, the findings indicate no differences in the relationship between agency and community strengths and thus it is argued both communities are equally resilient.

Considering agency, this dissertation strongly supports the notion of authors such as Skerratt (2013) and Magis (2010) that agency as the capacity to act independently plays a key role in

community resilience. The reason is that the findings have demonstrated how purposeful actions can break an undesired string of events. Just as Beel et al. (2017) suggested, it proved difficult to identify the initial event that offsets such a reaction. In contrast, events that had a desired effect on the community seemed more easy to identify. For instance, several participants indicated how the actions of a single person can lead to a more favourable situation. It is here where typical rural characteristics such as people-place relationship, social networks and positive outlook showed how a small alteration can be amplified by social community strengths ultimately creating a more resilient community. Strikingly, however, is that the motivation of agents that 'willing to step up' are not necessarily driven by community strengths but rather by personal traits such as 'sense of duty'. So where Beel et al. (2017, p. 461) describe agency is "*not necessarily stimulated by shocks*". This dissertation suggests to add that agents do not only act independent from their external environment, but also independent from the system they are part of.

In terms of advice, recognizing how small events can have large and (un)foreseen consequences to a rural community policy makers are advised to be cautious with imposing changes. Taking the primary school of Edinbane as an example of an 'imposed change', one could read this situation as: the community of Edinbane was experiencing an ageing population. They were well aware of the importance of maintaining a favourable demographic for their resilience hence, their desired response was having a primary school to be attractive to new young families. On paper, a school with a handful of pupils seems would seem inefficient and expensive yet, closing the school would yield a much higher cost to the local community. The cost of closing the school would not only 'cost' the local community to lose attractiveness to new young families hoping to settle, but it would also affect other community strengths. For instance, schools were found to foster social ties and children seemed important drivers for engaging with the community and creating a safe environment.

In total, the findings do suggest there is value in adopting a CAS-perspective as it helps to understand the complex and evolutionary nature of resilience. Although co-evolution and feedback loops have several methodological implications that clearly can be developed further, these concepts do provide new ways of looking at the relationship between agency and community strengths. There is evidence that community strengths can indeed foster resilience through their effect on agency but simultaneously we should be wary of implementing changes that can offset an undesired series of events. Furthermore to truly grasp what drives agency would require further research on motivations for 'stepping up'. At last, it is hoped this dissertation has made a useful contribution to further unpacking the concept of community resilience.

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Appendix A

Analysis sheet

Introduction – Questions & Analysis

Could you please give a small introduction of yourself? Such as how long have you been living here, age and occupation?

Would you say there is such a thing as the *community* of Dunvegan?

Could you please describe your connection to this community?

Part 1 Impactful event and Major Challenges – Questions & Analysis

Randomness

Since you have been living in Dunvegan what are the most notable events that impacted your daily life?

Since you have been living in Dunvegan what are the most notable events that impacted the community?

Challenges

What are in your opinion the most important challenges that Edinbane/Dunvegan has been facing?

Part 2 Community characteristics and Strength – Questions & Analysis

Community Characteristics

What characterizes / is typical for the community of Edinbane/Dunvegan? What keeps the community going?

Community Strengths probe list

Values and beliefs

Social Network

Engaged government

People-place relationship

Knowledge, skills and learning

Positive Outlook

Leadership

Engaging resources – (feedback of community strengths on agency)

So far, we have spoken about **community characteristics**, when dealing with the **Challenges**, which characteristics of the community would you consider most valuable when dealing with changes?

Could you give an example how **community characteristics ** affected how you dealt with **event/challenge**?

Part 3 Infrastructure important for resilience – Questions & Analysis Characteristics important for resilience – (structuring the system and making them more resilient)

Community level

What types of infrastructure have in your opinion been essential to the community and its way of life?

Which types of infrastructure are essential to the resilience of the community?

Why have these *infrastructure* been essential?

Personal level

Would you say you have been contributing to these *infrastructure/businesses*?

Have you been contributing in other ways when it comes to dealing with *events*?

What was your motivation for *list activity that they identified*?

Try to discover whether there is a link with the *community characteristics*