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Systematizing Experiential Learning for Sustainability Transitions

A framework for change-initiators

Acknowledgements

This thesis is the final touch of my study career. Nine years ago, I never could have expected this moment to come, and I cannot let this moment pass by without expressing my gratitude to the people that led me to this point.

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Nadia Hummel, August 9th, 2019

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1. Introduction

Our current way of living is unsustainable. We face rapid exhaustion of natural resources: greenhouse gas emissions are beyond the pale and there are many other dreadful sustainability challenges. We need to change. With the support of 196 countries for the Paris Agreement (Nagtegaal, 2016) structural reform of our unsustainable ways of living seems near. All countries that signed, agreed to limit global warming to 1,5/2 degrees Celsius. The Dutch approach entails, among others, getting rid of a fossil-fueled built environment: eight million buildings, of which seven million houses, need to be switched to alternative energy sources by 2050 (Rijksoverheid, 2018). Achieving this and other major sustainability transitions is a social challenge: it requires the cooperation of all people. That is a difficult task, because that cooperation involves a change in behavior (Rijksoverheid, 2018).

With changing one's behavior in order to achieve sustainability transitions comes a need for learning. It requires that people break with their unsustainable ways of living, but because our current way of living is deeply rooted in our way of thinking, cognitive learning on how to adopt a more sustainable way of living is insufficient to achieve sustainability transitions. Because our governing principles (our values, beliefs, insights, conceptions etc.) unwittingly control our behavior and actions, learning for sustainability transitions requires a deeper level of knowledge (Argyris and Schön, 1974). It is not only about accumulating knowledge and *knowing how we should* act sustainable. Instead, it is about to learn and, most notably, *to experience how it feels* to act more sustainable, so one can live and embody that knowledge. Therefore, learning for sustainability transitions should be experiential rather than cognitive.

Just *knowing* something, does not guarantee that one will act upon it. Though people might say that they espouse certain values based on what they *know*, those thoughts often tend to differ with their governing principles that control their behavior. This results in a disbalance between what people say and what people do (Ruijters & Simons, 2012). A telling example is given by Blake (1999) who argues that people are becoming increasingly aware of environmental concerns (i.e. knowing knowledge) but that only a few people act upon it, because acting upon it means taking environmental actions which involve changes to their way of living (i.e. living knowledge): *"Government research has shown that, despite 80% of people agreeing that a lot more could be done to resolve the problem of traffic congestion, and 60% considering using alternative transport to the car, only 25% claim to have actually done this in practice"* (Blake, 1999). Hence, learning through experience likely acquires a deeper level of knowledge: not only knowing how it should, but also knowing how it feels – which is important as it helps to helps to reconsider our underlying principles, to break with unsustainable ways of living.

In the literature, it is argued that this deeper level of knowledge can be achieved by so called double-loop learning, founded by Argyris and Schön (1974). To start with, single-loop learning is about accumulating knowledge, i.e. learning to know – and focusses on acquiring new ways of acting without changing governing principles that control human behavior. However, if these new ways of acting are not congruent with one's governing principles, double-loop learning is required. Because, what is the use of changing cognition when not acted upon? With double-loop learning, existing governing principles are being modified, it adjusts our values and beliefs (Ruijters & Simons, 2012). This is because double-loop learning is *"the process of reviewing and reflecting on one's governing principles due to (unexpected) confrontations with situations that run counter to one's values and beliefs"* (Schön, 1983).

Meaning that, when someone engages in double-loop learning, he or she experiences a situation that might not match with how they would have handled that situation, based on their governing principles. Subsequently, one's governing principles become the object of reflection. During that reflection, he or she reconsiders their values and beliefs, that will ultimately result in behavioral change (Schön, 1983).

This double-loop learning is a recurring concept in transitions literature (Loeber et al., 2007; Wildemeersch, 2007). These authors elaborate on double-loop learning and related concepts by addressing the importance of experience and reflection in learning aimed at sustainability transitions. In (predominantly) the field of education, learning processes based on experience and reflection is referred to as *experiential learning* (Kolb, 1984). However, in transitions literature such learning is referred to as social learning, as experience and reflection are likely to happen in a social setting. According to Schön (1983), the experience in double-loop learning processes is important because in order to reflect and review on one's governing principles, one needs to be confronted with situations that run counter to one's values and beliefs. According to Loeber et al. (2007), such learning processes should be perceived as social learning, as we need others to help us review our governing principles, relative to the (counter-intuitive) information we absorb during an experience: *"[…] uneasiness may be experienced when someone is confronted with information that does not match his or her understanding of a situation, such as news of the unforeseen effects of his or her actions. A common response is to avoid such unwelcome information. It is either ignored or dismissed as unimportant or untrue, unless others help one to become aware of it and take it into consideration"* (Loeber et al., 2007). This implies that a learning process based on experience and reflection is unlikely to occur without the interaction with others. Hence, for this research, double-loop learning is perceived as learning from experience through reflection in a social setting.

Additionally, this interpretation of double-loop learning is also emphasized by Wildemeersch (2007), who argues that social learning is essentially experiential, because, learning in a social setting for solutions to unexpected problems (e.g. sustainability transitions) is based on learning-by-doing. In social settings, people learn by way of social (inter)action and thus are also confronted with different governing principles. In the process of learning these differences in values and beliefs become apparent during social (inter)action and are either implicitly or explicitly reflected upon. Additionally, the creative tension between consensus and dissent between governing principles, can trigger the learning process for solving unexpected problems (Wildemeersch, 2007). Conclusively, following the interpretations on double-loop learning by Loeber et al. (2007) and Wildemeersch (2007), learning for sustainability transitions requires a deeper level of knowledge, that can be attained by learning from experience through reflection, in a social setting. For this research, such learning processes will be referred to as experiential learning.

In transitions literature, many academic contributions emphasize why such experiential learning (albeit, in the discourse in transitions literature referred to as social learning) is important to foster sustainability transitions (see Wals (2007) for an extensive overview, but also Daudelin (1996)). Above, it has been argued that such experiential learning is important, because it helps people to reflect on their governing principles, and, subsequently to reconsider them. Daudelin (1996) explains that learning from experiences happens by way of reflection: *"one steps back from an experience to reconsider its meaning to oneself by the development of inferences, making learning the creation of*

meaning from past or current events that subsequently guides for future behavior" (Daudelin, 1996). This implies that experiential learning can lead to sustainable behavior in the future.

Though the importance of experiential learning for sustainability transitions is widely acknowledged with respect to both behavioral change and sustainability transitions, little attention is paid to how to systematically organize experiential learning. This research claims that knowing how to systematically organize experiential learning is essential to deal with today's dreadful sustainability challenges, as it will help change-initiators to engage people in experiential learning. In this research, change-initiators are perceived as people who are (professionally) working on achieving sustainability transitions. People need to become engaged with such learning because, in order to break with their unsustainable ways of living, they not only need to *know* how to break their unsustainable practice, they also need to embody that knowledge *"by trying and probing it in action"* (Straatemeier, Bertolini, & Brömmelstroet, 2010).

Though the question how to systematically organize experiential learning is yet insufficiently answered, some attempts are made to structurally approach experiential learning (e.g. Willemsen et al., 2007; Straatemeier, Bertolini, & Brömmelstroet, 2010). Willemsen et al. (2007) for instance, argue that an experiential learning process should be structured in first, immersing oneself in the 'doing' of a task (experiencing) followed by reflecting on the task involvement and reviewing what has been done and experienced, to subsequently interpret the events that have been noticed and understand the relationships among them. And finally, to plan, based on new insights, what actions should be taken next (Willemsen et al., 2007). Straatemeier, Bertolini & Brömmelstroet (2010) take on a similar approach embedded in a sequential case-study method, to develop a new research design for planning, that can lead to possible planning innovations. Each case-study is a concrete experience, the case-study is observed and reflected on, new insights are tested in a new situation which then again will results in a new case-study.

These examples are derived from David Kolb's *experiential learning theory* (1984), who thoroughly investigated learning process through the process of experience and reflection. This approach, that is established in the context of education, presupposes that an individual engaged in experiential learning follows a learning cycle of four phases: the observation of and a reflection on a concrete experience leads to the formation of abstract concepts which subsequently are then tested in new situations that ultimately result in a new concrete experience. Though this theory is very helpful to understand how experiential learning can be systematized, it is argued by Loeber et al. (2007) that Kolb's theory on the structure of experiential learning cannot be seen as a blueprint of systemizing experiential learning aimed at sustainability transitions. This is due to several limitations: first, Kolb's experiential learning theory is addressing on individual experiences and does not pay attention to the social aspect that previously has been argued to be imperative. This social setting is important for experiential learning aimed at sustainability transitions as people need others to help them reflect on their governing principles. The role of governing principles, guiding one's actions and behavior, is being overlooked in Kolb's theory. Secondly, this experiential learning cycle takes place within the context of education, and therefore does not consider how learning might be influenced by social settings outside 'the classroom'. Experiential learning aimed at sustainability transitions lacks a defined context and so there are many influences that can possibly obstruct or enhance the learning process (Loeber et al. 2007). In addition, the contrast between Kolb's approach and the approach of

experiential learning for sustainability transition (i.e. individual vs. groups – defined context vs. undefined context) it is also questionable whether an experiential learning process aimed at sustainability transition in practice follows the sequential phases that Kolb proposes, or that the learning process turns out more iterative before the learning cycle repeats itself.

Figure 1: Kolb's experiential learning cycle. Source: Kolb & Kolb, 2009
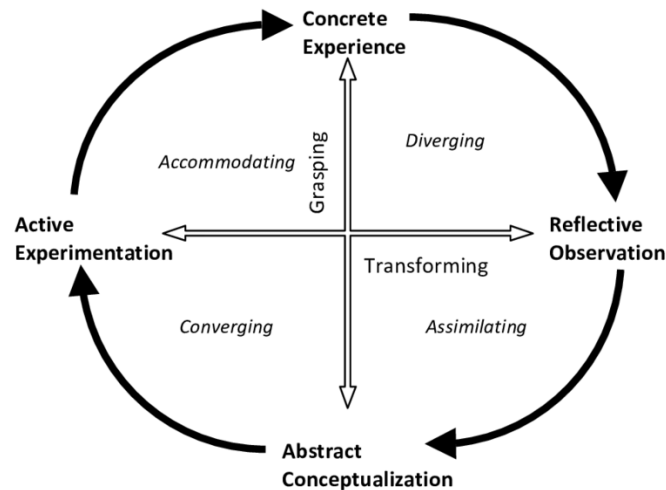
Therefore, the question remains how to systematize experiential learning for sustainability transitions. In this research, systemizing experiential learning implies a structural approach to create an experiential learning process. This includes by means of what activities, instruments, tools etc., experiential learning is designed. This research argues that, in order to systematize experiential learning, it needs to be embedded in a learning system. A learning system is proposed by Bawden (1995) as *"an organized and coherent group of people that purposefully collaborate together to achieve high quality transformations […] as they design and create new and responsible futures together"* (Bawden, 1995). Meaning that, when experiential learning is embedded in a learning system, a coherent group of change-initiators work together to facilitate and organize experiential learning processes, to ultimately achieve sustainability transitions. This implies that a learning system offers conditions that allow experiential learning to be systematically organized. However, what these conditions are and how they must be organized to systematize experiential learning needs to be studied.

Research aim and relevance

This research attempted to create a better understanding on how experiential learning can be systematized, to provide a hands-on framework for change-initiators that supports them to facilitate and organize experiential learning aimed at sustainability transitions. This has been done by answering the following research question:

Under what conditions can a learning system, aimed at sustainability transitions, systematically organize experiential learning?

To answer this research question, both theoretical and empirical inquiry has been conducted. First, a literature study was performed to learn more about learning systems and distinguish the conditions that allow for systematic experiential learning. Subsequently, academic articles concerning these conditions were consulted to discover what is already known – and what is still missing on how experiential learning should be systematized. This theoretical inquiry is complemented with an empirical case-study. Conducting a case-study helped to comprehend the insights from the theoretical inquiry as well as it helped to translate academic language into everyday practice, so change-initiators can identify themselves with it. Hence, this research does not only contribute to transitions literature, it also proves its social- and practical value as it provides change-initiators with a practical understanding of systematic experiential learning.

The case that will be analyzed for the empirical inquiry, is the innovation program called *Kas als Energiebron[1].* This is an extensive innovation program addressing the energy transition in the greenhouse industry. This case is a valuable example for change-initiators, because the Kas als Energiebron program operates as a learning system and systematically organizes experiential learning, aimed at a more sustainable future for the greenhouse horticulture industry. The Kas als Energiebron program consists of a coherent group of people that together organize and facilitate processes of experience and reflection, and engage horticulturalists with these learning processes to help them reconsider their governing principles, to ultimately change their unsustainable horticultural practices. And, with success: recent energy monitors show progression since the start of the program, meaning that horticulturalist perform more sustainably (van der Velden & Smit, 2017). Henceforth, the Kas als Energiebron innovation program will be referred to as "KaE".

Readers guide

The following chapter starts with a theoretical perspective on learning systems. Based on this perspective, this research concludes that there are three conditions of a learning system that are crucial to systematize experiential learning. These conditions are further elaborated in the subsequent paragraphs and result in three sub-research questions. Chapter three describes how qualitative case-study methodology is used to inquiry how these three conditions take shape in the case of KaE.

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1 Kas als Energiebron translates to 'Greenhouse as Energy Source' and is an extensive innovation program concerned with the energy transition in the greenhouse horticulture sector. It would be unjust not to name this program by its original name as the program itself refers to the Dutch term when communicating in other languages. Hence this research too will refer to de Dutch term when discussing this innovation program. However, the full term is often abbreviated to "KaE'', which has also been done in this research to enhance the readability. https://www.kasalsenergiebron.nl/en/

Additionally, a concise description of the KaE case is given, to provide context for the reader and to further elaborate on the benefits of this case. Then, in chapter 4, the three sub-research questions are addressed, each concerning one condition, of which the conclusions are brought together in chapter five. These conclusions are the input for the framework for change-initiators. Lastly, chapter six finalizes this research by reflection on both the research process and the research outcome.

2. Theoretical perspective

In the previous chapter it is argued that experiential learning is of great importance to achieve sustainability transitions. Merely accumulating knowledge is considered insufficient, because it is primarily focused on learning to know knowledge, rather than learning to live and experiencing knowledge, causing a disbalance between what people say and what they do (Ruijters & Simons, 2012). Instead, for people to truly change their unsustainable behavior, a deeper level of knowledge is required. This deeper level of knowledge can be attained by learning from experience through reflection in a social setting. This learning process is referred to as experiential learning. However, the question how to systematically organize experiential learning for sustainability transitions is yet to be answered. In the previous chapter it is argued that experiential learning needs to be embedded in a learning system, as a learning system provides conditions that allow for systematic experiential learning.

Presently, this theoretical perspective provides a better understanding of what learning systems are, and how they should function to systematically organize experiential learning. Based on the insights of Schön (1973) and Bawden (1995), that are brought together in a book on social learning systems (Blackmore, 2010), a concise explanation is given which led to the identification of the three conditions imperative for systemizing experiential learning. How these conditions can be shaped in order to do so, is further elaborated in the subsequent paragraphs.

2.1 Learning systems

What became clear in the previous chapter, is that a learning system is a coherent group of people that work together to design and create new and responsible futures (Bawden, 1995). Such a group should not only see themselves as a leading group that makes decision, rather, they should be aware that they all individually contribute to the group as a whole - both in its organizational form, as well as how they operate to create responsible futures by improving on [sustainability] issues that are considered problematic (Bawden, 1995).

This 'working together' consists of learning how to improve sustainability issues, as well as acting upon what they have learned – to not only design responsible futures, but also to create those responsible futures. This requires a deeper level of learning, what this research refers to learning from experience through reflection, i.e. experiential learning. This group needs to critically reflect on 1) the process they follow to generate and share knowledge, and on their understanding from their experiences with that knowledge, 2) how this group tests the quality and validity of this knowledge, 3) how they design plans for action in the face of the knowledge they generate, and 4) how these plans are actually put into action for change (Bawden, 1995). Additionally, this group need to engage with each other and be reflexive of their own governing principles, by the discussing similarities and differences of the values and beliefs they hold individually, relative to the sustainability issue at stake and the learning process they induce as such. However, to truly create responsible futures, this coherent group als needs to engage with those who need to act: *"the transformation of complex situations in the world in a systematic manner will only effectively happen if those who need to act to achieve those transformations are themselves transformed in the way that they 'see' that world an 'act' on it"* (Blackmore, 2010). Meaning that people who need to change their unsustainable ways of living –

causing the sustainability issue at stake – also need to be engaged at this level of learning. In addition, as reflecting on the experiences of the learning process is a key aspect of the learning system, it may be argued that learning systems are primarily concerned with experiential learning.

Similarly, Schön (1973) also proposes a learning system to be a group of people that work together to solve sustainability issues. However, he perceives the government as a learning system, in which people work together by means of learning to identify, analyze and solve [sustainability] issues. This too requires another level of learning: learning how the learning system should act upon (i.e. solve) what they have learned (i.e. identified and analyzed). In addition, Schön (1973) argues that such learning system starts from a crisis. That is, learning occurs when there is *disruptive evidence, contradictory to prevailing (theoretical) evidence that cannot be disregarded* (Schön, 1973). Therefore, learning systems need to be progressive and embrace such disruption – and collectively act upon this to work towards responsible futures. In doing so, this group must stand firm, as such disruption cannot immediately overthrow prevailing theory. They need to work together to make their conviction more powerful, so the defense against it will ultimately shift. This too is part of the learning process: learning how to make a conviction more powerful and how to spread it. In doing so, Schön argues that there are multiple roles to be fulfilled within a learning system: it needs someone who forces people to look at the disruption, but also someone who helps people to reconsider our deeply held beliefs and values that are incompatible with the disruption people just learned about. A learning system also needs someone that presents to people what might be (sustainable) – contrarily to what is (unsustainable). And, it needs someone who shows people where they are going when ignoring the disruption, by confronting them with the consequences of their unsustainable behavior. A final process of a learning system is to enable people to act upon their conviction for a more sustainable future and to make it mainstream that people act that way. Or, in the words of Schön, to create institutional structures that enables people to act in accordance, and how to discard old structures that withhold people from acting in accordance (Schön, 1973).

2.2 Conditions to systematize experiential learning

When considering the insights of Bawden (1995) and Schön (1973), there are three similarities in the way learning systems are perceived. These similarities are the conditions that constitute learning systems that allow for systematic experiential learning. First, a learning system exists out of a group of (progressive) people, aiming to solve problematic [sustainability] issues. Though not explicitly notified here, other academic contributions to Blackmore's book on social learning systems (2010) argue that this group should consists of members from diverse backgrounds and disciplines (Wenger, 2000; Snyder & Wenger, 2004). For this research, this group of people is referred to as "learning network", which is defined as *"a transdisciplinary network of change-initiators aimed at sustainability transitions"*.

Secondly, such change-initiators work together to create and share knowledge on how to tackle [sustainability] issues. This collaboration requires active organization. For experiential learning embedded in a learning system, this means that a learning network needs to design and facilitate the process of learning from experience through reflection in a social setting. This is somewhat explorative, and thus an inclusive approach is in order. This means that during both theoretical and empirical inquiry all 'steps to take' and 'tasks to perform' by the change-initiators of the learning network, in order to create and share knowledge for responsible futures will be referred to as experiential learning

techniques. This term was chosen because it implies all possible methods that can be used to organize experiential learning processes.

Thirdly, learning systems engage with people, either directly to let them partake in experiential learning processes, or indirectly by enabling them to act in a more sustainable way and make that behavior mainstream. The success of a learning system aimed at sustainability transition relies a great deal on the engagement and participation of those who need to act. Those who need to act, henceforth will be referred to as 'learners' and are perceived as the central actors who need to change their behavior to break with their unsustainable way of living. The third and final condition of a learning system thus will be referred to as the 'engagement of learners'.

Conclusively, the three conditions that constitute learning systems that allow for experiential learning are the learning network, experiential learning techniques and the engagement of learners, respectively.

2.3 What is known about organizing learning systems?

In the following paragraph, academic literature is consulted to learn more about the organization of learning systems. More specifically, it is inquired how a learning network should be shaped, what experiential learning techniques need to be facilitated and how learners become engaged with the learning system. An important notion to make here, is that there is a theoretical void on this topic: it has not yet been adequately inquired how experiential learning, embedded in a learning system should be organized. Hence, the literature consulted addresses not specifically experiential learning but related concepts as social learning for sustainability transitions and (transition) management. However, based on what appeared from this research thus far, assumptions and interpretations are made for what these theories could mean for systematizing experiential learning to create a starting point on which the empirical inquiry can build. In chapter six will be reflected how these assumptions and interpretation correspond with the empirical data.

2.3.1 How can learning networks be shaped to systematize experiential learning?

Based on the previous paragraph it can be argued that the learning network is the heart of a learning system. Hence, it is important to learn more about how such learning networks need to be shaped to systematically organize experiential learning. Assuming that different network structures influence the dynamics of a network, and with that the extent to which there are responsibilities, how knowledge is shared and which change-initiator performs what role, it is important to learn about different network structures. Therefore, Provan & Kenis' contribution on network governance (2008) is consulted. Subsequently, to know how a learning network should function it is important to understand by means of what roles and competences experiential learning can be organized. This way it becomes clear what roles must be included in a learning network, and all actors from the learning network know what to do to collaboratively systematize experiential learning. To get a better understanding of this subject, two sequential publications of the Competence Center for Transitions have been consulted. In these publications Andringa & Weterings (2006; 2008) aimed to explore and deepen the skillset *transition professionals* (in this research referred to as change-initiators) should possess.

Provan & Kenis (2008) argue that in order to solve *wicked problems*, like achieving sustainability transitions, network governance is required. Network governance is connecting and sharing information, resources, competences and activities of at least three organizations to bring about a desired outcome. This form of governance relies on the idea of collaborative action and the fact that all actors involved are, to a certain extent, equally concerned with the outcome and each other's success. However, this network must be actively 'produced'. Provan & Kenis (2008) argue that there are three different network structures that can be produced – this is what they refer to as the governance of networks, contrary to network governance. These three different structures will now be briefly discussed, because it provides insight in the different dynamics of networks that can possibly influence the ability of the network to systematize experiential learning.

First, *the self-governed network*. This network consists of different organizations that collectively work together without a governing entity. Sharing information, resources, competences and connecting through activities fully relies on the efforts, of those who have a stake in a successful network. The benefit of a self-regulating network is that the actors involved are highly participative and that the structure as such is easy to organize – whoever benefits can take part. However, a downside of this network structure is that finding a clear consensus on which path to take can be difficult, as well as that the network in and of itself is hard to convey to the outside world (Provan & Kenis, 2008). Presumably, this network structure is less likely to systematize experiential learning because the dynamics between the participating actors is not explicit. It is not set in stone who takes responsibility for what, and how or by whom experiential learning techniques are organized. Hence, this network structure seems not fit to systematically guide experiential learning processes towards responsible futures

Secondly, *the lead organization-governed network*. In this network the relations between partaking actors are vertical, actors on multiple levels – from governmental level to local level – are working together towards a common goal. In contrast with the self-governed network, this network structure has a lead organization that organizes, coordinates and facilitates in sharing and connecting information, resources, competences and activities in order to achieve the common goal. This way, working towards a shared objective can be done more systematically and result driven. A flip side however, is that partaking actors are possibly less participative, which undermines the feasibility of the common goal (Provan & Kenis, 2008). Contrary to the self-governed network, this network structure has a clearer dynamic between participating actors. The lead organization is responsible for systematically organize experiential learning, in which participating actors are involved. Additionally, with this network structure the learning network does not only take responsibility to organize systematic experiential learning, it also participates in experiential learning techniques like the other actors, working towards a common goal. This is important for experiential learning embedded learning system, as is argued in §2.1 that the learning process starts from a crisis, when a learning network embraces disruption to work towards responsible futures.

Thirdly, *the network administrative organization.* The structure of this network is comparable to the structure of the lead organization-governed network. Both structures have a governing entity that perform the primary role of coordinating and facilitating network activities. Albeit the network administrative organization does not actively take part in working towards the common goal of the

network. Externally governing the network is the exclusive purpose of the network administrative organization (Provan & Kenis, 2008). This structure seems, despite its similarities with the lead organization-governed network, less likely to systematize experiential learning because the governing entity does not collaborate in experiential learning techniques. However, experiential learning is about learning from experience through reflection. Hence, it is doubtful if this structure is suitable to systematically organize experiential learning if the administrative organization is not substantively involved with the experiential learning techniques.

Figure 2: Three types of network structures. Source: Provan & Kenis, 2008
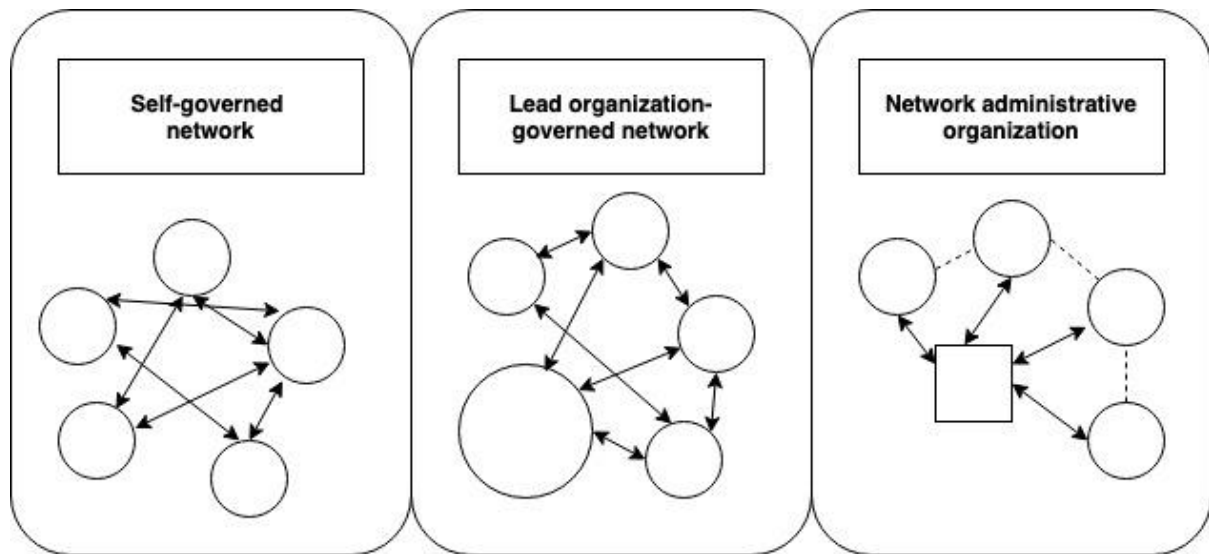
Based on these insights, it is argued that the learning network needs to be shaped following the lead organization-governed network structure to systematize experiential learning. Whether, and if so, how this is the case, will be empirically inquired based on the case-study on the KaE program.

2.3.1.2 Roles and competences of a learning network

Apart from the network structures according to Provan & Kenis (2008), the Competences Center for Transitions (henceforth referred to as CCT) sought to explore and deepen the skillset of transition professionals. The notion of transition professionals is a comprehensive term for *"all people who are professionally committed to the success of system-innovative projects and/or programs, regardless their social background"* (Andringa & Weterings, 2006). When transition professionals work together, they form a transition network, which this research refers to as a learning network. CCT argues that, ideally suited, a learning network consists out of a wide range of transition professionals coming from different social backgrounds (e.g. corporates, officials, researchers etc.). This corresponds with Wenger (2000) and Wenger & Snyder (2004), arguing that a learning network should consists of members from diverse backgrounds and disciplines. The term transition professional, as Andringa & Weterings (2006) propose, is in this research referred to as change-initiators.

The CCT has developed a framework of roles and competences clusters that are essential for learning networks to govern and guide sustainability transitions – and thus to systematically organize experiential learning aimed at sustainability transitions. Getting a better understanding by means of what roles and competences change-initiators can systematically organize experiential learning is

important because, firstly, it theoretically complements on how a learning network should be organized: not only its structure, but also its functioning. And, secondly, it provides a practical approach for change-initiators on how to organize their learning network to systematically facilitate experiential learning.

According to CCT, a role comprises a variety of tasks, whereas competences clusters are about explicit knowledge on experience, instruments, skills, attitudes and domain to adequately fulfill a role. The framework consists of five roles (the researcher, the manager, the group worker, the networker and the innovator, respectively) and two types of competences clusters: basic competences and transition competences. Basic competences are skills that each transition professional should master, yet in itself they are insufficient for systematizing experiential learning. These competences are, amongst others, addressing relational and organizational skills[2]. However, to successfully systematize experiential learning, a learning network should complement its basic competences with transition competences. This is because transition competences are addressing skills that are foundational for a learning network to constitute a learning system, because it helps change-initiators to design and create responsible futures, and thus indirectly to organize systematic experiential learning. An important notion to make here is that, according to CCT, it is important for all change-initiators in the learning network to master basic competences, but it is not required for them to also master all the transition competences. Though, it is strongly recommended that within a learning network all transition competences are represented. On a similar note, each role is preferably represented by one or more change-initiators in the learning network. Although presumably the role of the researcher is performed by a change-initiator who has a researcher's background, none of the roles are specifically reserved for change-initiators with a corresponding background. Table 1 provides an overview of competences clusters and matching roles. Below, these roles and transition competences are elucidated. Subsequently, it is elaborated how this research interprets how these transition competences address skills that help change-initiators to design and create responsible futures.

Table 1: An overview of roles and matching competences clusters. Source: Andringa & Weterings, 2006

Roles	Competences clusters
The researcher	*Recognizing patterns, reorientation, anchoring and upscaling, monitoring, transition management*
The manager	*Recognizing patterns, reorientation, experimenting, anchoring and upscaling, transition management*
The group worker	*Reorientation, experimenting, monitoring, transition management*
The networker	*Experimenting, anchoring and upscaling*
The innovator	*Reorientation, experimenting,*

The role of the researcher is characterized by a strong emphasis on gathering knowledge through data collection as well as by means of performing and supervising analysis and exploring possibilities. The manager coordinates processes and has a strong performance-orientation in terms of planning, process monitoring and the allocation of tasks. The group worker focuses on the quality and efficiency of the learning network whereas the network creates support and hence ensures junction with the external environment. Finally, the innovator offers creativity – by developing visions and looking for new and unknown paths the innovator offers room for new ideas (Andringa & Weterings, 2006).

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[2] For a complete overview of the basic competences, consult Andringa & Weterings, 2006

As table 1 displays, each role is linked to multiple competences clusters. In total, CCT has identified six transition competences clusters (Andringa & Weterings, 2006; 2008). The first cluster is *recognizing patterns.* Aptitudes that are important in this cluster are the ability to recognize structures and patterns of complex (sub)systems, to analyze them and subsequently to simplify them. This competences cluster is foundational to systematize experiential learning because it helps the learning network to embrace disruption and make their conviction more powerful to ultimately spread it (Schön, 1973, see §2.1). More specifically, by means of analyzing and simplifying the structure of a sustainability issue, a learning network can target specific learners and engage them in the learning process to, subsequently, spread how the learning network proposes to solve the sustainability issue at stake.

Secondly, the cluster of *reorientation* is all about the ability to translate long term perspectives into 'today's action'. In doing so, skills as vision, inspiration and persuasiveness are very important as content and process are inextricably linked. This competences cluster is foundational to systematize experiential learning because it helps change-initiators to structure the experiential learning process until the long-term perspective – i.e. when all learners have adapted their governing principles and broke with their unsustainable way of living – is achieved. This way, the learning network can systematically organize the path to reach that common goal. Additionally, mastering this competences cluster also helps change-initiators to engage learners through persuasion. Schön (1973) argued that a learning system needs someone that presents to people what might be, contrarily to what is. This corresponds with the skills of vision and inspiration (see §2.1)

The third cluster concerns *experimenting*. In this cluster the formation of consortia and alliances is considered important as it enables the learning network to experiment with innovative solutions. Hence it is important for the change-initiators mastering this competences cluster that they have knowledge of different processes and procedures and are skilled communicators in connecting interests. This competences cluster is foundational to systematize experiential learning because it helps change-initiators to create external support of actors. By making them part of experiential learning techniques such as, for example, experiments with innovative solutions of which external actors can benefit, the learning network is more likely to continue its experiential learning process.

Fourthly, the *anchoring and upscaling* cluster refers to being able to recognize opportunities and anticipating what is needed to expand and to create support. In doing so communicative skills and persuasiveness are essential. This competences cluster has interfaces with the experimenting cluster, as it is about creating support. Anchoring and upscaling however, is more about grounding the experiential learning process aimed at sustainability issues and to expand this learning process, also to make it easier for learners to engage. Hence, this competences cluster is foundational to learning systems and thus to systematize experiential learning because it helps change-initiators to make systematic experiential learning more mainstream (Schön, 1973, see § 2.1).

Fifthly, the cluster *monitoring* is about initiating and continuing a reflexive learning process with the learning network, for instance by monitoring group dynamics and reflecting on actions and performance of themselves and other actors. Hence, this competences cluster is foundational to systematize experiential learning because change-initiators explicitly and continually reflect on their experiential learning techniques and process, and adjust as needed (Blackmore, 2010, see §2.1).

The final competences cluster is *transition management*. This cluster is extensive and combines all aptitudes of the clusters described above and several additional skills. For example, to systematize experiential learning, change-initiators must also be able to maintain an overview and be aware of the coherence between change-initiators in the learning network and to alternate between process and content and know when which steps need to be taken. This is an important competences cluster to systematize experiential learning because it helps change-initiators to have a bird view over the entire experiential learning process and thus can refine the systematics of the learning process as needed. For instance, if the learning network applies a structured approach towards experiential learning, this process still needs to be governed to successfully help learners to reconsider their governing principles. This means that the learning network might need to spend more time on experiences before heading towards the process of reflection or vice versa. Meaning that, despite systematizing experiential learning, the learning network always need to be reflexive by reflecting on the actual process that they use to generate and share knowledge (Schön, 1973, see § 2.1).

Finally, CCT closes off the competences profiles by emphasizing the importance of two personal characteristics that every actor should have when involved in experiential learning, as they determine the extent to which change-initiators are able to successfully perform their roles. That is, change-initiators should be driven by the belief that change is needed and be motivated by optimism: change is possible (Andringa & Weterings, 2006; 2008).

2.3.2 What experiential learning techniques allow for systematic experiential learning?
The theories on network structures (Provan & Kenis, 2008) and on roles and competences for transition professionals (Andringa & Weterings, 2006;2008) have been consulted to get a better understanding of the form and function of learning networks to systematize experiential learning. Subsequently, the second condition of a learning system concerns the experiential learning techniques that the learning network must design and facilitate in order to create and share a deeper level of knowledge for responsible futures. It is important to inquire what experiential learning techniques must be designed and facilitated to systematize experiential learning (i.e. to uncover what steps need to be taken and what tasks need to be performed) because it are these techniques that epitomize the process of experiential learning. By creating a better understanding of how experiential learning processes can be epitomized, change-initiators are offered a hands-on approach on how to organize systematic experiential learning.

To provide a theoretical perspective of experiential learning techniques, the book "*Social learning towards a sustainable world"* by Wals (2007) has been consulted. In this book 27 academic contributions are bundled on the principles, perspectives and praxis of, albeit, social learning and learning-by-doing. As argued in the introduction, social learning is in essence experiential (Wildemeersch, 2007). Hence it is assumed that the patterns Wals (2007) successfully found in his epilogue on the principles, perspectives and praxis of social learning are also applicable for systematizing experiential learning.

A first pattern Wals (2007) observed, is that amongst the contributors of his book there is a strong consensus on the importance of interactions between a diversity of people – and on the importance of both reflection and reflexivity, as together this leads to meaningful learning processes. For

systematizing experiential learning this means that experiential learning techniques need to address a diversity of people, and that the techniques need to provide room for reflection and reflexivity. A second pattern Wals (2007) found, is highly corresponding with the lead-organization governed network by Provan & Kenis (2008): *"the success of [experiential] learning depends a great deal on the collective goals and/or shared visions shared by those engaged in the process".* Meaning that, all experiential learning techniques the learning network organizes, should convey the common goal. A third agreement amongst the contributors to Wals' book, is that [experiential] learning occurs from conflict, because working towards sustainability transitions is inherently associated with diverging governing principles:

> *"By explicating and deconstructing the oftentimes diverging norms, values, interests and constructions of reality people bring to a sustainability challenge, it not only becomes possible to analyze and understand their roots and their persistence, but also to begin a collaborative change process in which shared meanings and joint actions emerge"* − A. Wals, 2007 (p. 497)

For organizing experiential learning techniques, this citation implies that techniques should enable confrontation amongst learners to reconsider their governing principles and build new, corresponding governing principles that guide learners to a sustainable way of living. Additionally, because conflicts and discords amongst governing principles are considered to be important for learning to occur, it is crucial for the learning network to be considerate of learners' governing principles. Though eventually learners need to adapt their governing principles to break with their unsustainable way of life, it should not be done at once. As Wals (2007) argues: *"there is no learning without dissonance, and there is no learning with too much dissonance".* Thus, for systematizing experiential learning, it is important that the learning network structures experiential learning techniques in such a way that learners can alter their governing principles little by little. The learning network thus needs to organize experiential learning techniques that create room for different levels of discord to trigger learning at the individual level (reconsidering their own governing principles) as well as learning at a collective level (building corresponding governing principles) to guide learners towards sustainable ways of life.

Wals (2007) refers to this process as the deconstruction, confrontation and reconstruction of governing principles, and argues that these are the central steps in [experiential] learning processes – that is to say, what experiential learning techniques should epitomize. Hence, to systematize these central steps, Wals (2007) proposes six consecutive stages that an [experiential] learning process should follow. These consecutive stages are listed in table 2

Table 2: Consecutive stages of experiential learning. Source: Wals, 2007

Stages	Explanation
1) Orientation and exploration	"Identifying key actors and, with them, key issues of concern or key challenges to address in a way that connects with their own prior experiences and background thereby increasing their motivation and sense of purpose"
2) (Self)awareness raising	"Eliciting one's own frames relevant to the issues or challenges identified"
3) Deframing or deconstructing	"Articulating and challenging one's own and each other's frames through a process of clarification and exposure to conflicting or alternative frames"
4) Co-creating	"Joint (re)constructing of ideas, prompted by the discomfort with one's own de-constructed governing principles and inspired by alternative ideas provided by others"
5) Applying/experimenting	"Translating emergent ideas into collaborative actions based on the newly co-created frames and testing them to meet the challenges identified"
6) Reviewing	"Assessing the degree to which the self-determined issues or challenges have been addressed, but also a review of the changes that have occurred in the way the issues/challenges were originally framed, through a reflective and evaluative process"

Theoretically, these stages provide a systematic approach for [experiential] learning, to create and share a deeper level of knowledge for responsible futures. For each stage, experiential learning techniques should be designed and facilitated to serve the purpose of that stage. However, Wals (2007) did not elaborate on these practical implications and thus this theory falls short in translating these stages in concrete, practical actions that change-initiator can put into practice. Hence, to provide change-initiators with a systematic, hands-on approach to organize experiential learning techniques, the practical implications of these consecutive stages are inquired empirically.

2.3.3 How do learners become engaged in systematic experiential learning?
In the previous paragraphs it has been discussed how learning networks should be shaped so it is able to systematically organize experiential learning processes – and how consecutive stages to create a deeper level of knowledge offers a systematic approach of organizing experiential learning techniques. Henceforth follows the inquiry on the last condition of a learning system: the engagement of learners.

As previously argued, in order to achieve sustainability transitions the cooperation of all people, that perform a certain practice unsustainably, is needed. Blackmore (2010) elaborates on this by arguing that "*the transformation of complex situations in the world in a systematic manner will only effectively happen if those who need to act to achieve those transformations are themselves transformed in the way that they 'see' that world and 'act' on it*" (Blackmore, 2010). Meaning that, the people who need to change their unsustainable ways of living – causing the sustainability issues at stake – also need to be engaged in the learning system. Hence, it is essential to inquire how this can be done to provide a hands-on approach for change-initiators.

To engage learners in a learning system, and thus to get them to participate in the experiential learning process, Brulle & Jenkins (2006) argue that forcing consensus on what learners should value is counterproductive: *"[sustainability] movements are more effective if they engage citizens in a sustained dialogue rather than treating them as mass opinion to be manipulated".* Instead, Brulle & Jenkins (2006) see creating a genuine dialogue that creates value-change and a better understanding of both the self- and the public interest (i.e. confronting learners with different governing principles and subsequently jointly (re)construct those principles, see table 2) as the remedy to a general public lack of lucid understanding of sustainability issues (Brulle & Jenkins, 2006). For engaging learners with experiential learning processes this means that the learning network should not communicate merely the message of their "conviction" to make it more powerful and spread it (Schön, 1973, see §2.1). Rather, the learning network should be considerate with the learner's governing principles and comfort zones and thus, corresponding to Wals (2007), the learning network needs to engage learners by altering the learners governing principles step by step, starting from engaging learners around values they consider important. Furthermore, Brulle & Jenkins (2006) argue that the engagement of learners should not solely rely on professional advocacy and top-down approaches. Contrarily, it is proposed that a learning network should also commit to so called grassroot organizing (Brulle & Jenkins, 2006). With grassroot organizing, a learning network creates a movement of collective action from the local level, to effect change at the local, regional, national or international level. Hence, grassroots movements are often characterized by bottom-up approaches rather than top-down approaches (Yenerall, 2017). For engaging learners with experiential learning processes this means that, in order to do so, the engagement of learners should not only (directly) depend on the efforts of the learning network, but the learning network should consider engaging other actors who can encourage learners to participate in experiential learning techniques.

Additionally, Tilbury & Wortman (2004) provide more practical implications for the engagement of learners. They have built a framework to provide a steppingstone for change-initiators and learning networks to engage [learners] in sustainability transitions. Derived from their main argument that learning is the primary agent of sustainability transitions because by learning the values, behaviors and lifestyle required for sustainable ways of living can be stimulated, Tilbury & Wortman perceive the role of learning in fostering sustainability as followed:

> *" [...] the process of learning how to make decisions that consider the long-term future of the equity, economy and ecology of all communities, [and thus] builds the capacity for such future-oriented thinking." – Tilbury & Wortman, 2004 (p. ix)*

For this research, this implies that the engagement of learners should be based on future-oriented thinking, both with and regarding learners. This corresponds with what Schön (1973) mentioned about that a learning network needs someone to present to learners what might be – e.g. a sustainable future – or what will be, by confronting them with the consequences of their unsustainable behavior (see §2.1). Additionally, this also corresponds with the competences cluster of reorientation. If a change-initiator of the learning network masters this competences cluster, he has skills like vision, inspiration and persuasiveness that help him to translate long-term perspectives into daily practice (Andringa & Weterings, 2006;2008). This way, the change-initiator is able to engage learners by presenting what might be, and, subsequently, how to get there.

Since Tilbury & Wortman (2004) see learning as primary agents to build capacity for future-oriented thinking, their framework provides five different approaches that change-initiators can use to enhance the learners' capacity for future-oriented thinking to engage in sustainability transitions. First, the framework supports the imagination of a better future by means of *envisioning*. Such future thinking helps learners to *"discover their possible or preferred futures, and to uncover beliefs and assumptions that underlie their visions and choices".* This corresponds with Wals' idea of (joint) reconstruction of one's governing principles (see stage 4, table 2). Secondly, Tilbury & Wortman (2004) also plead for reflection and critical thinking, as it challenges [learners] to critically question their values and beliefs and to recognize their biases. This is conforming the ideas of (amongst others), Schön (1983), Kolb (1984) and Wals (2007) on the value of reflection for experiential learning.

A third approach to engage learners in sustainability transitions, is by way of participation. When change-initiators facilitate that learners can participate in decision making of a learning process, it becomes more likely that learners are also willing to act upon what they have learned: *"through participation, [learners] build skills to take control of both the decision making process and responsibilities for its outcomes. This greater control leads to greater motivation to participate in action"* (Tilbury & Wortman, 2004). For the engagement of learners in systematic experiential learning this means that, by letting learners participate in, for example, designing and performing experiential learning techniques, the learners might be tempted to become engaged in systematic experiential learning. Fourthly, creating partnerships is vital as it can accelerate experiential learning processes because it combines resources, skills and financial assets to prosper long-term ideas and strategies that are necessary for change. Considering this research, this corresponds with the competences cluster experimenting, which concerns the formation of consortia and alliances and hence enables the network to experiment with innovative solutions (Andringa & Weterings, 2006).

A last approach Tilbury & Wortman (2004) propose to engage learners in sustainability transitions. They perceive system thinking as an innovative approach to look at the concerns of sustainability in a more relational way, and therefore can help the learning network to engage learners by addressing them not solely on the sustainability issue but helping learners to perceive sustainability issues in its context. This corresponds with the competences cluster of recognizing patterns (Andringa & Weterings, 2006). What will become clear later, is this system thinking approach can be associated with letting learners participate in the decision making of a learning process

These theoretical insights helped to create an understanding of how change-initiators can engage learners. However, this research argues that these insights lack two imperative aspects with respect to engaging learners in systematic experiential learning. Firstly, the approaches that Tilbury & Wortman (2004) propose seem to address learners that are to a certain extent already engaged in systematic experiential learning. Hence, these approaches aim to keep learners engaged, rather than getting learners engaged, therefore it lacks ways of how to approach potential learners and subsequently engage them in systematic experiential learning. For example, a potential learner is unlikely to participate in performing experiential learning techniques when he is not familiar with the learning system. On the contrary, Brulle & Jenkins (2006) do propose several helpful approaches of how potential learners can be approached, for instance by means of grassroots movements, but do not translate these approaches to practical implications. Hence, empirical inquiry is needed to fill these

voids and to provide change-initiators with a hands-on approach to engage (potential) learners to systematic experiential learning.

2.4 Research questions

This theoretical inquiry on learning systems and how to organize them has provided valuable insights but also revealed knowledge gaps that need to be filled. As this research aims to provide change-initiators with a hands-on framework to systematically organize experiential learning processes, this theoretical framework thus needs to be complemented with empirical inquiry. Hence, a case-study is conducted concerning the innovation program Kas als Energiebron. For one, to contribute to the field of transition studies by filling the knowledge gaps, and secondly, to comprehend these theoretical understandings in practical context which helps to translate the academic language into everyday practice that change-initiators can identify with. To guide this empirical inquiry, three (case-specific) sub-research questions are formulated.

In §2.3.1 it is assumed that different network structures can influence the dynamics between change-initiators in a learning network and that different transition competences are foundational to systematically organize experiential learning (Provan & Kenis, 2008; Andringa & Weterings, 2006;2008). To provide a better and more practical understanding on the form and function of learning system, the following sub-research question will be empirically inquired:

1. *How does the learning network of Kas als Energiebron is shaped, and how does that enable systematic experiential learning?*

In §2.3.2 is suggested how experiential learning can be systematically approached, however, the literature falls short on how such learning processes are epitomized by experiential learning techniques (Wals, 2007). Meaning that there is a knowledge gap on the practical implication of systematic experiential learning. Hence, this will be empirically inquired by addressing the following sub-research question:

2. *What experiential learning techniques can be identified in the case of Kas als Energiebron, and how do these techniques systematize experiential learning?*

Lastly, in §2.3.3 is elaborated how learners become engaged with experiential learning. However helpful these insights, the literature (Brulle & Jenkins, 2006; Tilbury & Wortman, 2004) does not sufficiently address the practical implications of approaching potential learners. Therefore, this matter has also been empirically considered by answering the following sub-research question:

3. *How does the Kas als Energiebron program engage (potential) learners in systematic experiential learning?*

By answering these three questions, each concerning one condition of a learning system, an answer is also provided for the main question proposed for this research: "*Under what conditions can a learning system, aimed at sustainability transitions, systematically organize experiential learning?*"

3. Methodology

This chapter will elaborate on the methodology by which this empirical inquiry was conducted. First, the research approach and strategy will be discussed, followed by a concise case description of the innovation program of Kas als Energiebron. Finally, the steps of both data collection and data analysis are considered.

3.1 Research approach and strategy

Because this research seeks to understand how experiential learning aimed at sustainability transitions can be systematized, it was decided to write from a constructivists approach. According to this paradigm, everyone holds a different worldview, meaning that reality is socially constructed. How a social phenomenon can be understood, thus is dependent on the context (Creswell, 2014). For systematizing experiential learning, this means that there is not 'one truth' on how it should be done. Rather, to understand how experiential learning can be systematized, the researcher needs to make sense of the meaning that change-initiators attach to the learning system in which experiential learning is embedded. Hence, this empirical inquiry focusses on change-initiators' views on such learning systems (Creswell, 2014). In line with this constructivist approach, it was decided to use case-study methodology. A case-study is a common methodology used by researchers following the constructivists approach as it *"investigates a contemporary [social] phenomenon in-depth and within its real-life context".* Therefore, it meets the desire of constructivists to understand a phenomenon in socially constructed realities (Yin, 2009).

With respect to this research, there is a desire to understand the phenomenon of learning systems and to investigate how the three conditions of learning systems in practice systematize experiential learning. By empirically inquiring a learning system in which experiential learning is embedded, e.g. the case of Kas als Energiebron, a more in-depth understanding of the practical implications of experiential learning systems was created. This was done so by using qualitative data-collection methods, which allowed for broad and general questions to so the participants of the case-study could construct their views and meaning of Kas als Energiebron as a learning system (Creswell, 2014). This data was used to inductively develop a framework (supported by the theoretical perspectives presented in chapter two) for future change-initiators to systematize experiential learning aimed at sustainability transitions.

3.2 Introducing Kas als Energiebron: a case description

The empirically inquired learning system concerned the case of Kas als Energiebron, an innovation program aimed at fostering the energy transition in the greenhouse horticulture industry. Henceforth, Kas als Energiebron is abbreviated to KaE. Below, the case of KaE is introduced. Additionally, it is explained why the KaE case is a valuable example to learn more about how learning systems need to be organized to systematize experiential learning processes.

"Kas als Energiebron is the innovation- and action program that stimulates energy savings and the use of sustainable energy in the greenhouse horticulture industry" (Kas als Energiebron, 2019). Since 2006, a lot of research has been conducted under the name of Kas als Energiebron. Meanwhile, 662

studies are completed and another 98 are still running (KaE, 2019). All studies are aimed at a sustainable and responsible future of the greenhouse horticulture industry. Accordingly, together with entrepreneurs, the KaE program stimulates innovations that can cause breakthroughs in the greenhouse horticulture industry.

It is not surprising that the Netherlands has an extensive innovation program regarding the field of greenhouse horticulture. Ever since World War II, the Netherlands has been world leading in greenhouse horticulture, making it an important industry for the Dutch economy. Notwithstanding, there was a lot of commotion in the early 80's, when it was brought to light that the fertilizers and chemicals that were being used to increase the production, turned out to be harmful. Additionally, the damaging effects of CO_2 emission were also acknowledged, which caused environmental debates to flare up. The tides had to turn: the greenhouse horticulture industry needed to become sustainable (Berkers & Geels, 2011).

Concrete steps were taken in 1991, when the first long-term agreement regarding energy was concluded. This agreement contains deals between the greenhouse horticulture industry and the Dutch government to collaboratively work on a more sustainable industry by means of energy savings and sustainable energy sources. However, the primary focus was on energy efficiency (i.e. the energy consumption per unit). With success: this factor increased with 46% in 2005 compared to 1980. Only, being more energy-efficient meant an increase in production, not a decrease in the consumption of energy (LTO Glaskracht & Stichting Natuur en Milieu, 2007). It took a few more years before the focus shifted from energy-efficiency to actually reducing the energy consumption. It had to, because the sum of CO_2 emissions caused by the greenhouse horticulture was beyond the pale. Although the detrimental effects of CO_2 emission was the (political) driving force, horticulturalists did not at all prioritize reducing CO_2 emissions by saving energy, because the energy prices were already relatively low[3]. They knew about the effects, but did not act upon it. And thus, the Ministry of 'LNV' (the Dutch ministry for agriculture, nature and food quality) asked SIGN (a foundation for innovation in the greenhouse horticulture) to focus on a breakthrough for a more sustainable horticulture. SIGN joined forces with InnovationNetwork (the former National Council for Agricultural Research) to reduce the energy consumption of the greenhouse horticulture industry. Not much later there was a breakthrough: in 2001, the concept of Kas als Energiebron was introduced (Roza, 2006; Grin & van Staveren, 2007).

To realize this breakthrough, SIGN & InnovationNetwork approached many people for help, but nearly all of them turned it down. Kas als Energiebron was a controversial metaphor that caused a lot of skepticism. After all, the concept implied a (seemingly impossible) trend deviation: from the greenhouse horticulture as major energy consumer, to the greenhouse horticulture as (sustainable) energy producer. This shows that the learning system of Kae is progressive, embraced the disruption and stood firm until the defense against it ultimately started to shift (Schön, 1973, see §2.1). Eventually, there were a few people willing to take the risk, and first attempts were made to create an energy-producing greenhouse. A lot has happened ever since, and so this breakthrough has grown from a "ludicrous idea", to the extensive innovation program that it is today (Roza, 2006; Grin & van Staveren, 2007).

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3 Energy prices did fluctuate, but not enough to be corrected by saving energy.

There are a few reasons that make KaE a valuable example to learn more about how learning systems need to be organized to systematize experiential learning aimed at sustainability transitions. Generally, the KaE program is embedded in a learning system. It induces learning for the energy transition in the greenhouse horticulture industry and explicitly encourage horticulturalists to engage in this learning. More specifically, the way how the three conditions that constitutes the learning system of KaE are organized (the learning network of which it consists, the experiential learning techniques they perform, and how they engage (potential) learners) caused the greenhouse horticulture industry to become sustainable.

Due to a unique, long-lasting partnership between the greenhouse horticulture industry and the Dutch government[4] that closely cooperates with knowledge institutes, the KaE program has a "golden triangle" learning network. Meaning that all three actors reinforce each other in achieving the common goal: a responsible future for the greenhouse horticulture industry, specifically being climate neutral by 2050. Together, they perform research, stimulate innovation and show horticulturalist how the future of their field may look like. In doing so, the KaE program evidently causes progress in achieving a more responsible future. For example, the Energy Monitor 2017 (van de Velden & Smit, 2017) proves there is an increased share in sustainable energy sources and a decreasing trend regarding CO_2 emissions. This is (partly) resulting from the efforts of the KaE's learning network, helped horticulturalist to change their (unsustainable) horticultural practices. Hence, the way in which KaE's learning system systematically operates is a great example to learn more about the shape and functioning learning networks, what kind of experiential learning techniques help learners to gain a deeper level of knowledge and how (potential) learners become engaged in systematic experiential learning.

3.3 Data collection and data analysis

To investigate the conditions that constitute the learning system in which KaE is embedded, the three sub-research questions (see §2.4) have been answered by way of qualitative data collection methods, followed by a thematic analysis.

3.3.1 Data collection

The data has been collected by means of different methods. First, to become familiar with the KaE case, a preliminary analysis was conducted by means of desk research. Based on this preliminary analysis, the in-depth interviews were prepared. These interviews form the heart of the data. Additionally, one moment of observation served as experiential learning technique for the inquirer, to experience how a learning system is epitomized.

Desk research

To become familiar with the KaE program and create a knowledgebase on which further data collection could be built on, desk research was conducted. During this phase, the website of the KaE program[5] was consulted and thoroughly analyzed. This provided insight in the organizational structure and methods/approach of the program. Additionally, two reports about how the KaE program came to exist, were considered (Roza, 2006; Grin & van Staveren, 2007).

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4 The greenhouse horticulture industry and the Dutch government have been working together since the first long-term agreement on Energy, concluded in 1991.
5 www.kasalsenergiebron.nl

Conducting in-depth interviews has been the primary method of this research to collect data, the selection of respondents was based on the preliminary analysis. From this analysis appeared that there are five different perspectives concerning the KaE program. To start with, KaE in its organizational form consists of two different backgrounds: the government and the greenhouse horticulture industry. However, the learning network that organizes systematic experiential learning, turned out to be more comprehensive: the organization of KaE closely collaborates with knowledge institutes, and the participation of horticulturalists and suppliers is considered imperative to systematically organize experiential learning. Because all these different perspectives are closely involved with the learning network, it was decided to include all five in the data collection. This way, a wide variety of subjective meanings and views attached to the learning system is offered, creating a more in-depth understanding of experiential learning systems. Additionally, including all the different perspectives also helped to verify different observations that appeared from the interviews, making the framework proposed in this research more credible (Stake, 1995). The selection of respondents thus is based on these five different perspectives: the government (specifically the ministry of LNV), the greenhouse horticulture industry, divided in the branch organization, the horticulturalists and suppliers, and lastly the perspective of knowledge institutes.

In total, seven in-depth interviews (ranging from 1,5 to almost 3 hours) were conducted: two with the program managers from both the ministry as well as the branch organization, two with horticulturalists, two with researchers from WUR and one with a supplier. Table 3 provides and overview of the respondents and elaborates on their relationship with the KaE learning system. Despite it has been an informed choice to include all five perspectives, and to select people that are all very closely involved with the KaE program, it must be noted that this selection does come with the risk that the respondents may have been biased, and thus the results may have been affected by this. Nevertheless, due to their expertise and involvement with the KaE learning system, it was expected that this selection would yield rich and comprehensive data.

Table 3: an overview of the respondents

	Respondent	**Relation with the KaE learning system**
1	Ministry of LNV	Program manager from the government
2	Branch organization Glastuinbouw Nederland	Program manager from the greenhouse horticulture industry
3	Horticulturalist 1	Chairman of the ´Entrepreneurial Group KaE´, represents horticultural entrepreneurs in the KaE program
4	Horticulturalist 2	Innovations stimulated by the KaE program are tested at this tomato nursery
5	Researcher 1	Manager of the WUR Greenhouse Horticulture department, conducting research commissioned by KaE
6	Researcher 2	Conducting research commissioned by KaE
7	Supplier	Lecturer for the KaE program, also provides climate computers for monitoring and manages data platforms for horticulturalists

Conform a constructivist approach, the topic list that was used to conduct these interviews consisted of open-ended questioning, so the respondents were free to share their personal views. All interviews were held on location, which allowed for understanding the daily setting and context of the

respondents (Stake, 1995). Additionally, the interviews were, with informed-consent, audio recorded and then transcribed for the data analysis.

The topic list followed, like this research, the structure of the three learning system conditions: the learning network, experiential learning techniques and the engagement of learners. The interviews started with asking the respondents how they perceive the network concerning the KaE program: how they think it looks and what actors are involved, how those actors fulfilled their role in the network etc. However, the interviews did not follow the structure of the topic list. Without explicitly moving on to the next topics, the conversation naturally shifted back and forth between the three conditions, which emphasizes how intertwined these three conditions are. The topic list that was used can be found in appendix I. The transcripts, however, are due to confidentiality not included in this report. If you wish to consult the transcripts, they are available (in Dutch) on request.

Observation

Finally, to complete the data collection, an experiential learning technique in practice was attended, to create a deeper understanding of how the learning system of KaE is epitomized. In advance, an observation list was prepared with points of interest, again following the structure of the three conditions: the learning network, experiential learning techniques and the engagement of learners. During the observation field notes were made, which directly after were processed in a written report. The observation list can be found in appendix II. The written report (in Dutch) is together with the transcripts available on request.

3.3.2 Data analysis
To analyze the collected data, a thematic analysis has been carried out using the software program NVivo. Notwithstanding, the phases of data collection and data analysis ran parallel, as every time the data set grew, the researcher moved back- and forward between the data and hence expanded the analysis.

The thematic analysis was performed as proposed by Braun & Clarke (2006). The first step was to become familiar with the data. This has been done by transcribing the audio recordings, and while transcribing, noteworthy quotes and recurring topics were highlighted. Subsequently, when the transcripts were uploaded in NVivo, the data was reviewed and preliminary codes were assigned to describe the content. After the first few interviews, it was attempted to finds patterns across the content of the interviews and the codes. This was an iterative process until the moment of saturation. Then, all identified codes and patterns were sorted into themes. These themes were reviewed and refined by reviewing the entire data set one more time. To conclude, the themes were defined and named to serve as a starting point for writing the results. This thematic analysis resulted in a code tree, which can be found in appendix III.

4. Kas als Energiebron as a learning system

This chapter presents the results from the empirical inquiry on the learning system of KaE and how it is organized. Each paragraph addresses one of the three conditions of a learning system, aimed to answer the sub-research questions as proposed in §2.4. Where possible, the empirical data is linked to the theoretical perspectives presented in chapter two. This is to scientifically substantiate the inductively developed framework for change-initiators to systematize experiential learning aimed at sustainability transitions.

4.1 The learning network of Kas als Energiebron

This paragraph is devoted to understand how the learning network of KaE is structured and how it functions, to learn how that helps to systematize experiential learning. First, the empirically observed network concerning the KaE program is mapped. Then, it is described how these different actors fulfil roles and competences within that network. Lastly, it is discussed what can be learned from the learning network of KaE about systematizing experiential learning.

4.1.1 The structure of the KaE learning network

The program of KaE is run by a team, dedicated for this purpose. The KaE team, in its organizational form, consists of a management team, a project team and an entrepreneurial group. The management team consists of two people, one management member from the Ministry of LNV, and one management member from the branch organization Glastuinbouw Nederland[6]. The project team, however, is the driving force behind the program. It consists of six people, representing the same two perspectives. In this project team, two people from the Ministry of LNV have been appointed as program manager and policy specialists, and four people working for Glastuinbouw Nederland represent the greenhouse horticulture industry. They fulfil the positions of program manager, project leader, policy specialist and innovation specialist, respectively. The project team of KaE works closely with entrepreneurs, both with horticultural businesses and the supplying industry (for instance, greenhouse builders). By means of the entrepreneurial group, which represents mostly horticultural entrepreneurs and board members of crop-cooperations, a large proportion of the practicing horticulturalists has an influence on the content of the program in terms of knowledge development Additionally, the KaE team engages with practicing horticulturalists by way of so-called BCO's (supervising committees for knowledge development (this will be elaborated in §4.2) Simultaneously, to develop this knowledge, KaE closely collaborates with knowledge institutes. Especially the horticulture department of Wageningen University & Research (WUR) as well as with Delphy, a commercial research institute – both research facilities are located in Bleiswijk. Furthermore, other research institutes such as technical universities and the organization for applied scientific research (TNO) also regularly conduct research commissioned by the KaE team. While conducting research, the researchers cooperate with BCO's, which consists of (crop specific) horticulturalists, suppliers and sometimes advisors.

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6 Glastuinbouw Nederland translates to "Greenhouse Horticulture the Netherlands". Similar to KaE, Glastuinbouw Nederland also refers to the Dutch term when communicating in other languages. Hence this research too will use the Dutch term when discussing this branch organization.

All these actors thus collaboratively work together to create (and, what will become clear later, share) knowledge for a responsible future for the greenhouse horticulture industry. Hence, the learning network reaches beyond KaE in its organizational form (see figure 3 for an overview). However, what can be observed here, and what also noted in the case description (§3.2), is the learning network consists of a triad – the government, the industry and knowledge institutes. This triad, as a learning network, centers around horticulturalists. After all, the learning network is able to design a responsible future, but they need the horticulturalists to change their practices to ensure that the responsible future will be achieved. While the horticulturalist thus is the learner who needs to change their unsustainable practice, all change-initiators that are part of the learning network are enabling and supporting the horticulturalist in doing so.


Figure 3: Kas als Energiebron in its organizational form. Source: own data
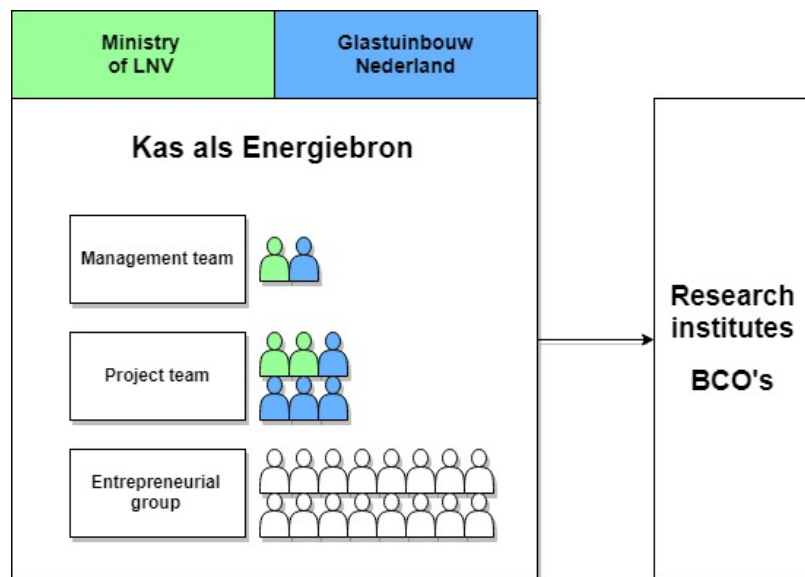
Although KaE in its organizational form is steady, the learning network regarding experiential learning is more dynamic, because all change-initiators of the KaE learning network are also part of their own network with whom they cooperate. For instance, change-initiators from the learning network can form consortia amongst their own network to experiment with new innovations, resulting from research commissioned by the KaE team (and with that creates external support for experiential learning, see §2.3.1.2). Additionally, addressing the network surrounding horticulturalists is particularly relevant for experiential learning, because all actors surrounding horticulturalists can enable and support horticulturalists in performing sustainable greenhouse horticulture. Therefore it can be argued that the learning network to systematize experiential learning in the case of KaE consists of KaE in its organization form and the dynamic networks of horticulturalists. However, it must be noted that there is overlap between the two. For example Glastuinbouw Nederland: this change-initiator is represented in the KaE team, but their participation in this innovation program is but one aspect of their work. Hence, Glastuinbouw Nederland also is related with horticulturalists on other levels, for instance through lobbying. An important notion to make here, is that these networks (often representing organizations and businesses) depend on the efforts of the people behind it. Regardless

their 'professional label', a successful learning network relies on the people embodying the network[7]. In figure 4 is attempted to, based on the data collection, map a horticulturalists' network[8].

Figure 4: A horticulturalists' network. Source: own data
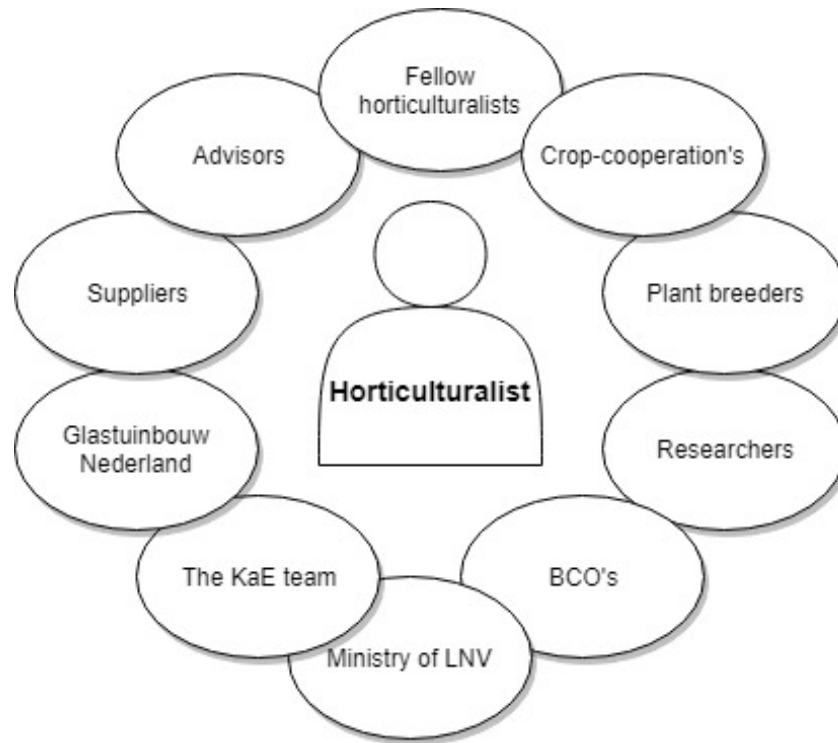
From this analysis, it can be observed that the shape of KaE's has similarities with the lead organization-governed network, as proposed by Provan & Kenis (2008). This structure has a governing entity that coordinates and facilitates network activities. In this case, the governing entity is the KaE team. Additionally, the partaking actors in such a network structure are vertical. Which is the case in the learning network of KaE: there is the Ministry of LNV on a governmental level, as well as there are local actors such as horticulturalists, suppliers and advisors. Together, they systematically work together to create and share knowledge for a responsible future of the greenhouse horticulture industry. However, Provan & Kenis argue there is one down-side of this network structure: not all actors will be participative which undermines the feasibility of achieving a sustainable future of the industry. Hence, it is the responsibility of the KaE team as a governing entity to not only engage horticulturalists as learners with the learning system, but also to engage actors surrounding the horticulturalists. How this is done, is further elaborated in §4.3

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7 A telling example is the merger between the Ministry of LNV and the Ministry of Economic Affairs: between 2010 and 2017, the Ministry of LNV fell under the authority of the Ministry of Economic Affairs. Though, this hardly had any impact, because the same representatives remained part of the KaE team.

8 This illustration is based on a drawing of one of the respondents, who tried to map the network of a horticulturalist. During this process, it became apparent that a horticulturalists' network is multidisciplinary and reaches beyond actors within the greenhouse horticultural industry. Hence, because these networks are so comprehensive it was decided not to include actors external to the greenhouse horticultural industry in this research.

4.1.2 Roles and competences of the KaE learning network

Although many horticulturalists will recognize this network, there is a distinction to be made regarding the types of horticulturalists. Not particularly concerning crops and cultivation, but rather in terms of progressiveness. Notably: how participative they are in the learning network in terms of experiential learning. The horticulturalist that were interviewed for this research, for instance, are closely involved with the learning network and are considered very progressive. The KaE team refers to such progressive horticulturalists as front runners, and are considered to be the most important change-initiators for engaging learners with experiential learning. Hence, the KaE team attributes a certain role to these horticulturalists: they drive innovations by implementing them, and thus can help engage their fellow, less progressive horticulturalists (the learners) to engage with the learning network by being an example. These less progressive horticulturalists are, by the KaE team, referred to as 'the following pack'. These horticulturalists form by far the largest group, and the KaE team wants to engage them as learners. This is because, many are willing to change their practice, but they often wary to make such big changes or are not (yet) capable of undergoing change. Hence, there is a disbalance between what they value and what they practice. Lastly, the remaining horticulturalists form 'the back of the pack'. These horticulturalists rather carry on their current practice than undergo any change.

Not only progressive fellow horticulturalists can help less progressive horticulturalists (i.e. the learners) to engage with the learning system, as argued before: all actors of a horticulturalist' network can support and enable them to change their horticultural practices for a sustainable future of the industry (see figure 4). This is either by way of (financial) support, services and products, but also, by way of collegiality. For example: if the greenhouse builder of horticulturalists X decides to apply sustainable innovations to his products, the horticulturalists can either choose to go with another suppliers (but, according to one the respondents, that is something rather uncommon in this field) or, the horticulturalists can adopt this new innovation and thereby contribute to a sustainable future of the greenhouse horticulture industry. However, in doing so, the actors of the horticulturalists should be actively participating in the learning network. And thus, as argued before, it is responsibility of the KaE team as a governing entity to not only engage horticulturalists as learners with the learning system, but also to engage actors surrounding the horticulturalists. This is further elaborated in §4.3.

When the KaE team has successfully engaged actors of a horticulturalists' network in the learning network, they become change-initiators that all have their own role in working towards a sustainable future of the industry. In the subsequent section, these roles are empirically described and, where possible, linked to the roles and/or competences proposed by Andringa & Weterings (2006;2008).

First, fellow horticulturalists as change-initiators, especially the front runners, fulfil the role of ambassador. By implementing new innovations stimulated by the KaE program, they can show horticulturalists that wary, how innovations turn out in practice, and with that reduce uncertainties. Hence, they show learners what might be. When looking at the roles that are proposed in §2.3.1, this corresponds with the innovator-role and competences cluster of reorientation, which is primarily about vision, inspiration and persuasiveness. Meaning that front running horticulturalists provide new ideas for learners how they can change their unsustainable practice by inspiring them with how they have changed their practice.

Then, the crop-cooperation's. As become clear in the above, crop-cooperation's are represented in the entrepreneurial group. Together, they decide what crop-specific knowledge needs to be developed for a more sustainable growing process. It may be clear that plant breeders are also closely involved in this process. When considering the roles and competences of CCT, there is not a one-on-one match with a cluster of competences that crop-cooperation's as change-initiators masters. However, it is evident that crop-cooperation's are closely related to change-initiators performing the role of the researcher.

Thirdly, it is needless to say that horticultural researchers fulfil the role of researcher (though, as argued above, in other learning systems this does not necessarily have to be this way). Researchers develop knowledge – with the input of the crop-cooperation's, via the entrepreneurial group – together with the BCO's to ensure that during scientific field trials the practical knowledge of horticulturalists and suppliers is taken into consideration, related both to technical aspects as well as cultivation.

Because due to the BCO's technical knowledge is considered during development of knowledge, there is a role for the suppliers to develop new technical installations based on research results to offer to horticulturalists. Of course, there is a variety of products. It is, after all, a commercial industry. The choices that horticulturalists make, often depend on the advice of advisors. The role of advisors is to help horticulturalists prevent errors and ideally to advise them to perform a more sustainable practice. This corresponds with the competences cluster of experimenting. Because by developing a new installation based on research results, suppliers experiment with the innovative solutions that appeared from the research. In doing so, consortia and alliances are formed. Sometimes, advisors are part of these consortia as they often are the link between demand (I.e. horticulturalists) and supply (I.e. suppliers).

Additionally, the Ministry of LNV plays a practical yet essential role in this process of supply and demand. For one, by awarding grants to contribute to the development of new and sustainable installation as well as to horticulturalist to make it more profitable to procure these new installations. And secondly, by adapting laws and regulation when necessary. Furthermore, Glastuinbouw Nederland also broadly supports horticulturalists by stimulating a responsible, financially sound future of the greenhouse horticulture industry and by providing good general terms and conditions for horticulturalists to contribute to that future. These facilitating roles correspond with the competences cluster of anchoring and upscaling. As these enabling roles help to ground the learning system and thus encourage experiential learning for sustainability transitions.

Combined, the Ministry of LNV and Glastuinbouw Nederland form KaE in its organizational form. The KaE team has the most important role in the learning network. They create the coherence in the network between all actors, by bringing them together in experiential learning techniques. Experiential learning techniques are, as argued in §2.2, all 'steps to take' and 'tasks to perform' by the change-initiators of the learning network in order to create and share knowledge for responsible futures. The KaE team is the lead organization of the learning network (Provan & Kenis, 2008) and thus fulfils an enabling role. This complies with the competences cluster of transition management. The KaE team must retain the overview of the entire learning system and be reflexive: on the coherence between all change-initiators, on the governance of experiential learning techniques and on the engagement of learners. Hence, the systematics of experiential learning depends on the performance of the KaE team.

Similar to horticulturalists, before some of these change-initiators are engaged with the learning network, these change-initiators too are to a greater or lesser extent progressive and future-oriented. For example advisors: though the KaE team would like to see advisors being part of the learning network as ambassadors for new sustainable innovations, the experience is often different. As the role of advisors is to prevent horticulturalists from making mistakes. Hence, they tend to be risk-adverse rather than pushing new innovative solutions. For systematizing experiential learning this means that actors as advisors and suppliers first need to become engaged as learners too, before being able to support horticulturalists in changing their unsustainable practices. However, when they have adapted their practices, they become (similar to progressive fellow horticulturalists) ambassador and hence perform an innovator-role.

4.1.3 What can be learned from the learning network of KaE to systematize experiential learning?

When looking at the learning network of KaE there are a few conclusions to be drawn, that create a better understanding of how a learning network can be shaped to systematize experiential learning. First and foremost, there must be a shared objective for learning amongst the learning network – a sustainable future for the greenhouse horticulture industry, and more specifically climate neutral by 2050. For systematizing experiential learning, a learning network should have a lead organization to work towards this common goal. With a governing entity in the learning network, there is one actor who has the responsibility of leading the learning network as well as systematizing the experiential learning process. By being reflexive with regard to both the learning network and the design and process of experiential learning, the governing entity of the learning network can effectively structure – and when needed restructure – the approach of experiential learning – i.e. systematize experiential learning. Additionally, what the KaE case teaches us is that the governing entity takes up the task to broaden the learning network by including change-initiators that can influence the practice/behavior of learners. This includes being on the lookout for learners that already are a few steps ahead, like the progressive horticulturalists in the case of KaE. Furthermore, for each change-initiator involved in the learning network, there is a role in the process of experiential learning. To optimize the functioning of a learning network, the governing entity should address the strengths of the change-initiators and use that to make the learning network an example where other actors and learners want to be a part of. Stimulate the production of knowledge, but know what knowledge is needed: listen to what learners want to learn . After all, *'they know best where the shoe pinches'*. Share this knowledge with the supplying industry and advisors, to bridge between knowledge and practice. Encourage progressive learners to implement this new knowledge and let them be an example for the other learners.

4.2 The experiential learning techniques of Kas als Energiebron

In this paragraph, the experiential learning techniques that the learning system of KaE organizes are inquired. By exploring the 'steps taken' and 'tasks performed' by the KaE learning network in order to create and share a deeper level of knowledge for a responsible future of the greenhouse horticulture industry, this research tried to get a better understanding by way of what techniques the process of learning from experience through reflection is created. Conclusively it has been made explicit how these experiential learning techniques systematize the experiential learning process. Before continuing, it is important to note that during the analysis it appeared that there is a distinction to be made between foundational experiential learning techniques, which focus on the creation of knowledge – and actual experiential learning techniques, that are focused on sharing that knowledge by inducing learning from experience through reflection. Though, it has been decided to stick to the term of experiential learning techniques for the creation of knowledge, as it appeared that the process of knowledge creation as such, is experiential as well: during knowledge development researchers (and BCO's) experience interim results, reflect upon that, to adjust accordingly and continue the research, i.e. learning from experience through reflection.

4.2.1 Foundational experiential learning techniques: creating knowledge

During the analysis it appeared that there are two foundational experiential learning techniques preparatory to other experiential learning techniques. That is, in order to facilitate and organize experiential learning techniques concerning knowledge sharing, there first need to be knowledge development. This knowledge development, needs to be financed. A first foundational experiential learning technique observed in the KaE case thus are financial arrangements between the Ministry of LNV and the greenhouse horticulture industry to finance the activities of the KaE program. A first arrangement is a unique, yet somewhat delicate 50/50 arrangement, meaning that every investment made by the greenhouse horticulture industry – whether by private research and development or fee incomes through Glastuinbouw Nederland – is doubled by the Ministry of LNV. This financial instrument to run the KaE program thus is delicate, because the budget depends on what the greenhouse horticulture as a whole is willing/able to invest. Though this delicate arrangement might limit the activities of the KaE program to work toward a responsible future of the industry due to a tight budget, the is another financial agreement to stimulate that responsible future. To wit, the Ministry of LNV boosts the implementation of new sustainable innovations, by granting 10 to 12 million euros in subsidies per year. In the discourse of the KaE team, this 50/50 arrangement is intended for "research for sustainable developments and information provision for the greenhouse horticulture industry". Hence, the experiential learning techniques that are observed in the case of KaE can be divided in the two categories of developing knowledge, and sharing knowledge. However, the development of knowledge in the case of KaE is perceived as a foundational experiential learning technique, because based on new knowledge and insights that derive from such knowledge development, the KaE team facilitates and organizes all kinds of activities to share this knowledge, i.e. information provision.

With all research commissioned by the KaE team, there is close collaboration between research institutes, horticultural entrepreneurs and the supplying industry by means of BCO's, and the entrepreneurial group. In order to link science with practice, they deliver input for knowledge development, as well as they supervise during knowledge development. This experiential learning technique thus addresses a variety of actors which allows for reflection on (the content of) and reflexive research process (Wals, 2007, see §2.3.2). Additionally, by letting this diversity of actors participate in this foundational experiential learning technique, it becomes more likely that

horticulturalists are going act upon what they have learned (Tilbury & Wortman, see §2.3.3). Secondly, the research commissioned by the KaE team knows a wide variety, from crop-specific knowledge to researching the possibilities for sustainable lighting. However, what makes the research of the KaE program so unique, is that beside niche-studies, KaE also inquires greenhouses as overall research project, as a system so to speak. Considering that horticulturalists benefit more from knowledge on a sustainable greenhouse as a whole, then they benefit from niche results not knowing what the effect of a new type of light has on other aspects of the greenhouse. Hence, the KaE team engages learners with experiential learning techniques, by letting them participate in the decision making of what knowledge is developed (and desired) for horticulturalists to change their unsustainable horticultural practice. What appeared, is that a system approach to engage (potential) learners, follows from the approach of letting learners (that are already engaged with the learning system) participate in the decision making of what knowledge is desired (Tilbury & Wortman, 2004).

4.2.2 Actual experiential learning techniques: sharing knowledge

The activities KaE facilitates and organizes in order to share knowledge that derived from research, are considered the actual experiential learning techniques because these activities induce learning from experience through reflection. In the case of KaE, two types of actual experiential learning techniques can be observed: activities to experience new knowledge, and activities that reflect on this knowledge.

The KaE team organizes activities to experience new knowledge derived from research. Primarily activities such as demonstration projects, practical experiments and fieldtrips. Such activities allow for learners to be confronted with other, sustainable greenhouse horticultural practices that run counter to how horticulturalists perform their practices. In the case of KaE, these activities take place at the IDC (the innovation- and demonstration center of Wageningen University & Research), the research facilities of Delphy (a commercial research institute that conducts research commissioned by the KaE team) and at the businesses of progressive horticulturalist. Under the guise of 'seeing is believing', such activities are effective ways of showing learners what might be (Schön, 1973, see § 2.2), and according to Tilbury & Wortman (2004), it helps learners discover their own preferred future.

The IDC serves both to knowledge development as well as experiencing that knowledge. At this facility, there are small test-greenhouses which allows researchers to experiment with extremes, without major consequences. If it turns out that the results of a research are promising, the research can be applied on a larger scale, for instance at the company of a progressive horticulturalist, as a practical experiment. Progressive horticulturalists are subsequently encouraged to invite fellow, less progressive, horticulturalists to come visit and see how they have changed their unsustainable practices. Such field trips to practical experiments are often facilitated by the KaE team, as one of this research' respondents noted: *"[…] back then, there was an entire communication plan and a program for guided tours. What that showed, was that entrepreneurs were facilitated to open up their businesses to show others what they do. Because, reaching the mass is primarily showing them the potential of their own businesses".* This accurately describes how progressive horticulturalists are able to influence less progressive horticulturalists, conforming the role attributed by the KaE team to progressive horticulturalists.

These photos were taken during a visit at the IDC for an interview with a researcher from WUR.

"For a responsible future of the greenhouse horticultural industry, innovate projects are necessary. By way of applying and implementing knowledge, a substantial increase in productivity as well as the quality of products is achieved. The primary cause here, is that these effects are not limited to a small group of entrepreneurs, but that the entire industry benefits. The IDC as physical location, close to the greenhouse horticulture area, serves as catalyst where entrepreneurs, together with research and education, work together on the implementation of knowledge. – WUR, (n.d.)

Next to these activities that are centered around experience, the KaE team organizes activities that are concerned with providing information and reflection. Contrarily to what might be expected from experiential learning techniques, these activities are more cognitively designed. For instance, KaE organizes information sessions – for example, so called "canteen meetings" and a comparable "roadshow". During such events, members of the KaE team visit horticultural areas to engage with a variety of horticulturalists and other horticultural entrepreneurs in a discussion about the future of the industry. One of these meetings has been attended by the inquirer to create a deeper understanding of how experiential learning techniques are epitomized. During such cognitive learning activities, a member of the KaE team leads the event, shares recent research results and translates that to what that means for practicing horticulturalists. Additionally, during such information sessions there is plenty of room for debate, asking questions and sharing thoughts – i.e. reflection.

Furthermore, two other activities that were being observed addressed both the aspect of experience as well as the aspect of reflection. First, there is an annual event, called EnergiekEvent, where all horticultural entrepreneurs are invited to come and experience the latest innovations by means of attending workshops and visiting field experiments. Additionally, there are plenary discussions and during the day there is room for conversation amongst visitors to reflect upon these new innovations. However, contrarily to this yearly event, the KaE team also explicitly induces a continuing learning process that addresses both experience and reflection by means of a course. At this course, about ten horticultural entrepreneurs gather eight times to learn about new cultivation techniques. During this course, the students of the course are (cognitively) taught about the theory behind new methods. Web tools were used to practice online with these new theories and by means of specially developed course material (a manual, *The Basic Principles of HNT* by Geelen, Voogt en Van Weel, 2015), information was provided on new theories and methodologies for a more sustainable greenhouse horticulture practice. However, in line of thought of Wildemeersch (2007), learning is experiential because people learn from

doing. And thus, after the theoretical part of the course, the students need to implement what they have learned in their own practice to subsequently continue the course on location, by visiting each other's company to experience the practice of this new knowledge and to discuss this. Additionally, the KaE team also offers a more in-depth follow-up course for horticultural entrepreneurs who want to learn more.

4.2.3 What can be learned from experiential learning techniques of KaE to systematize experiential learning?

In conclusion, there are two primary insight that appeared from this analysis that say something about the systematics of experiential learning. First, the different types of experiential learning techniques. There are two techniques to be noted: foundational experiential learning techniques that focus on (the enabling of) knowledge development, and there are actual experiential learning techniques that are focused on sharing that knowledge. With respect to these types of experiential learning techniques is another distinction is observed: techniques that address the process of experience, and techniques that address the process of reflection. Additionally, there are techniques that combine both processes of experience and reflection. Together, these three types of experiential learning techniques constitute the process of *learning from experience through reflection*. In the case of KaE, all these types of techniques convey the common goal for a sustainable future of the industry and offer a framework for action to get there, but not all techniques are equally confrontational regarding one's governing principles. For instance, visiting a new innovative type of greenhouse at the IDC is presumably less confronting than during a moment of reflection discussing what such innovations would imply for a horticulturalists' business (after all, we need others to help us review our governing principles, relative to the counter-intuitive information we absorb during an experience (Loeber et al., 2007)). In relation to Wals' (2007) notion that during such learning processes there must be room for different levels of discord to trigger learning at the individual level as well as at a collective level (see §2.3.2), it is argued that experiential learning techniques that focus on experience, for instance a demonstration project addresses learning at the individual level, and that experiential learning techniques focusing on reflection are more concerned with learning on a collective level. Additionally, though these techniques are highly intertwined, they exist independently. This means that it is up to the learner to decide with which experiential learning technique to engage, and in which order. Hence, a first conclusion to be drawn with regard to the underlying systematics of experiential learning, is that experiential learning is to be epitomized by offering these different type of experiential learning techniques.

Additionally, another conclusion to be drawn regarding the systematics of experiential learning is that, in order to systematize approach experiential learning, the learning network does not necessarily (contrarily to what Kolb (1984) and Wals (2007) suggest) need to follow a sequence of stages. As appeared from this case, systematic experiential learning consists of different experiential learning techniques – that together can constitute an experiential learning process. Hence, these techniques do not necessarily follow-up on each other. Rather, this research argues that these techniques complement each other and therefore an experiential learning process is nonlinear. However, the different types of experiential learning techniques that embody the experiential learning process, do have similarities with the sequential stages as proposed by Kolb (1984) and Wals (2007) – see figure 1 (p. 8) and table 2 (p. 20) respectively. The stage of concrete experience in Kolb's learning cycle and the

stage of exposure to conflicting frames as proposed by Wals, for instance, strongly correspond with the experiential learning techniques aimed at experience e.g. demonstration projects. Additionally, experiential learning techniques aimed at reflection, e.g. information sessions, can cover both Kolb's stages of reflection and abstract conceptualization as well as the joint (re)construction of ideas according to Wals. And, as a final example, the stage of experimenting, both proposed by Kolb and Wals, are covered by the experiential learning technique aimed at both experience and reflection – for instance with the KaE course, in which learners are to experiment with newly acquired knowledge in practice. In figure 7 is attempted to illustrate the underlying systematics of experiential learning techniques. The different types of techniques are inherently linked because together they constitute an experiential learning process, but no direct connections are drawn because it is a nonlinear process, and thus the learning network can organize the learning process by moving back and forth between the types of experiential learning techniques.

Figure 7: the underlying systematic of experiential learning techniques. Source: own data
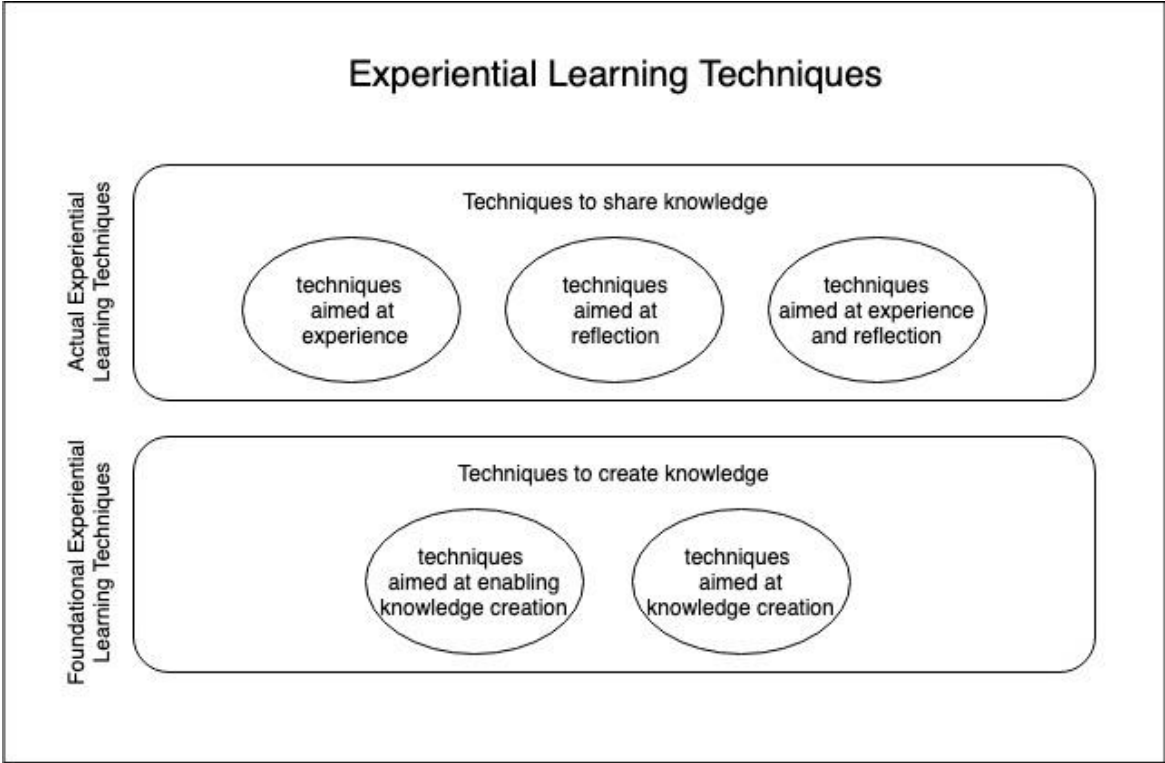
4.3 The engagement of learners in the case of Kas als Energiebron

Previously, it is argued that to systematize experiential learning a learning network needs to be shaped according to the lead organization-governed network structure (Provan & Kenis, 2008). Subsequently, this learning network performs different types of experiential learning techniques in order to systematically organize (nonlinear) experiential learning processes. However, as argued in §2.2, in order for a experiential learning to successfully foster sustainability transitions, the people who need to change their unsustainable practices must be engaged as learners of the learning system. Then, they can engage with a deeper level of knowledge, helping them to (re)construct their governing principles to subsequently change their unsustainable practices. In this paragraph, it is inquired how the learning network of KaE engages its learners with the learning system.

The engagement of horticulturalists (and, the less progressive actors of a horticulturalists' network) is a difficult task. According to the respondents of this research, this is due to barriers as the risk that changing their horticultural practices brings, as well as competition amongst horticultural businesses. Many horticulturalists wary to make such big changes, as they don't know how new innovations will turn out in practice. After all, horticulturalists often are entrepreneurs too, and carry the responsibilities for their employees and businesses, and thus tend to avoid major risks. As one of this research' respondents noted: *"First of all, we are entrepreneurs. We are responsible for our employees, but we also bear responsibility towards our suppliers. Of course, we can invest in all kinds of sustainability innovations, but what if they turn out wrong? We can't afford that..".* Additionally, the fact that many are entrepreneurs means that competitiveness can be a barrier to attend information sessions, as during such sessions knowledge and information is shared: *"What we see, is that horticulturalists of larger businesses do not attend the course, to start with because they are with too many, but secondly, they feel like by attending the course they're teaching other monkeys how to climb, that's the last thing they want to do".*

Such risk-aversion and competitiveness also applies to, for instance, advisors. Though the KaE team wishes to see advisors as ambassador for a more sustainable future of the industry, the role of an advisor is to prevent horticulturalists from making mistakes – and thus they are rather cautious with recommending new and innovative practices. Hence, the KaE team should not only engage horticulturalists as learners, but also engage the (less progressive) actors surrounding horticulturalists.

Additionally, as argued in §4.1, the KaE team as governing entity of the learning network expanded the learning network with change-initiators that can influence the practice/behavior or learners, to help engage learners. Considering the theoretical perspectives of §2.3, it is argued that the KaE team thus did engage learners by both a more direct (top-down) approach as well as by way of grassroots movements as proposed by Brulle & Jenkins (2006).

4.3.1 Engaging learners: a direct approach

The KaE team puts in a lot of effort to overcome the barriers of horticulturalists to engage with the learning system. The direct approach is a very straightforward: it is the direct recruitment of horticulturalists to take part in experiential learning techniques, like partaking in the course. This recruitment happens through network coordinators of Glastuinbouw Nederland, as one of the respondents noted: *"It really is hard work to recruit all horticulturalists to attend our course and information sessions. We're constantly calling, until we have enough participants".* This approach is likewise applied for (less progressive) actors surrounding horticulturalists, like advisors. What is crucial in this way of engaging learners, is the human factor and social dialogue. It appeared to be very important that the KaE team really knows the horticulturalists, that they know what is important for them and what makes them wary. But, most importantly: that the KaE team knows how to deal with that to engage horticulturalists anyways. As proposed by Brulle & Jenkins (2006), having a genuine

dialogue creates a better understanding of both the self- and public interest of engaging with the learning system. However, creating such dialogues requires practice. One of the respondents noted, that over time he had become trained to deal with horticulturalists who come up with all kinds of reasons not to participate in the KaE program, and that the KaE team learned how to communicate with horticulturalists. Not necessarily to refute the reasons why horticulturalists would not participate, rather, by emphasizing why horticulturalists should participate. This appeared from the shifted focus of communication over the years.

At the time, the KaE program started as a radical trend deviation: from the greenhouse horticulture as major energy consumer, to the greenhouse horticulture as (sustainable) energy producer. The focus of communication thus started from the point that by means of energy savings and sustainable energy sources, the industry would become more sustainable. At first this seemed effective, after all, energy has always been an important topic for horticulturalists as it concerns a considerable part of the monthly costs. However, it became apparent that whenever the energy prices are relatively low, horticulturalists do not prioritize saving energy. They are entrepreneurs, and so they rather focus on optimizing the production process, as that yields more revenue. Hence, in order for the KaE team to engage horticulturalists with the program, they need to focus their communication on that what horticulturalists value, and not on forcing the shared objective – climate neutral by 2050. The program manager of the KaE team from Glastuinbouw Nederland explains how he deals with this matter:

"A part of the motivation is the climate problem, I call that the eco-argument. However, besides the eco-arguments, there are the ego- and emo-arguments, which are also very important – if not even more important than the eco-arguments. Hence, whenever we approach horticulturalists, we motivate them – of course – by addressing that energy is a major part of the total costs. However, we also emphasize that it is becoming increasingly important in the market: consumers attach ever more value to how products are being produced. And last but certainly not least, our industry still is dependent on fossil fuels. For now still from the Netherlands, but perhaps in the (near) future from Russia. Thus, emphasizing those ego- and emo-arguments is just as important as stressing the eco-arguments. Slogans as 'fossil free, the sooner the better' only causes trouble and resistance. Of course, we use the eco-argument, but relative – and in relation to other arguments. So we try to engage them by telling them "don't get carried away, but do start orienting, as it is not a matter of whether you need to change, but when you need to change – be ready when that time comes".

Furthermore, the program manager of the KaE team from the Ministry of LNV also agrees that using terms like 'getting rid of fossil fuels' works counterproductive*: "Yes, we emphasize that our ambition is to be climate neutral by 2050 – but our primary message for now is, acquaint yourself with new innovations and think about what that means for your (future) horticultural practices..".*
Hence, the focus of communication to engage horticulturalists with the learning system is no longer mere energy saving and sustainable energy sources, but becoming familiar with new innovations and technologies, providing a framework for action and to think about what that means for the future of their businesses.

What can be concluded from this, is that the KaE team and the learning network are considerate about the learner's governing principles and comfort zones. Forcing on a consensus how horticulturalists should perform their practice works counterproductive. Rather, engage learners starting from the values they consider to be important and subsequently alter their governing principles step by step (Wals, 2007).

Besides communicating this way to directly recruit horticulturalists to engage with experiential learning techniques, the KaE team also uses traditional channels, such as their website, newsletters and items in journals to reach out to horticulturalists. Though traditional channels, a unique feature is

that they are all used to publicly share new research results. All results of the studies commissioned by the KaE team are *open access.* For one, because the researches are (partly) publicly funded, through the 50/50 arrangement between the greenhouse horticulture industry and the Ministry of LNV. And secondly, because the KaE team wants horticulturalists to use that knowledge to change their unsustainable practices. Thus, in addition to the experiential learning techniques aimed at providing knowledge and reflection, learners are also engaged with the learning system by providing all new acquired knowledge through online communication channels.

4.3.2 Engaging learners: a grassroots movement approach

In addition to the KaE team recruiting horticulturalists, the learning network also functions as a grassroots movement, where the learning network uses collective actions from the horticulturalists' network to help engaging horticulturalists with experiential learning. For instance, through the mechanism where crop cooperations are closely involved with the entrepreneurial group. This way, horticulturalists are already indirectly involved with the learning system. After all, they have a say in what knowledge is to be developed by means of research, through the board members that are represented in the entrepreneurial group. The knowledge that results from these researches then again are distributed through that mechanism. Such knowledge distribution also takes place through other actors from both the learning network and the horticulturalists' network, like BCO's and fellow horticulturalists. One of the respondents noted, that because BCO's are jointly responsible for the research results, horticultural entrepreneurs that are part of such BCO's are passionate about their newly acquired knowledge and thus tend to share and communicate this with their fellow horticulturalists. Hence, the KaE team engages learners by way of letting them participate in the process of knowledge development and knowledge sharing. When considering the theoretical framework of this research, this complies with what Tilbury & Wortman (2004) say about how participation can help to engage learners: "*through participation, learners build skills to take control of both the decision-making process and responsibilities for its outcomes. This greater control leads to greater motivation to participate in action".* For systematizing experiential learning, this means that the organization and facilitation of experiential learning techniques should allow for the participation of learners (both horticulturalist and other actors), as is the case with the foundational experiential learning technique aimed at knowledge creation. With this research technique, learners are participating by means of providing input for research and subsequently supervising this research through BCO's. As a result of their participation, learners are thus more likely to also implement that new knowledge which they contributed to.

However, the engagement of horticulturalists with the learning system only is effective when the horticulturalists have a future in this industry. For instance, in §4.1 it was mentioned that the KaE team considers three types of horticulturalists: the front runners, the pack, and the back of the pack. The back of the pack often do not have the need to change their unsustainable practice. This is because, for instance, these horticulturalists are nearing their retirement, and have no successor to take over the company. If these horticulturalists prefer to continue on the same foot for a few more years, they can. The learning network thus invests little in this type of horticulturalists. On the other hand, the learning network invests all the more in the new generation horticulturalists.

The engagement of horticulturalists with the learning network, also happens through the next generation of horticulturalists. Learning to practice sustainable horticulture from the start, is easier

than relearning in order to later change unsustainable horticultural practices. And thus, the learning network of KaE strongly encouraged the integration of new, sustainable ways of cultivation in the current curricula of agriculture education[9]. On the short term, this will not yet pay off – but that will change as soon as the next generation of horticulturalists takes over. However, there is one option that can help engaging current horticulturalists with the learning system through the next generation horticulturalists. Which is by way of practical assignments and (graduation) internships. As one this research' respondents noted: *"When you send students with knowledge on this new and sustainable method into the field, for may it be internships or practical assignments, these students can induce cross-pollination […] especially for horticulturalists that not yet participated in the course, or horticulturalists who do not yet sufficiently practice this new way of sustainable cultivation, students can give them a little push. As well as that when the students graduate and become employed at a horticultural business, they might think of current horticultural practices as outdated, and are willing to change that."*

4.3.3 What can be learned from how the KaE learning network engages its learners?

Based on this analysis, it is observed that in order to engage learners in systematic experiential learning, the governing entity of the learning network uses a direct approach to reach out to (potential) learners to engage them with experiential learning techniques, as well as that they organize grassroots movement for the engagement of learners. Whether or not learners become engaged, strongly depends on the efforts of the governing entity as well as the focus of communication that change-initiators use regarding (potential) learners. What can be learned from how the KaE learning network engages its learners, is that it is important to address values that learners find important and to offer a framework for action, rather than trying to engage learners by forcing consensus to engage because the industry must become climate neutral. This however, requires that the change-initiators know what learners value, and whether or not they are willing to engage with the learning system. And moreover, that change-initiators know how to handle such situations, to assure that learners who experience barriers still become engaged.

Regarding the engagement of learners by way of grassroots movements, it is observed that engaging actors (that can influence the practice) as change-initiators, creates collective action on the local level, that can effect change in the way how learners act (Yenerall, 2017). For example, progressive fellow horticulturalists that inspire less progressive horticulturalists by showing them the potential of their horticultural business. Hence, for a learning system to ultimately achieve sustainability transitions, it is important that a governing entity identifies who these actors are, and to engage them with the learning network. For one, to let them participate in experiential learning processes, for instance knowledge development (BCO's) or demonstration projects (progressive horticulturalists), but also to also engage them as learners when necessary (as, for example, is the case with advisors). Using grassroots movement to engage learners, thus helps to expand the learning network with new change-initiators, who subsequently all fulfil a role in systematic experiential learning.

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9 This did not go without struggle. After four years of following institutional paths, without success, a detour was taken: agricultural educators were approached directly and guest lectures were given. The educators turned out to be very enthusiastic and wanted to include it in their program. Soon, there was a call for agricultural education and the Ministry of LNV granted 1,5 million euros to develop a new course program concerning this new way of cultivation: *"[…] a creative way, where the institutional paths are circumvented to ensure that current agricultural educators teach the new generation a sustainable way of cultivation"* -

5. Conclusion

In this chapter, the research findings are brought together to serve as input for the framework this research sought to provide, for change-initiators to help them systematize experiential learning aimed at sustainability transitions.

In view of the fact that the world faces many dreadful sustainability challenges, people need to structurally reform their unsustainable practices and behavior. However, achieving such major sustainability transitions is a social challenge because it requires that people break with their unsustainable ways of living, that are deeply rooted in their way of thinking. This means that, even though people might learn about how they should their lives for a sustainable future, they do not necessarily act upon it as long they don't change the way they think. To change those governing principles, people should learn to experience how a more sustainable way of living feels, to gain a deeper level of knowledge. To acquire this level of knowledge, people need to learn from experience through reflection (Argyris & Schön, 1974).

Though in academics it is widely acknowledged why such experiential learning is important to foster sustainability transitions (Loeber et al., 2007; Wildemeersch, 2007), little attention has been paid to how experiential learning can be systematized. That is, what structural approach [change-initiators] can apply to create an experiential learning process in which people can engage, to alter their governing principle and ultimately change their unsustainable ways of living. This research argued that a first step to systematize experiential learning, is to embed it in a learning system. A learning system is proposed by Bawden (1995) as *"an organized and coherent group of people that purposefully collaborate together to achieve high quality transformations [...] as they design and create new and responsible futures together".* Meaning that, when experiential learning is embedded in a learning system, a coherent group of change-initiators work together to facilitate and organize experiential learning processes, to ultimately achieve sustainability transitions.

5.1 Research findings

By way of both theoretical and empirical inquiry it has been researched under what conditions a learning system allows for systematic experiential learning. Based on academic literature (Schön, 1973; Bawden, 1995; Blackmore, 2010), it is argued that there are three conditions that together constitute a learning system for experiential learning: a learning network, experiential learning techniques, and the engagement of learners. Subsequently, it has been inquired how these three conditions need to be organized in order to systematize experiential learning.

In order to systematize experiential learning for sustainability transitions, there must be a shared objective for learning amongst the learning network. All change-initiators that are part of this network, should be willing to work towards this sustainability goal. Secondly, a learning network should have a governing entity that takes the responsibility to lead the learning network towards this goal, by being reflexive with regard to both the learning network as such and how it operates. With this is implied that the governing entity of a learning network should have an holistic view of the learning system, meaning that they see when to make adjustments in the learning system, with regard to the learning network, the experiential learning techniques and the engagement of learners. Additionally, the governing entity should broaden the learning network by including change-initiators that have an

influence on the practice and behavior of learners as, by addressing their strengths, they can contribute to both experiential learning techniques, as well as the engagement of learners. Conclusively, a governing entity allows for systematic experiential learning, as it determines on how (re)structure the approach on how to facilitate learning from experience through reflection.

Furthermore, the experiential learning techniques that are identified in this research can be divided in two primary categories: foundational experiential learning techniques and actual experiential learning techniques. The foundational techniques address the (enabling of) knowledge creation, whereas the actual experiential learning techniques are focused on sharing this knowledge. The latter category can again be divided in two sub-categories: techniques that address the process of experience, and techniques that address the process of reflection. In addition, as appeared from this research, there are also techniques that combine both the process of reflection and the process of experience. What can be concluded here, is that these types of experiential learning techniques together constitute the process of learning from experience through reflection. What is important here, is that these different types of techniques should address different levels of confrontation to trigger learning at the individual level as well as at a collective level (Wals, 2007). Moreover, what appeared from the empirical inquiry is that these different experiential learning techniques are highly intertwined because they all convey the same shared objective and together provide room for experience and reflection, yet they exist independently. Hence, it is the learners decision in what order he or she attends experiential learning techniques. Conclusively, to systematically organize experiential learning, experiential learning techniques thus do not necessarily have to follow sequential stages (as suggested by Kolb, 1984 and Wals, 2007). Rather, experiential learning techniques should complement each other. Hence, systematic learning from experience through reflection does not need to be a linear process. Systematically organize experiential learning, thus happens by offering these different techniques, allowing learners to move back and forth between levels of confrontation until his governing principles are altered.

Lastly, this research showed that there are two approaches the learning network can apply to engage learners with experiential learning. First, the governing entity of the learning network can use a direct approach to reach out to (potential) learners to engage them with experiential learning techniques, e.g. recruiting learners to attend courses, demonstration projects, discussions etc. With this approach, it turned out imperative that a governing entity learns how to communicate with – and to learners. It is important that with a direct approach, the governing entity considers the values of learners and anticipate on that to, slowly but surely, alter their governing principles. The engagement of learners is about emphasizing what's in it for them and by offering a framework of action, rather than to force on consensus on the shared objective of the learning network. Secondly, a learning network can engage learners by way of grassroots movements. In essence, this grassroots movement starts from the moment that the governing entity involves actors from a learners' network to with the learning network. Think, for example, about the greenhouse builder of horticulturalists X, who innovates his products and thus ultimately influences the practice of that horticulturalist. Hence, by this way, collective action at a local level can influence the way in which a learner performs a practice.
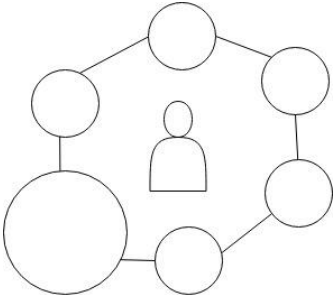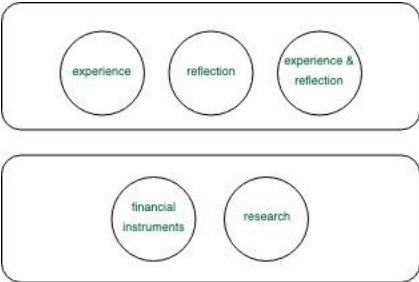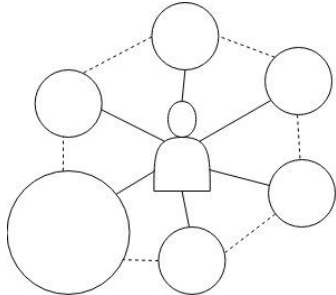
Altogether, it is hard work to constitute a learning system aimed at sustainability transitions, to systematize experiential learning. The process of learning from experience through reflection is not something that comes naturally. Instead, it requires hard work, active organization and perseverance

from change-initiators to collaboratively work towards responsible futures. To help change-initiators get started, the following paragraphs offers a concise framework, based on the insights derived from this research.

5.2 Systematizing experiential learning: a framework for change-initiators

Before continuing, there is one final notion to make. This framework is based on one operating learning system that is empirically inquired. The insights that derived from this research are, where possible, supported with theoretical perspectives. Notwithstanding, this framework serves as inspiration for change-initiators to get started with experiential learning for sustainability transitions, but is by no means a set-in-stone method to constitute a learning system to systematically organize experiential learning. Based on the research findings, there are two lessons for each condition of the learning system. The framework was built on these lessons.

Figure 8: A framework for change-initiators. Source: own data

The Learning network
1) Expand the learning network with change-initiators from the learners' network, and create a shared objective for learning.
2) Appoint a governing entity, who has a holistic view of the learning system

Experiential Learning Techniques
3) Facilitate diverse types of experiential learning techniques. Address both knowledge creation and knowledge sharing by way experience and reflection to offer different levels of confrontation
4) Experiential learning does not have to be a linear process. Prefer complementary experiential learning techniques over sequential experiential learning techniques.

Engagement of Learners
5) In a direct approach, be considerate of your learners' governing principles. Emphasize what's in it form them if they engage in the learning system rather than to force on the shared objective of learning.
6) Use grassroots movements to create collective local action by way of participation, to influence how the learner performs a practice.

6. Discussion

This final chapter looks back on this research and provides room for reflection. Both the research outcomes as well as the research process are considered.

This study has concluded that in order to systematize experiential learning, it needs to be embedded in a learning system consisting of three conditions: a learning network, experiential learning techniques and the engagement of learners. Subsequently it has been, both theoretically and empirically, inquired how these conditions need to be organized to allow for systematic experiential learning. Below, the findings of the empirical inquiry will be reflected upon, relative to the theoretical perspectives given in chapter two.

Additionally, the inquirer will reflect upon the research process as such. More specifically, reflecting on the methodological approach as well as on being reflexive on the performance as researcher.

6.1 Reflection on the research outcomes

First, with regard to learning networks, it was assumed that different network structures influence the dynamics of a network, and with that, the extent to which there are responsibilities, how knowledge is shared and which change-initiator performs what role. Provan & Kenis (2008) argued that there are three different network structures that, indeed, influence the relations amongst the actors of such a network. In a self-governed network for instance, actors are on a par when it comes to, for example, responsibility to share knowledge or organize network activities. As there is no specific actor to take the lead, it is less likely that a network with that structure, systematically works towards a common goal - contrarily to the other two structures which do have actors with explicit responsibilities. After learning about these different structures, it was argued that – for systematic experiential learning – a lead organization-governed network structure seemed the most suitable. This is because there would be one actor who acts as coordinator of the network activities, such as connecting information and resources, as well as organizing activities (and thus can structurally approach the learning process), but this actor is also closely involved with achieving the shared objective, making the learning network a more coherent group (Provan & Kenis, 2008; Bawden, 1995). From the empirical inquiry, it indeed appeared to be a lead organization-governed network structure that embodies the KaE learning network. The KaE team functions as governing entity to facilitate all kinds of experiential learning techniques, in order to achieve the shared objective. However, additional to such coordinating and facilitating activities, another important role for a governing entity appeared to be expanding the network with change-initiators, but this is not incorporated in the theory of Provan & Kenis (2008).

In addition, the CCT framework on transition roles and competences (Andringa & Weterings, 2006;2008) was consulted to get a better understanding of how a learning network - regardless it's structure – should function. Though offering a valuable insight in how change-initiators in a learning network should be skilled to bring about sustainability transitions, in this research not all empirically observed roles were explicit in the framework of CCT, suggesting that roles and competences in practice go beyond the framework of CCT. To get a better understanding of how transition competences need to be performed and, vice versa, to how these skills and performances link to transition competences, it is argued that the practical implications need further investigation to get a

better understanding of how a network should function. Unfortunately, the time scope of this research did not allow this further investigation.

Secondly, with respect to experiential learning techniques, the research outcomes showed that the process of learning from experience through reflection is constituted by complementary experiential learning techniques. This is in contrast to, what both Kolb (1984) and Wals (2007) suggest, that experiential learning is follows sequential stages. As appeared from the theoretical inquiry, the social setting in which learning takes place can influence the (experiential) learning process of learners (Loeber et al., 2007). Therefore, organizing experiential learning is not forcing on a sequence of experiential learning techniques, rather, to facilitate experiential learning, offer complementary experiential learning techniques so learners themselves can engage in their own experiential learning process, moving back and forth as they wish.

Third and lastly, it was argued, based on the theoretical perspectives, that the literature lacks two imperative aspects with respect to the engagement of learners. First, Tilbury & Wortman (2004) proposed approaches that focuses more on keeping learners engaged, rather than getting them engaged. This research showed that to get learners engaged, an active and direct approach is needed in which change-initiators actively seek contact with potential learners, and try to persuade them to join in experiential learning, by emphasizing what's in it for them. This requires that change-initiators communicate with learners on a personal level. Additionally, Brulle & Jenkins (2006) did elaborate on how to engage potential learners: by way of creating genuine dialogue and grassroots movements (this corresponds with the research findings of a direct approach and engaging actors from the learners' network that are able to influence their practice/behavior) but did not propose practical implications for doing so. As this research identified both aspects, a more comprehensive understanding of how learners should be engaged is given.

Altogether, the theoretical perspective served well as a starting point to inquire learning systems in practice. And, however many empirical observations were supported by the consulted literature, this was a first attempt to grasp the practice of learning systems for sustainability transitions to systematize experiential learning. Hence, to fortify this knowledge and to enhance the framework for change-initiators, further inquiry of learning systems is necessary.

6.2 Reflection on the research as a process

To wrap up this research, a personal note to reflect on the research process.

The writing of this thesis consisted of a theoretical inquiry to familiarize myself with the concept and conditions of learning systems. It helped me to build a foundation for the empirical inquiry. However, this does not mean that the empirical inquiry followed from the theoretical inquiry. Rather, these phases ran parallel and complemented each other along the process.

As qualitative case-study methodology is a research method I feel comfortable with, going for this approach was more a hunch than it was a choice. Notwithstanding, qualitative case-study methodology turned out to be an eligible approach to inquire how learning systems operate in practice and how that allows for systematic experiential learning. By way of this method, I was able to encounter and all three conditions of the learning system. I spoke with change-initiators of both the learning network as well as the governing entity. I experienced how reflection and experience are encouraged during experiential learning techniques, as well as that I learned about both sides of the story of engagement – the efforts of the learning network, as well as how learners experience resistance. However, for the latter it would have been valuable if I could have spoken with more less progressive horticulturalists to hear their story. Now, I only spoke with the chairman of the entrepreneurial group and with the actors that actively work on the engagement of horticulturalists. Despite that, I consider the data that was collected rich and sufficient to inductively build a framework. However, as argued right above, this research was a first attempt to grasp the practice of learning systems. Thus the framework that was developed cannot be seen as a set-in-stone method to constitute learning systems. What would have made the findings of this research, and thus the framework, more legitimate, was to conduct a comparative case-study, in which I would inquire two or more learning systems in practice. The reason why I choose not to, was simply due to an expected lack of time to conduct two or more case-studies. For writing my thesis, I preferred conducting one thorough case-study over multiple, less profound case-studies.

A final note to make, is that I am well aware that, while the research process evolved, I became increasingly immersed in all the data causing blind spots to occur. Looking back, I should have taken more breaks from writing to review the data collected and to reflect on how I, as a researcher, interpreted that data. During the preparation of this report, I tried my utmost best to elucidate and substantiate the research outcomes. Nevertheless, it is possible that some parts of this research lacks clarity for the reader. Hence, feedback and suggestions on how this research could be improved, are warmly welcomed. If you have any general remarks, comments, suggestions or thoughts to share, please do not hesitate to reach out: a.j.hummel@uu.nl

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Appendix

I: Topic list

0) Introduction
   - Who am I, and what is this research about.

1) Learning network
   - What actors are involved with the KaE program?
   - How are these actors related and what are their responsibilities?
   - What is your role as [xxx] within the learning network of KaE? And how do you fulfil/perform that role?

2) Experiential learning techniques
   - What kind of (learning) activities facilitates KaE, according to you?
   - With what kind of (learning) activities are you involved? And how do you contribute to that?
   - What is the purpose of these (learning) activities?
   - How do these (learning) activities help fostering the energy transition in this industry?
   - With what kind of approach are these (learning) activities organized?
   - How do actors collaborate to organize and facilitate such learning for horticulturalists?

3) Engagement of learners
   - How are horticulturalists being engaged with such (learning) activities? How do you contribute to that?
   - What kind of resistance do you encounter, and how do you try to overcome that?
   - When horticulturalists are engaged, how do you ensure they stay engaged? That they continue their sustainable practice?

4) Advise
   - What would be your advice for future change-initiators about engaging learners? What are lessons that you learned, what worked well or, would you do something different?

II: Observation list

Learning network	Experiential learning techniques	Engagement of learners
How many attendees?	What is the purpose of this technique	Why are they here today?
Composition of the audience	Content, what is discussed?	How is the public engaged during this event?
Who is talking?	Setting and ambiance	

Kas als Energiebron as a Learning System

1   <u>Learning network</u>
- Actors
- Roles
- Responsibilities
- Relations
- KaE in its organizational form
  - Ministry of LNV (/Economic Affairs)
  - Glastuinbouw Nederland
  - Entrepreneurial group
    - Horticultural entrepreneurs
    - Crop-cooperations
  - BCO's
  - Research institutes
    - WUR
    - TU
    - TNO
    - Delphy
- Horticulturalists' network
  - Fellow horticulturalists
  - Suppliers
  - Advisors
  - Researchers
  - Crop-cooperations/plant breeders
  - BCO's
  - KaE team

2   <u>Experiential learning techniques</u>
- Knowledge creation
  - Research
  - Monitoring
  - Financial arrangements
    - Law and regulation
- Knowledge sharing
  - (Practical) experiments
  - HNT Course
    - Course material
  - Demonstration projects
  - Events
    - EnergiekEvent

- Canteen meeting
- Roadshow
- Workshops
- Excursions
- Open access

3 <u>Engagement of learners</u>
- Direct
  - Personal communication
  - Focus of communication
  - Recruitment
  - Communication channels
- Indirect
  - Influencing
    - Horticulturalists' network
      - Seeing is believing
    - Next generation
      - Education
  - Participation

4 <u>Additional</u>
- Resistance
- Perception of KaE
- Standing firm
- Patience
- Advice from respondents
  - Pitfalls