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ABSTRACT

In this deliverable we investigate: ***how can ecosystems be supported when engaging them in the Every1 project?*** We understand ecosystems as any networks, initiatives or clusters that can be valuably engaged in the digitalisation of energy. Our analysis consists of two parts.

First, we investigate what factors shape effective ecosystems. Based on a literature review, we identified three frameworks that help us understand effective ecosystems: helix models framework, innovation ecosystem framework, and social innovation ecosystem framework. Which framework is most relevant for an ecosystem depends on the context and objectives of the ecosystem. Informed by the frameworks, we identified internal and contextual factors that can be taken into account when aiming for effective ecosystems. Insights from this analysis feed into our engagement efforts to support ecosystems, including our analysis in the second part of this deliverable.

Second, we identified the engagement strategies that will be used in the Every1 project to support the ecosystems. We take a comprehensive understanding of engagement, which emphasises to take a contextualised and flexible approach on engagement, to be able to address needs for engagement as they unfold during the project. We distinguish three phases in our engagement process. First, the enrolment of the ecosystem in the Every1 project. Second, the core of the collaboration. This entails specific support in the form of tailormade learning materials about the digitalisation of energy through a co-creation approach. In parallel, the collaboration entails ecosystem design guidance through the EXPLORE-SHAPE-UNITE approach, which aims to foster new initiatives, projects, and business cases in the digitalisation of energy. The EXPLORE-SHAPE-UNITE approach can benefit from the learning materials developed in the project. The EXPLORE-SHAPE-UNITE approach is especially a key way to support new-to-digital-energy ecosystems to become active in the digitalisation of energy. Next, in the last phase of engagement we aim to sustain our efforts to be able to end the project in a responsible way.

This deliverable underlines that in order to support ecosystems in the digitalisation of energy through engagement with the Every1 project, we need to be aware of contexts and ecosystem-needs as they evolve during the project. This deliverable provides a fundamental basis from which we depart our engagement efforts in the project. This deliverable will guide our engagement efforts with which we aim to support everyone to take up their role in the digitalising energy system.

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1. Introduction

In the transition towards a more sustainable electrical energy system, it is key to engage with a variety of stakeholders who interact with the electrical energy system (Stober et al., 2021). Stakeholder engagement in the energy transition is important, because on the one hand the energy transition impacts the way stakeholders interact with energy, whilst on the other hand a variety of stakeholders is needed to enact the transition (C. A. Miller et al., 2015). A pertinent topic to engage stakeholders in the energy transition about, is the digitalisation of the energy system. The digitalisation of electrical energy systems comprehends the increased uptake of information and communication technologies (ICT) in energy systems (International Energy Agency, 2017). Stakeholder engagement about digitalisation of energy is needed because the digitalisation of energy impacts all stakeholders who interact with the energy system, and brings about new situations and roles for stakeholders (International Energy Agency, 2017). Therefore, the Every1 project aims to engage with all stakeholders in the digitalisation of energy and aims to offer them support to take up their role in the digitalising energy system. Every1 uses the notion of "ecosystems" both as analytical and practical tool for action. This deliverable investigates what the engagement of ecosystems in the Every1 project will entail, by answering the question: ***how can ecosystems be supported when engaging them in the Every1 project?***

In the Every1 project we understand stakeholders as everyone who can or needs to be engaged in the digitalisation of the electrical energy system. This means that stakeholders are both individuals who interact with the digitalisation of energy in their household, as well as professionals who interact with the digitalisation of energy in their job. To reach this variety of stakeholders, the Every1 project will engage with ecosystems in which the stakeholders are networked. We take a broad perspective on ecosystems, as we understand ecosystems as any networks, initiative or cluster that can be meaningfully engaged in the digitalisation of energy and the Every1 project. This enables us to reach a variety of stakeholders through the variety ecosystems with whom we engage.

In this deliverable, we detail engagement strategies to support ecosystems in the Every1 project. We do this in two steps. First, we aim to understand what makes effective ecosystems. We do so by answering **sub-question 1: *what are factors that shape effective ecosystems?*** This understanding of effective ecosystems will help us to identify how ecosystems can be supported to become more effective. Second, we identify engagement strategies that can support ecosystems in the Every1 project. We do this by answering **sub-question 2: *what engagement strategies can be used to support ecosystems with the Every1 project?***

This deliverable builds upon earlier work in the Every1 project. In earlier work we identified the types of ecosystems will be engaged in the project, and the main purposes of the ecosystem engagement. The first insights that this deliverable takes from earlier Every1 work, are the types of ecosystems with which the Every1 project will engage as identified in *D1.1 Extended stakeholder and ecosystem mapping* and *D1.2 Structured overview of ecosystems.* In this identification of potential ecosystems to engage with, a distinction is made between existing digital-energy ecosystems and new-to-digital-energy ecosystems:

1. ***Existing digital-energy ecosystems.*** The existing digital-energy ecosystems are ecosystems who already work on the energy transition, in which they can come across the digitalisation aspect of the energy transition. This means the support that the Every1 project will offer to the existing digital-energy ecosystems relates close to the ongoing business of these ecosystems. We identified and mapped three types of existing digital-energy ecosystems to engage with: energy communities, local authorities, and clusters of organisations.

2. ***New-to-digital-energy ecosystems.*** New-to-digital-energy ecosystems will be engaged, which we understand as ecosystems that do not focus on the energy transition and digitalisation. Through these new-to-digital-energy ecosystems we aim to reach stakeholders who are less familiar with digitalisation of energy, and those for who this topic is not part of their daily business. By engaging with both existing digital-energy ecosystems and new-to-digital-energy ecosystems, we thus reach stakeholders who are more familiar with the field of energy and digitisation, and those stakeholders who are less familiar with the field. In the identification of new-to-digital-energy ecosystems in D1.2, special focus has been on ecosystems that connect marginalised groups. The new-to-digital-energy ecosystems identified that could potentially be engaged are the following: social welfare organisations, religious communities, elderly associations, disability associations, sport associations, consumer and producer organisations. Those new-to-digital-energy ecosystems will be supported by the Every1 project to become digital-energy ecosystems that are more familiar with the topic.

The second source of insights from earlier work that informs this deliverable, are the identified main purposes of ecosystem engagement as explained in *D1.2 Structured overview of ecosystems*. These purposes need to be served by the engagement strategies that we develop in this deliverable. There are two main purposes of ecosystem engagement in the Every1 project:

1. ***Co-creating tailormade learning materials.*** The Every1 project will co-create learning materials together with the ecosystems, to be able to offer the ecosystem members tailormade learning materials about the digitalisation of energy. The learning materials are supporting the ecosystem members in their role in the energy transition, as it will offer them valuable knowledge and skills. Knowledge and skills have been identified to be key to enable stakeholders to participate in the digitalisation of energy, both for individuals in their household (Calver & Simcock, 2021; Chambers et al., 2022; European Commission, 2022), as well as for the workforce who work for organisations interacting with digitalisation of energy (European Commission, 2022; Lucas et al., 2018). By engaging with ecosystems, the Every1 project can develop tailormade learning materials for the variety of stakeholders that are part of the ecosystem, thereby improving knowledge and skills of stakeholders. The co-creation of learning materials takes place in *WP3 From knowledge gaps over learning paths to identifying training material needs* and *WP4 Knowledge creation, capacity building, and training materials.*

2. ***Offering ecosystem design guidance.*** The second more broader purpose of engagement is the ecosystem design guidance that supports the ecosystems in doing their work. Ecosystems have a facilitating role in the digitalisation of energy, as the ecosystems aim to support the work of their members. Ecosystems can support their members for example by connecting various stakeholders to collaborate on innovative solutions (Gomes et al., 2018) or local societal challenges (Terstriep et al., 2020), by reskilling and upskilling their members (Domanski, 2018; Expert

Group on Clusters, 2020). When the Every1 project supports the work of ecosystems by offering ecosystem design guidance, it is thus supporting the members of the ecosystem to take up their role in the digitalisation of energy. The support to ecosystems in their work will be offered in *Work package 5 Maximising impact.*

The deliverable continues as follows: first, in Chapter 2 the methodology will be explained. Next, in Chapter 3 the analysis on effective ecosystems will be presented, answering sub-question 1. Informed by this, Chapter 4 presents the engagement strategies that we identified for ecosystem engagement with the Every1 project, answering sub-question 2. Last, the deliverable ends with a conclusion. In this way, the deliverable shows how ecosystems can be supported by engaging them in the Every1 project.

2. Methods

This deliverable answers the research question: ***how can ecosystems be supported when engaging them in the Every1 project?*** To answer this question, we worked with two interrelated sub-questions.

First, we answered **sub-question 1: *what are factors that shape effective ecosystems?*** By answering this question, we deepened our understanding of the ways in which ecosystems operate. This understanding can inform our engagement with ecosystems in two ways: by pointing out how ecosystems operate we learn how we can co-create learning materials with the ecosystems, and by pointing out on what factors ecosystems might need guidance. The analysis of sub-question 1 was based on academic literature research. The literature research was complemented with insights from practice, through an exploration of the ways in which existing ecosystems approach these factors for effective ecosystems. Details on the methodology for answering sub-question 1 are described in section 2.1. The findings of this analysis are presented in Chapter 3.

Second, we answered **sub-question 2: *what engagement strategies can be used to support ecosystems with the Every1 project?*** Building upon the insights created by answering sub-question 1, the engagement strategies for ecosystem engagement were investigated, to learn what engagement strategies are valuable for ecosystem engagement in the Every1 project. The methodology used to define these engagement strategies is explained in section 2.2. The identified engagement strategies are presented in Chapter 4.

2.1. Factors for effective ecosystems

Our analysis on the factors that shape effective ecosystems consisted of three interrelated components:

1. The analysis started with the **identification of bodies of literature that offer theoretical frameworks** that provide an understanding of ecosystems, and insights on factors that shape ecosystem effectiveness. There is a broad literature base available about ecosystems, in which the ecosystem concept is used for different purposes and in different contexts. Therefore, it was important to critically analyse which bodies of literature offer the most relevant frameworks to understand the ecosystems we aim to engage in the Every1 project. With this first component of our research, we thus aimed to identify the most applicable theoretical frameworks within the variety of bodies of literature.
2. Then, **the identified theoretical frameworks were analysed in more depth.** During this analysis we identified dimensions of the ecosystem frameworks that are relevant for our work in the Every1 project. The identified dimensions structured the presentation of the results.
3. Last, we asked two key informants from existing ecosystems to reflect upon our theoretical findings. In this way we **explored what our theoretical findings can mean for ecosystems in practice.**

The three components built iteratively upon each other, as we moved back and forth between the three components of the analysis when this was needed based on new insights that we gained. An overview of the analysis process is presented in Figure 1.

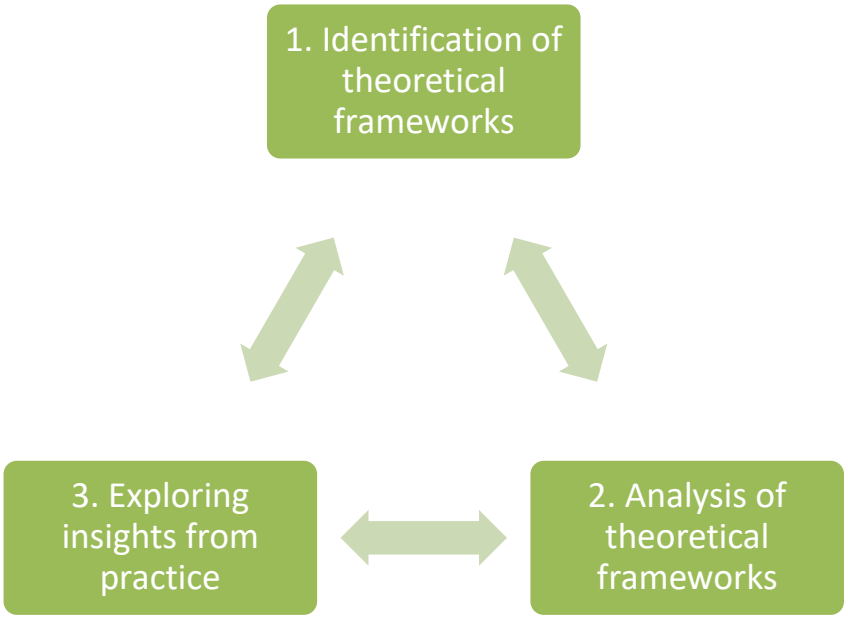

Figure 1 - Analysis process of factors for effective ecosystems

2.1.1. Identification of theoretical frameworks

First, we identified the bodies of literature that offer theoretical frameworks that help us to understand the ecosystems in the Every1 project and the factors that shape their effectiveness. This meant that we needed to identify theoretical frameworks that match with the ecosystem types we engage with in the Every1 project. On one the hand, there is a variety of frameworks that provides insights on ecosystems. What those frameworks have in common is that they focus on networks of stakeholders, but differ, for example, in focus points, types of stakeholders, purpose of the ecosystem, and origin of the body of literature. On the other hand, the ecosystems we aim to engage with in the Every1 project, have also in common that they are networks of stakeholders, but at the same time vary in their focus points, types of stakeholders and purpose of the ecosystem. **We thus needed to identify bodies of literature that offer frameworks that match with the ecosystem types we aim to engage with in the Every1 project.**

To identify theoretical frameworks that correspond with the characteristics of ecosystems we aim to engage with in the Every1 project, we departed from the characteristics of ecosystems we aim to engage with. These ecosystem types were already identified in D1.2. Those ecosystem types we will engage with in the Every1 project are: energy communities, local authorities, and clusters of organisations. We characterised these ecosystems based on our earlier work in D1.1 and D1.2. **Next, we searched for bodies of literature that offer a theoretical framework on the characteristics of ecosystems we will engage with.** The identification of literature was done by a narrative literature research, which enabled us to explore a variety of directions of literature, and analyse this through the lens of the needs we have in the Every1 project to understand ecosystems. This enabled us to focus on deepening our understanding of the available literature that can be relevant for understanding ecosystems in our Every1 project (Greenhalgh et al., 2018). This narrative review was conducted in a structured manner by searching for literature with search terms like “ecosystems,” “stakeholder networks,” “stakeholder clusters,” “stakeholder collaboration” to take a broad understanding of ecosystems, combined with terms like for example “literature,” “review,” “overview” to get

an overview of the broad field of ecosystem literature. Search engines used consist of Scopus and Google Scholar. The literature was investigated by analysing the potential that a body of literature has to provide an understanding of ecosystems we will engage in the Every1 project. The results of this first step of the analysis are presented in section 3.1, which shows how we identified the following three theoretical frameworks: helix models, innovation ecosystems, and social innovation ecosystems. Each of the three frameworks offers a unique but related perspective on ecosystems, which helps to understand the variety of ecosystems that will be engaged in the Every1 project.

2.1.2. Analysis of theoretical frameworks

In this second step we delved deeper into the theoretical frameworks that were identified in the first component of our analysis. While analysing the frameworks we found five dimensions which seem particularly relevant for our project, as explained in section 2.1.2.1. The literature that was included in this analysis was based on the search process and inclusion criteria as explained in section 2.1.2.2.

2.1.2.1. Analysing five dimensions of ecosystems

During the literature analysis, we identified five dimensions of ecosystems that are key to understand when aiming to inform future ecosystem engagement and support in the Every1 project. These dimensions structure the presentation of the findings of our literature analysis. The five dimensions were identified based on our practical needs in the Every1 project and iteratively updated based on the theoretical insights we gained during our literature research. The focus on those five dimensions was important, because the five dimensions ensured that our analysis of the broad bodies of ecosystem literature became tailored to our work in the Every1 project. The following five dimensions were found to be important to understand ecosystems in the Every1 project:

1. **Focus of the framework.** Each ecosystem framework has a different focus point, each taking a different angle on ecosystems. To understand what a framework has to offer, we thus need to understand what the focus point of the framework is. This will help to understand for which types of ecosystems in the Every1 project the framework can offer valuable insights.
2. **Involved stakeholders.** All three frameworks are focussed on networks of stakeholders, which often consist of a variety of stakeholders. Nevertheless, different frameworks emphasise the need for some specific stakeholder types in ecosystems, often related to the purpose of the ecosystems. To understand for which ecosystem types in the Every1 project the body of literature can offer insights, we need to understand on which stakeholders the body of literature is focused.
3. **Insights for digital-energy ecosystems.** Next, this dimension concretises what the framework offers for the ecosystems we aim to engage with, which are existing and new digital-energy ecosystems. This dimension is often not discussed explicitly in literature, as ecosystem literature is not focused on digital-energy ecosystems explicitly. Instead, this dimension was analysed by combining our insights on digital-energy ecosystems with insights from the ecosystem literature. With this dimension we spell out what insights the framework has to offer for ecosystems in the digitalisation of energy, thereby creating an understanding of the types of ecosystems in the Every1 project for which the framework can add insights.
4. **Internal factors for effective ecosystems.** We understand internal factors for effective ecosystems as the factors that can be directly impacted by the ecosystem members and coordinators themselves. Insights on internal factors for effective ecosystems can inform our work in the Every1 project by showing what internal factors are important to consider when aiming to support ecosystems.

5. **Contextual factors for effective ecosystems.** We understand contextual factors for effective ecosystems as factors that cannot be directly impacted by the ecosystem members and coordinators themselves. These factors are shaped by stakeholders outside the ecosystem. Understanding the contextual factors that shape the effectiveness of ecosystems helps to understand in which contexts ecosystems can flourish, which can inform support to ecosystems by showing which contexts need to be sought or created to support ecosystems.

2.1.2.2. Literature search and inclusion criteria

We conducted this second part of the analysis also as a narrative literature review, because a narrative review allowed more space for interpretation and exploring directions that deepened our understanding (Greenhalgh et al., 2018). **This enabled us to iteratively identify the dimensions of the frameworks that are necessary to understand in the Every1 project whilst also synthesising insights on these dimensions** (Greenhalgh et al., 2018). We conducted this narrative approach in a structured manner. We combined search terms that specified the body of literature with search terms that specified the dimensions within that body that we were interested in. Examples of search terms that specified the body of literature are "helix models," "triple helix," "innovation ecosystems," "innovation clusters," "social innovation ecosystems" and "social innovation." Salient examples search terms that specified the dimensions of that body of literature that we are interested in for our project, are "literature review", "effectiveness", "approach" and "strategies". The search terms were searched in prominent academic search engines Scopus and Google Scholar.

To analyse each body of literature systematically, we set up inclusion criteria that determined if we included contributions or not (Creswell, 2014; Kraus et al., 2020). **For each of the three bodies of literature, we included contributions that corresponded to the following four criteria:**

1. **The contribution provided insights on ecosystems that are relevant for the aim of our project.** By analysing the bodies of literature, we found five dimensions that are key to understand for our project aims, as specified in section 2.1.2.1. These dimensions were identified to be relevant for all three theoretical frameworks, and therefore guided our analysis. We identified the following five dimensions: the focus of the ecosystem framework, involved stakeholders, insights for digital-energy ecosystems, internal factors for effective ecosystems and contextual factors for effective ecosystems. Therefore, the final included contributions at least provided insights on one of the dimensions.
2. **The contribution needed to be applicable to the context of the Every1 project,** which is in Europe, in the context of the sustainable energy transition and digitalisation. This did not mean that the contribution needed to explicitly focus on digitalisation of energy in Europe, but that it had to be applicable to this context.
3. **The contribution needed to be available in English**, as this was the language spoken by the researchers.
4. **The contribution could be a peer reviewed academic contribution or grey literature.** Peer reviewed academic contributions are reviewed through the academic process, which makes this type of literature accepted as a high-quality source (Kraus et al., 2020). Grey literature can be defined as "publicly available, foreign or domestic, open-source information that is usually available only through special channels and may not enter normal channels or systems" (Benzies, Premji, Hayden, & Serrett, 2006, p. 56), for example government reports, committee reports of business management reports). Grey literature could be included because we were interested in information that can help us to engage with ecosystems in practice, which could potentially also be found in more pragmatic oriented documents offered as grey literature.

When we found contributions that met our inclusion criteria, the contributions were organised in literature management program Mendeley. The results of this component of the analysis can be found in section 3.2.

2.1.3. Exploring insights from practice

In this last component of the analysis of effective ecosystems**, we explored how existing ecosystems approach the identified factors for effective ecosystems in practice.** This exploration was based on reflections from two key informants related to the coordination of cluster organisations. The aim of this exploration was threefold:

1. **We aimed to explore the extent to which the theoretically identified factors help to understand how ecosystems in practice operate.** It is valuable if the identified factors help to understand how ecosystems operate, as these insights will be useful for further ecosystem engagement in the Every1 project.
2. **We aimed to create first insights on example approaches for effective ecosystems.** These example approaches can be an inspiration for other ecosystems to become more effective. The example approaches can be helpful to support other ecosystems in the Every1 project.
3. **We aimed to create a starting point for further exploring what the theoretical findings have to offer to other ecosystem types,** like energy communities and local authorities. The exploration in this deliverable was focused on cluster organisations, as they are one of the key ecosystem types the project will engage with, but further work will also explore the theoretical findings in the context of other ecosystem types.

We asked two key informants to reflect upon their approaches for the factors for effective ecosystems. The first key informant was the coordinator of ***cluster organisation Flux50***[1]. Flux50 is a membership organisation that supports the Belgium region Flanders to establish international recognition as a Smart Energy Region, by facilitating cross-sectoral collaboration (Flux50, n.d.-c). Flux50 offers members the latest knowledge about technologies, a network including academia, industry and government, and facilitation of innovative projects (Flux50, n.d.-b, n.d.-c). In 5 years' time Flux50 facilitated about 70 innovative projects, 10 research projects and 10 demonstration projects, which represents a subsidy of approximately 40 million euros to support innovation in Flanders (Flux50, n.d.-a). This shows that Flux50 has experience in coordinating a cluster on a broad scale. This made the Flux50 coordinator a valuable key informant to reflect upon their approaches to the factors for effective ecosystems.

The second key informant was a coordinator of the ***International Cleantech Network (ICN)***[2]. ICN is a network that connects 19 cleantech cluster ecosystems from across the world. The ICN members are clusters that all work with public-private setup, including companies, public authorities, and research institutions (ICN, n.d.-a). The ICN member clusters operate in various industries such as water, circular economy, and energy (ICN, n.d.-b). The ICN coordinator was thus a valuable informant to reflect upon approaches on the effectiveness factors in practice, because the ICN coordinator offered insights on a wide variety of ecosystems. Therefore, the ICN coordinator informed our analysis about the salient approaches to the factors for effective ecosystems that the coordinator was aware of. The two key informants thus came from a different perspective, offering different angles for exploring how ecosystems in practice approach the factors for effective ecosystems.

The key informants were asked to reflect upon the ways in which their ecosystems approach the identified factors for effective ecosystems. This exploration started with the identification of the ecosystem framework that was applicable and most valuable for their ecosystem to reflect with. The key informant thus selected a framework from the three

[1] Website of Flux50: https://flux50.com/
[2] Website of International Cleantech Network: https://internationalcleantechnetwork.com/

earlier identified frameworks: helix models framework, innovation ecosystems framework, and social innovation framework. As found in the earlier components of the analysis, each of the three identified ecosystem frameworks has its own focus and angle, which needed to fit the ecosystem that is aimed to analyse with the framework. Next, the key informants reflected upon the factors for effective ecosystems of the applicable theoretical ecosystem framework. The reflection on the factors was guided by the following question: ***how do(es) your ecosystem(s) approach this factor for effective innovation ecosystems?*** The results of this third component of the analysis can be found in section 3.3.

2.2. Ecosystem Engagement Strategies

In the second part of this deliverable, we answered **sub-question 2: *what engagement strategies can be used to support ecosystems with the Every1 project?*** By answering this question, we aimed to outline and concretise the engagement strategies that the Every1 project will undertake to support ecosystems. We therefore aimed for a pragmatic answer to this question, which can be operationalised in the project, whilst being informed by state-of-the-art understandings of engagement. In order to define our engagement strategies, we synthesised insights from three sources:

1. ***Literature about engagement.*** We identified our engagement strategies informed by broader discussions and insights from literature on engagement. This means that we did not analyse engagement literature with the aim to summarise all available insights on engagement. Instead, **we analysed engagement literature with the aim to understand how theoretical insights on engagement can inform the engagement strategies in the Every1 project.** Insights were searched in well-established databases Google Scholar and Scopus. The included contributions come both from peer reviewed journals, to gain insights from state-of-the-art academic literature on engagement. This was complemented with grey literature, which comprehends other types of contributions, often in the form of government, committee, business reports that are often more focused on insights from and for practice (Benzies et al., 2006). The insights from grey literature enabled us to learn from engagement approaches from other existing initiatives and reports from other institutions.

2. ***Insights from our analysis on effective ecosystems in Chapter 3.*** Our insights generated in Chapter 3 show what makes effective ecosystems, which informed us in the support of ecosystems that we offer with the engagement strategies investigated in Chapter 4. By understanding what factors make effective ecosystems, we created an understanding of the factors that are key to consider when aiming to support ecosystems through our engagement.

3. ***Project rationale and flexibility.*** The last source that informed our engagement strategies, was the **outline of the Every1 project as agreed upon in the project proposal, whilst keeping a flexible approach that is sensitive to real-life circumstances as they emerge during the project.** With our investigation of engagement strategies in Chapter 4, we aimed to outline and concretise our engagement strategies in the Every1 project. This means that we did not only want to comply with state-of-the-art insights from literature, but also needed to align with the project structure as agreed upon in the project proposal. This enabled us to tailor our engagement strategies effectively and efficiently in line with other activities in the Every1 project and the overarching goals of the project. But, as we also wanted to be able to flexibly respond to circumstances as they emerge during the project, we also aimed for a flexible approach within the overarching project outline.

By combining insights from all three sources, we identified engagement strategies as presented in Chapter 4.

3. Factors for effective ecosystems

In the Every1 project, we aim for everyone to take up their role in the digitalising energy system. To be able to support everyone, we will engage with and offer support to a wide variety of stakeholders. **The Every1 project aims to engage the wide variety of stakeholders by reaching out to ecosystems. We take a broad understanding of ecosystems, by understanding ecosystems as networks of stakeholders, which we will show are often also referred to as clusters, communities, triple, or quadruple helix.** We understand ecosystems as mechanism through which we can reach and support the ecosystem members, which entail the variety of stakeholders that the Every1 project aims to support. To be able to support stakeholders through ecosystem engagement, we investigate in this chapter what makes effective ecosystems. We answer in this chapter **sub-question 1: *what are factors that shape effective ecosystems?***

Insights from this chapter can inform ecosystem engagement on both objectives of the engagement. First, by understanding what factors shape effective ecosystems, we create insights on how ecosystems operate. These insights help to understand how to engage with the ecosystems to co-create the tailormade learning pathways and materials with (in WP3 and WP4). Second, by understanding what factors shape effective ecosystems, we understand how we can support ecosystems in their work (in WP5), as these factors point towards important aspects to focus upon in ecosystem design guidance.

To answer sub-question 1, we undertook an analysis that consists of three steps, of which the methodology is explained in more detail in section 2.1. First, as described in section 3.1, we identified three theoretical frameworks that offer valuable insights on the ecosystem types we will engage with in the Every1 project: helix models framework, innovation ecosystems framework, and social innovation ecosystems framework. Next, as presented in section 3.2, we analysed those three theoretical frameworks more thoroughly. In this analysis five dimensions emerged that are most relevant for our project to understand from each of the three perspectives. Third, the analysis on effective ecosystems ends with an exploration of the theoretical insights in practice, of which the results are presented in section 3.3.

3.1. Identified theoretical frameworks

First, we identified the following three frameworks on ecosystems to be valuable for our work with ecosystems in the Every1 project:

1. ***Helix model framework.*** This framework is focussed on the collaboration for synergies between diverse stakeholders: academia, governance, industry, and optionally society and the natural environment (Carayannis et al., 2022; Taratori et al., 2021).
2. ***Innovation ecosystem framework.*** This framework is focussed on collaborations to co-create value through innovation, often with technology focus. The collaborations are often cross-sectoral (Gomes et al., 2018; Zheng & Cai, 2022).
3. ***Social innovation ecosystem framework.*** This framework is focussed on collaboration to address societal challenges through social innovation. Social innovations aim to change our social practices and relations. The collaborations are often cross-sectoral (Domanski et al., 2020; Pel et al., 2020; Terstriep et al., 2020).

We selected those three frameworks, because each of them provides a valuable and unique angle on the ecosystem types we will engage with in the Every1 project. The existing digital-energy ecosystems that the Every1 project will engage with, as identified in D1.1 and D1.2, are: energy communities, local authorities, and clusters of organisations. More information about these ecosystem types can be found in Table 1.

Energy Communities	Local Authorities	Clusters of Organisations
Energy communities are initiatives that empower citizens, small businesses, and local **authorities to produce, manage and consume their own energy** (Directorate-General for Energy, 2022). Energy communities interact with the digitalisation of energy, as the **digital technologies are key for the energy communities to operate** (Gjorgievski et al., 2021). Energy communities can thus be understood as constituting an ecosystem of **various stakeholders** who work together to **address local needs and therefore use digital energy technologies, drawing upon both social and technological innovations.**	Local authorities have the potential to **stimulate and govern local initiatives related to energy,** for example by initiatives that foster self-production, addressing energy poverty and empowering local energy communities (Gancheva et al., 2019). Digitalisation of energy impacts those local energy initiatives, in which the local initiatives can be supported through the local authorities. The local authorities can be seen as ecosystems that bring together **various stakeholders** to foster local initiatives in the energy transition and digitalisation, **which can focus on both innovative technical solutions and solutions that are focussed on address local societal challenges.**	A cluster can be defined as **geographic concentrations of industries related by knowledge, skills, inputs, demand, or other linkages** (Delgado et al., 2016). Clusters can bring together various stakeholders to collaborate on innovative solutions, and support their members with reskilling and upskilling (Expert Group on Clusters, 2020), which can also be done related to energy and digitalisation. The clusters can be seen as ecosystem that bring together **stakeholders with various backgrounds** to collaborate on solutions in the energy transition and digitalisation, **which can include both social and technical innovative solutions.**

Table 1 - Existing digital-energy ecosystems to be engaged in the Every1 project, as in D1.1 and D1.2

The different existing digital-energy ecosystems we aim to engage have different focus points and contribute to the energy transition and digitalisation in a variety of ways. By engaging with this variety of ecosystems, the Every1 project can reach the variety of stakeholders that is networked in these ecosystems. Nevertheless, the ecosystem types we will engage with, have two overarching key aspects in common. First, the ecosystems bring together a variety of stakeholders with different backgrounds. Second, the ecosystems work, amongst other things, on innovative solutions in the digitaliastion of energy, which can have a more technological or more social focus. **The three frameworks for ecosystems that we identified, offer valuable angles to understand those two aspects of the existing digital-energy ecosystems we aim to engage with.**

3.1.1. Existing digital-energy ecosystems bring together a variety of stakeholders: relevance of the helix model framework

The focus of the helix model framework is on collaboration between different pillars, or 'helices': governance, academia, industry and potentially society and the natural environment (Taratori et al., 2021). **As the existing digital-energy ecosystems we engage with focus on including a wide variety of stakeholders, the helix model framework can offer valuable insights in creating synergies between these wide varieties of stakeholders.** We found that all ecosystem types we engage with a variety of stakeholders, from different pillars: governance, industry, academia, and society. The ecosystems differ in the specific pillars they engage with, and differ in the emphasis ecosystems put on the importance of working with all pillars. ***Energy communities*** tend to focus on the inclusion of society, industry, and governance, but academia can also be involved. Ecosystems surrounding ***local authorities*** include in any case the governance helix as local authorities are included. The local authorities can collaborate with industry, academia, and society. In ***clusters of organisations*** a variety of stakeholders is brought together, often focussed on industry, but also including governance, academia, and society. **The helix model framework can help to understand how these different configurations of ecosystems can foster synergies between stakeholders from different helices.**

3.1.2. Existing digital-energy ecosystems foster new solutions: relevance of the innovation ecosystems and social innovations ecosystems frameworks

Furthermore, the ecosystems we engage with do not solely exist to network stakeholders. The ecosystems enact this collaboration to foster solutions. ***Energy communities*** implement technical solutions to solve societal challenges related to local energy consumption. ***Local authorities*** can initiate and support ecosystems that work on a variety of solutions, which can be technology focussed, but also focussed on addressing societal challenges. ***Clusters of organisations*** can stimulate solutions that are more technology driven, especially in clusters including mainly industry stakeholders. Clusters can also contribute to local social development by stimulating the collaboration, which then often includes more societal actions. Therefore, we identified the innovation ecosystems framework and the social innovation ecosystem framework as valuable bodies of literature to provide an understanding of key factors on ecosystems. **The innovation ecosystem framework is focussed on collaborations that stimulate innovative solutions that are mainly technology driven, often driven by industry and academia** (Gomes et al., 2018; Zheng & Cai, 2022). **The social innovation framework puts into attention collaborations that aim to address social challenges, which are more driven by non-profit organisations and local authorities** (Domanski et al., 2020; Pel et al., 2020; Terstriep et al., 2020). So, with innovation ecosystems focussed on technological innovation, and social innovation ecosystems focussed on addressing societal challenges through social innovation, the combination of those two frameworks covers a variety of purposes that the ecosystems we aim to engage with can have.

Based on this analysis, we identified the following three ecosystem frameworks to be relevant for understanding ecosystems in the Every1 project: helix model framework, innovation ecosystems framework, and social innovation ecosystem framework. **Which ecosystem frameworks are most valuable to use when aiming to understand existing digital-energy ecosystems, depends on the specific ecosystem that is aimed to be understood. The three**

frameworks are not mutely exclusive, but instead complement each other by providing different angles on ecosystems.

3.2. Three frameworks on ecosystems

Next, we delve deeper into the three frameworks on ecosystems that were identified in section 3.1. While analysing the three frameworks, we found five dimensions that are key to understand for our project aim. **Our representation of our analysis of the frameworks is therefore structured according to the five dimensions that emerged during the analysis.** As explained in more detail in section 2.1.2, the five dimensions we focus on are:

1. ***Focus of the framework.*** This dimension shows the perspective that the framework offers to analyse ecosystems, which helps to understand for what purposes and what types of ecosystems the framework can offer valuable insights.
2. ***Involved stakeholders.*** This dimension informs on the stakeholders that are key in the framework, which shows for what ecosystem types the framework might be valuable.
3. ***Insights for digital-energy ecosystems.*** With this dimension we create insights on the way in which the framework can be useful for the specific context of digitalisation of energy.
4. ***Internal factors for effective ecosystems.*** We understand internal factors as the factors that can be directly impacted by the ecosystem members and coordinators themselves. This dimension is key to understand on what factors ecosystems can be supported by the Every1 project.
5. ***Contextual factors for effective ecosystems.*** Contextual factors are understood as factors that cannot be directly impacted by the ecosystem members and coordinators themselves, but instead are shaped by stakeholders outside the ecosystem. This dimension helps to understand what context factors need to be sought or created when aiming to support ecosystems.

This section continues by explaining per ecosystem framework the findings on these five dimensions: 3.2.1 about helix models, 3.2.2. about innovation ecosystems, 3.2.3 about social innovation ecosystems. Next, 3.3.4 presents the conclusion of the analysis, and a summary of the findings per ecosystem framework in Table 2.

3.2.1. **Helix model framework** to understand synergies between diverse stakeholders

3.2.1.1. Focus of the framework

A key framework that helps to understand ecosystems in the digitalisation of energy, are helix models. Academic literature on helix models for ecosystems is focused on the synergies that can be created when collaborating with diverse stakeholders. **Helix models focus on the collaboration between stakeholders from different 'helices', or 'pillars'.** The helix models evolved from the Triple helix model, that includes academia, industry, and government. Later, building upon the Triple helix model, the Quadruple helix models additionally includes society as fourth helix, and the Quintuple helix model adds the natural environment as fifth helix (Carayannis et al., 2022).

The helix models have in common that they emphasise the importance of creating synergies between those different helices to foster innovation, knowledge creation and sharing, and economic growth in a region (Carayannis et al., 2022;

Höglund & Linton, 2018; Taratori et al., 2021). By focusing on the need and complexity of inter- and trans-disciplinary collaboration, the helix models are not solely focused on technology in the collaborations but put these collaborations in a social context (Taratori et al., 2021).

3.2.1.2. Involved stakeholders

Academic work on helix models started with the development of the Triple Helix model, that is focused on interaction between three pillars: academia, industry, and government (Carayannis et al., 2022; Höglund & Linton, 2018; Taratori et al., 2021). This model is understood as the core model of knowledge and innovation, with focus on the economic implication of this (Carayannis et al., 2022). In the model, academia actors function as a magnet to stimulate scientific and technological knowledge in a region, and can for example be universities. Industrial actors are key in creating economic growth, and involve profit organisations. Governmental actors play an active role in actions, management, and land-use policies, on local, regional, national, and international level (Taratori et al., 2021) .

Building upon this Triple Helix model, the expanded Quadruple and Quintuple Helix models emerged. **First, the Quadruple Helix model expands the Triple Helix model by emphasising the role of society with a fourth helix.** There are different ways in which the role of society is conceptualised in helix models, ranging from society as contextual factor to society as active consumer actors (Carayannis et al., 2022; Höglund & Linton, 2018; Taratori et al., 2021). **The Triple and Quadruple helix models can be expanded to a Quintuple helix model, that includes an additional helix that represents the natural environment.** There are various ways in which the role of the natural environment in knowledge and innovation can be conceptualised, but these ways have in common that put knowledge and innovation in the context of the natural environment, and corresponding ecological issues (Carayannis et al., 2022; Taratori et al., 2021). The different helix models offer different perspectives on knowledge and innovation in a region, emphasising certain helices (Taratori et al., 2021).

3.2.1.3. Insights for digital-energy ecosystems

Insights from the helix model framework provide an understanding of the ways in which different stakeholders can collaborate to create synergies. **The insights on synergies among various stakeholders can support ecosystems in the digitalisation of energy, as the digitalisation of energy requires efforts from all helices in the models** (International Energy Agency, 2017). The helix framework helps to understand how different stakeholders relate to each other, and can position themselves to each other in collaborations. For digital-energy ecosystems this offers a relevant understanding on how the variety of stakeholders impacted and involved in the digitalisation of energy can collaborate to foster the energy transition and digitalisation. The framework can help stakeholders to understand what their role can be in an ecosystem, and how they relate to other stakeholders in the energy transition and digitalisation. This framework is thus especially valuable to understand digital-energy ecosystems that aim to involve a variety of stakeholders from different helices.

3.2.1.4. Internal factors for effective ecosystems

- ***Variety of stakeholders.*** The helix model framework emphasises the value of collaboration among different stakeholder groups. In any case academia, industry and government participate in the Triple helix model. Depending on the specific needs, society can also be involved as the fourth helix in the Quadruple helix model.

Additionally, as a fifth helix the natural environment can be considered as a fifth helix in the Quintuple helix model. The involvement of a variety of stakeholders is thereby at the centre of helix thinking about ecosystems (Carayannis et al., 2022; Taratori et al., 2021).

- ***Quadruple helix: reflexive involvement of society.*** In the quadruple helix model, society is included in the ecosystem by active involvement of residents, citizens, users, communities. When aiming to involve society in the knowledge and innovation processes, critical reflections are needed to involve society in a responsible manner. To start with, society should be considered as heterogenous group consisting of different people with different needs and preferences (Roman & Fellnhofer, 2022). Furthermore, it can be valuable to involve publics as early as possible in a project, to raise their awareness, and ensure their continuous involvement (García-Terán & Skoglund, 2019; Höglund & Linton, 2018; Taratori et al., 2021). Moreover, to gain trust and credibility of society, it is important to communicate, and exchange information in a transparent manner (Roman & Fellnhofer, 2022; Taratori et al., 2021).
- ***Knowledge transfer.*** Knowledge transfer among the different stakeholders is key in helix model ecosystems, especially when aiming for innovation (Carayannis et al., 2022; K. Miller et al., 2016). When aiming for knowledge transfer in helix ecosystems, attention should be paid to the variety of stakeholders in the ecosystems. The stakeholders may vary in their objectives, cultures, organisational procedures, and norms, which can impact their capacity to use the knowledge transferred within the ecosystem (K. Miller et al., 2016). Academics can play an important role in identifying and transferring knowledge within the ecosystem (Carayannis et al., 2022; K. Miller et al., 2016).
- ***Education opportunities.*** Work in helix collaborations can be fostered with educational opportunities for involved stakeholders. This is especially relevant when the knowledge needs cannot be met by knowledge transfer within the ecosystem itself (Kolehmainen et al., 2016).
- ***Shared vision.*** The development of a shared vision can be experienced to be lengthy, complex, and challenging, and therefore can benefit from leadership that keeps the variety of stakeholders enthusiastic (Kolehmainen et al., 2016). In the development of a shared vision, it can be challenging but necessary to overcome the distinct technical languages that different stakeholders are used to (García-Terán & Skoglund, 2019). In building shared vision, it can be helpful if partners trust and understand each other (Bellandi et al., 2021).
- ***Ecosystem governance.*** Governance of helix ecosystems plays an important role, especially in the development and maintaining of a shared vision in the helix collaboration (Kolehmainen et al., 2016).

3.2.1.5. Contextual factors for effective ecosystems

- ***Presence of stakeholders in a region.*** Having a variety of stakeholders involved in the ecosystem is a key element of helix understanding of ecosystems. To have all helices represented in a local ecosystem, all helices should be present in a region. However, not all regions have all helices with suitable capacity to participate in the ecosystem in their region (García-Terán & Skoglund, 2019; Kolehmainen et al., 2016). In some regions, there may not be a university or educational institution present in the area that could contribute to the needs in the ecosystem. Besides, existing business and industry are not always developed in a region to a stage that they can collaborate with others on for example innovation. Furthermore, some regions lack the capacity to have the public sector play an active role in the ecosystem. Especially in these regions where other helices are less represented, society as fourth helix often plays a more dominant entrepreneurial role in the ecosystem (Kolehmainen et al., 2016). But, research also shows that also in weaker regions the helix model has potential, although this requires more effort in managing, and implementing this (García-Terán & Skoglund, 2019). Regional policies can foster the attraction

of certain actors in a region, by policies favouring certain stakeholders and by making the region attractive to live in for personal of these stakeholder organisations (MacGregor et al., 2010).

- ***Trans local connectivity with like-minded initiatives.*** Beyond the local interaction between the different helices, a helix ecosystem can benefit from interaction and collaboration with other helix ecosystems. This can be collaboration across region, country, and political borders, for example when science parks in different countries get connected with each other. The different ecosystems do not need to focus on the same specific topics, and instead can have their own expertise, that combined create synergies (Höglund & Linton, 2018)

3.2.2. **Innovation ecosystem framework** to understand collaboration to co-create value through innovation

3.2.2.1. Focus of the framework

Another framework that can help understanding ecosystems in the digitalisation of energy, is the innovation ecosystem framework. Innovation ecosystem thinking has been put increasingly in focus in literature on strategy, innovation, and entrepreneurship. This has led to a variety of definitions, understandings and focus points related to innovation ecosystems. **The overarching understanding of innovation ecosystems that is put forward is innovation ecosystems as networks of stakeholders who work together to create value through innovation, often with focus on technological innovation** (Gomes et al., 2018; Zheng & Cai, 2022). Innovation ecosystem literature understands innovation as a result of joint efforts of various stakeholders, rather than something created by only a singular stakeholder. This more holistic framework on innovation is focused on the ways in which the stakeholders are interconnected and interdependent on each other (Gomes et al., 2018; Yaghmaie & Vanhaverbeke, 2020).

The innovation ecosystem concept is related to business ecosystems and innovation systems. First, the innovation ecosystem concept evolved from the business ecosystem concept. Gomes, Facin, Salermo and Ikenami (2018) clarify that that the innovation ecosystem concept puts *value creation* into focus, in contrast to business ecosystem understandings that put *value capturing* in focus. For our understanding of ecosystems in the Every1 project, we focus on the innovation ecosystem thinking, because we aim to understand how ecosystems can create value for the digitalising energy system. Second, the innovation ecosystem concept differentiates from innovation systems. The 'eco' part in innovation ecosystems emphasises the complex dynamics of collaborative value creation through innovation, by emphasising that the value creation is a result of various non-linear relations and interplays between stakeholders, and not a linear process as in innovation system theories (Zheng & Cai, 2022).

3.2.2.2. Involved stakeholders

Stakeholders participating in innovation ecosystems often include a focal firm, customers, suppliers, complementary innovators, and other stakeholders like regulators (Gomes et al., 2018). Universities can be of value for an innovation ecosystem, by providing fundamental knowledge, catalysing private sector development, licensing technology, and promoting the creation of spin offs (Vlaisavljevic et al., 2020). Although not the main focus, citizens, users, consumers can be involved in innovation ecosystems, when they can foster the innovation process in for example customer integration and open innovation (Domanski et al., 2020). This means that innovation ecosystems

thus can benefit from involving all quadruple helix stakeholders (industry, academia, government, society), but that it is not a necessary constituent and depends on the objectives and context of the innovation ecosystem.

3.2.2.3. Insights for digital-energy ecosystems

The innovation ecosystem framework emphasises the need for joint collaborative efforts to create innovative solutions, often with a technological focus. **This framework is thus especially helpful to understand ecosystems in the digitalisation of energy that aim to develop innovative technological solutions that foster the digitalisation of energy.**

3.2.2.4. Internal factors for effective ecosystems

- ***Variety of stakeholders.*** Innovation ecosystems thrive when a variety of stakeholders participate in the innovation ecosystem, especially when the different stakeholder bring different complementary competences into the collaborative innovation process (Rampersad et al., 2010; Yaghmaie & Vanhaverbeke, 2020). To understand which stakeholders need to be involved in the innovation ecosystem, it can be valuable to keep monitoring the landscape, by for example innovation diagnoses, technology audits, foresights and roadmapping (MacGregor et al., 2010; Spena et al., 2016).
- ***Knowledge transfer and management.*** Knowledge is seen as main antecedent and consequence of collaborative innovation efforts. This key role for knowledge in innovation ecosystems can be supported by processes, technologies, tools, and resources that stimulate the development, gathering and distribution of knowledge in the ecosystem (Spena et al., 2016). Spena et al (2016) identified three knowledge practices. First, ecosystems need to "connect the knowledge dots," by connecting and collecting knowledge by involving different stakeholders in the innovation ecosystem over time. Second, ecosystems need to "integrate knowledge," by putting the different knowledge sources together and creating a unique set of features to reach common objectives. Last, by "authoring and disseminating knowledge," ecosystems leverage the collected knowledge for learning and co-creation (Spena et al., 2016). Furthermore, to foster technological adoption in the innovation ecosystem, tools to promote those technologies can be valuable to foster innovation within the ecosystem (MacGregor et al., 2010). Last, it is helpful to provide knowledge and information in a simple language, so that it can be assimilated by all stakeholders, independent of their background and capabilities (Rampersad et al., 2010).
- ***Strong relationships among stakeholders.*** The strong relationships in innovation ecosystems depend on trust that stakeholders have in each other, which means that stakeholders keep their promises, demonstrate integrity and are transparent (Rampersad et al., 2010). Relationships in the innovation ecosystem can be fostered by creating networking opportunities that bring the stakeholders in the ecosystem into conversation with each other. This can for example be organised through open coffees, topic workshops, showcases, social programs, and speed dating (MacGregor et al., 2010).
- ***Shared vision.*** To foster innovation, a common vision and goals among ecosystem stakeholders is important (Pellikka & Ali-Vehmas, 2016; Rampersad et al., 2010; Yaghmaie & Vanhaverbeke, 2020). The development and maintenance of the common vision can be fostered by an ecosystem leader (Gomes et al., 2018; Rampersad et al., 2010; Yaghmaie & Vanhaverbeke, 2020).
- ***One ecosystem leader for governance.*** For innovation ecosystems it is valuable to have one stakeholder appointed to govern the innovation ecosystem. This ecosystem leader should be responsible for resolving challenges, understanding the variety of stakeholders and bring them together, utilising the competences of each stakeholder,

establish proper strategies to go beyond simple relationships, and ultimately shape the innovation processes (Gomes et al., 2018; Rampersad et al., 2010; Yaghmaie & Vanhaverbeke, 2020). Especially because of the variety of stakeholders with different backgrounds, collaboration in the innovation ecosystem does not always follow automatically, and benefits from one stakeholder who clearly leads the ecosystem (Gomes et al., 2018; Rampersad et al., 2010; Yaghmaie & Vanhaverbeke, 2020). But, the ecosystem leadership does not need to be too rigid, as too controlled leadership can hinder creativity for innovation (Gomes et al., 2018) and allows some space to let stakeholders make their own decisions (Yaghmaie & Vanhaverbeke, 2020).

- ***Willingness of partners to share resources.*** Innovation ecosystems are built on the idea that individual stakeholders complement each other. This means that the innovation ecosystem depends on the resources that innovation ecosystem stakeholders share their resources within the ecosystem: their knowledge, skills, and monetary resources (Pellikka & Ali-Vehmas, 2016; Yaghmaie & Vanhaverbeke, 2020). To encourage the willingness to contribute to the ecosystem, it can be helpful to ensure that all ecosystem stakeholders benefit from their commitments to the ecosystem, by ensuring that all feel compensated for their efforts (Yaghmaie & Vanhaverbeke, 2020).

3.2.2.5. Contextual factors for effective ecosystems

- ***Regional policies to foster innovation.*** Regional public policies can stimulate the collaboration for innovation in a region, by creating a valuable environment for innovative collaborations (Vlaisavljevic et al., 2020; Zheng & Cai, 2022). Innovative collaborations can be supported by regional policies that bring the different stakeholders together and help them foster relationships (Vlaisavljevic et al., 2020). Furthermore, regional policies can attract businesses by, for example, offering rental locations, services for new business establishments and favouring contact with business development companies. Moreover, regional policies can stimulate the attraction and maintaining of human capital in the region, by improving the attractiveness of the region, the quality of life for residents, culture, and sustainability (MacGregor et al., 2010).
- ***Trans local connectivity with likeminded initiatives.*** To foster the local regional collaboration in innovation ecosystems, stakeholders in the ecosystem must be willing to build partnerships across geographical and sectoral partners to complement the knowledge and capabilities that are available in the local innovation ecosystem (Vlaisavljevic et al., 2020; Zheng & Cai, 2022).

3.2.3. **Social innovation ecosystem framework** to address societal challenges through social innovation

3.2.3.1. Focus of the framework

The last framework that provides a valuable understanding of ecosystems in the digitalisation of energy, is the framework of social innovation ecosystems. **Social innovation ecosystems aim to address societal, political, economic, and environmental challenges through collaborative innovation efforts.** Social innovation ecosystems thus differ from innovation ecosystems, as social innovation ecosystems put societal challenges into focus, whereas innovation ecosystems focus on innovation that is often more technology focused. Social innovation changes our social practices and relations. Social innovation can for example impact the way we live, travel, work, handle crises (Domanski et al., 2020; Pel et al., 2020; Terstriep et al., 2020).

Like the innovation ecosystem concept, the 'eco' aspect underlines that social innovation is understood as a process that involves various stakeholders. Social innovation is understood to be shaped by an interactive learning process that involves networked stakeholders, that are embedded in a specific socio-cultural context (Pel et al., 2020; Terstriep et al., 2020).

The social innovation ecosystem concept is often used in the local context, both to urban and rural areas, where societal challenges are often addressed at local scale in for example 'smart,' 'green,' 'resilient' cities (Domanski et al., 2020; Terstriep et al., 2020).

3.2.3.2. Involved stakeholders

Social innovation ecosystems are often built on cross-sectoral collaboration. **Core actors in social innovation ecosystems are often non-governmental organisations (NGOs) and public authorities.** Other stakeholders often involved are private companies, research and education organisations, foundations, individuals and networks, social enterprises (Terstriep et al., 2020). Often social innovation ecosystems involve society by involving users and beneficiaries, also as a knowledge source for understanding the societal challenges (Domanski et al., 2020). So, like innovation ecosystems, the social innovation ecosystems can include all helix actors, but do not necessarily need to.

3.2.3.3. Insights for digital-energy ecosystems

As digitalisation of energy entails system-wide changes for a more sustainable energy system, like participation in demand response flexibility, the integration of renewable energy sources, and the increase of energy communities (International Energy Agency, 2017), the application of digitalisation of energy can be understood as social innovations. **The social innovation ecosystem framework offers insights on how stakeholder collaboration can foster the social innovation for digitalisation of energy, often related to the implementation of digital energy solutions.**

3.2.3.4. Internal factors for effective ecosystems

- ***Variety of stakeholders.*** Social innovation ecosystems build upon the collaboration of a diversity of stakeholders (Audretsch et al., 2022; Domanski, 2018; Terstriep et al., 2020). Key actors for social innovation are non-governmental organisations and public authorities, which can be complemented by other stakeholders (Terstriep et al., 2020). The variety of stakeholders allows to bring together complementing capabilities, and knowledge backgrounds (Domanski, 2018).
- ***Knowledge in ecosystem.*** Knowledge and skills are necessary for a social innovation ecosystem to flourish (Domanski, 2018). Universities can play a key role in this, but all stakeholders in the ecosystem should put effort in the development of their skills and knowledge (Domanski, 2018). Furthermore, interactions with similar like-minded initiatives can help ecosystems to gain knowledge (Chueri et al., 2019; Terstriep et al., 2020).
- ***Addressing local needs.*** As social innovation ecosystems often aim to address local societal challenges, the local embedding of the local innovation ecosystem is key for understanding local needs (Pel et al., 2020; Terstriep et al., 2020). This can entail collaboration with local stakeholders, including local authorities, NGOs, community organisations, businesses, and educational institutions. This is important to ensure the social innovation addresses local needs and gains legitimacy (Pel et al., 2020). Local embedding to address local needs can also entail more participatory governance (Terstriep et al., 2020).

- ***Financial resources.*** For social innovation ecosystems the lack of financial resources is the most often identified challenge (Domanski, 2018). It can be challenging to fully cover the costs of social innovation with revenues from the social innovation (Audretsch et al., 2022). Often main financial resources come from within the ecosystem itself (Domanski, 2018). The type of financial resource differs among different stakeholder types in the innovation ecosystem. For example, social entrepreneurs can be self-sustaining, whereas non-profit stakeholders might be based on voluntary associations (Audretsch et al., 2022).

3.2.3.5. Contextual factors for effective ecosystems

- ***Experimental space.*** Social innovations can be stimulated with experimental spaces, like 'incubators', 'social innovation labs', or 'living labs'. Those experimental spaces can bring stakeholders together to make new sense of the social innovation, and can offer the social innovation ecosystem an innovative milieu to experiment in (Domanski et al., 2020; Terstriep et al., 2020).
- ***Social innovation culture.*** For social innovation to flourish, it is helpful that there is culture of social sensibility surrounding the ecosystem. This means that it is essential that the culture is focused on aspects like ethics, awareness and understanding of societal problems, altruistic behaviour, collective thinking and acting (Audretsch et al., 2022).
- ***Trans local connectivity with like-minded initiatives.*** Connection with other likeminded social innovators can be valuable for social innovation ecosystems to exchange knowledge and experience (Pel et al., 2020; Terstriep et al., 2020). So, the interaction does not need to be focused on growth and upscaling of the existing local activities, but rather can focus on the knowledge and experience exchange among likeminded initiatives. A challenge in embedding in these trans local networks can be the scarce resources that social innovation ecosystems often have to deal with (Terstriep et al., 2020). These trans local connections can furthermore help in collective funding acquisition and raising a collective political voice (Pel et al., 2020).
- ***National policy.*** Social innovation aims for new daily practices, that can require institutional change. This means that social innovations often must deal with regulations and governance that puts boundaries on social innovation. National policy can be needed to enable experimental spaces for social innovations (Terstriep et al., 2020). Furthermore, funding is one of the key challenges for social innovation ecosystems, as they are often poor in terms of resources for social innovations. Often their own resources are their main financial source (Domanski, 2018). Public funding can be a valuable promoter of social innovation ecosystems (Audretsch et al., 2022; Domanski, 2018).

3.2.4. Conclusion on the three frameworks on ecosystems

Section 3.2 investigated the three theoretical frameworks that we identified to have valuable insights for the ecosystem types we will engage with in our project: the helix models framework, the innovation ecosystems framework, and the social innovation ecosystem framework. In this section we investigated those frameworks more thoroughly. During this analysis, five dimensions of those frameworks were found to be key to understand for the aims of project. The representation of our analysis in this section is therefore structured according to those five dimensions: focus of the framework, involved stakeholders, insights for digitalisation of energy ecosystems, internal factors for effective ecosystems and contextual factors for effective ecosystems. A summary of the key findings on each of the three frameworks, structured by the five dimensions, can be found in Table 2.

The analysis highlights that each framework offers a different but related perspective that is valuable for the ecosystems in the Every1 project. **Each of the three frameworks offers a unique angle to understand ecosystems, each framework with different focus points and therefore different ways of providing insights to digital-energy ecosystems. The frameworks can complement each other and are not mutually exclusive.** For example, both innovation ecosystems and social innovation ecosystems can potentially benefit from involving all helix actors in the ecosystem. Moreover, technology focused innovation ecosystems can potentially benefit from expanding their focus to also societal aspects of innovation, thereby benefiting from insights from both innovation and social innovation frameworks. The other way around can also be possible: social innovation ecosystems that can benefit from understanding how they develop technological innovations with the help of the innovation ecosystem framework.

Furthermore, the dimensions offer a valuable lens to understand the frameworks. Especially the first three dimensions are relevant to understand which framework is most valuable for which types of ecosystems. This is important, because **which framework can provide valuable insights depends on the specific ecosystem in practice.** Because the ecosystems the Every1 project engages with in practice are diverse, it is valuable to have an overview of various frameworks that can provide insights in ecosystems, to be able to use the most applicable insights for each unique ecosystem we engage with. To understand which framework is valuable in which situation, especially the first three dimensions we identified in our analysis are helpful. The ***focus of the framework*** dimension explicitly puts forward the unique angle the framework offers. The ***involved stakeholders*** dimension highlights which types of stakeholders are often key in this type of framework. The frameworks are especially relevant for the ecosystems that also focus on these types of stakeholders. The ***insights for digital-energy ecosystems*** dimension spells out how the framework can be helpful for ecosystems in the digitalisation of energy, which points the situations and ecosystem types for which the framework can be especially relevant in the digitalisation of energy.

Moreover, the other two dimensions of the analysis, ***internal factors for effective ecosystems*** and ***contextual factors for effective ecosystems,*** offer key insights on what factors shape effective ecosystems. The analysis of internal and contextual factors that shape the effectiveness of ecosystems, points towards the need to understand ecosystems in practice in their own context and in relation to their own ecosystem objectives. **Factors for effective ecosystems are not a one-size-fits-all. Nevertheless, the factors for effective ecosystems identified in this section are key starting points for understanding the effectiveness of ecosystems.** We found that each of the ecosystem frameworks puts forward a particular set of factors for effective ecosystems, from the angle that the framework provides. When comparing the factors amongst the three different frameworks, we found that there are some factors unique to a specific framework. **But, we also found some factors that are put forward to be key in all three frameworks, which are:**

- ***Variety of stakeholders.*** All three frameworks are built upon the idea that synergies can be created when a variety of complementing stakeholders works together. Each framework emphasises the importance of certain stakeholders over others, but all depart from the understanding that synergies arise from involving a variety of stakeholders.
- ***Knowledge.*** Each of the three frameworks emphasises knowledge as an important theme to foster ecosystems. The knowledge focus depends on the framework, but we found that the knowledge availability and transfer within the ecosystem is important in all three frameworks.
- ***Policy context.*** In each of the three frameworks it was found that regional or national policies can support ecosystems. The exact way in which policy context plays out differs, but the theme is found to be important in all three frameworks.

- ***Trans local connectivity to likeminded initiatives.*** For all three frameworks it was put into focus that it is valuable to be able to share knowledge and experiences with similar initiatives, for which networks of ecosystems can be helpful.

The insights can inform strategies for engaging with digitalisation of energy ecosystems, on both objectives of the ecosystem engagement:

1. ***Co-creation of tailormade learning materials.*** The analysis provides insights on how ecosystems operate, and what factors are important to consider in their operations. This helps to understand how we can co-create learning materials together with the ecosystems. For example, the analysis emphasises that knowledge is a key theme in ecosystems, in different ways depending on the framework, meaning that learning materials can play a different role in different ecosystems. Furthermore, we learned that ecosystems often consist of a variety of stakeholders, which each have different needs and roles. This underlines the importance of tailor making learning materials not only to the ecosystems, but also to the variety of stakeholders within an ecosystem. Furthermore, we learned that for social innovation ecosystems it is important to have knowledge about local societal challenges and needs, whereas innovation ecosystems face more challenges with getting all stakeholders informed about technological insights.
2. ***Ecosystem design guidance.*** In WP5 support to ecosystems will be offered as part of the ecosystem engagement. The overview of factors for effective ecosystems can be valuable to assess how existing ecosystems operate and where they can be improved and supported. One way in which the Every1 project will provide support to the ecosystems, is by offering **networking opportunities** among ecosystems, which was identified to be a key factor amongst all three ecosystem frameworks. Furthermore, the overview of factors offers a structure to explore approaches those existing ecosystems use to address those factors. This can be an inspiration for ecosystem support.

Table 2 summarises the findings of this section. **Next, in section 3.3, the insights on factors for effective ecosystems will be explored by key informants on ecosystems in practice.** This will give us insights in approaches those existing ecosystems use to address those factors for effective ecosystems. This will explore the opportunities that the theoretical findings can have for our work in the Every1 project in practice, and will give us insights on example approaches.

Dimension	Helix Models	Innovation Ecosystems	Social Innovation Ecosystem
Focus of the framework	Focus on the collaboration **for synergies between diverse stakeholders.**	Focus on collaboration to co-create **value through innovation**, often with technology focus, often in cross-sectoral collaboration.	Focus on collaboration to **address societal challenges** through social innovation, often in cross-sectoral collaboration.
Involved stakeholders	- **Triple Helix:** academia, governance, industry - **Quadruple Helix:** academia, governance, industry, *society* - **Quintuple Helix:** academia, governance, industry, *society, environment*	Often include focal firm, and other stakeholders like: customers, suppliers, and universities. Can be supported by local authorities.	Key stakeholders are non-governmental organisations and local public authorities. Other stakeholders often involved are private companies, research and educational organisations, foundations, individuals, and social enterprises.
Insights for digital-energy ecosystems	Provides insights on how different stakeholders can collaborate to foster the digitalisation of energy. Shows how individual stakeholders relate to other types of stakeholders in the collaboration. Especially relevant for ecosystems who aim to involve a variety of stakeholders.	Provides insights on how different stakeholders can collaborate to foster technological innovations that stimulate the digitalisation of energy. Especially relevant for ecosystems focused on technological innovations through collaboration with various stakeholders.	Provides insights on how different stakeholders can collaborate to support the application of digitalisation of energy through social innovation, which is often related to the implementation of digital energy solutions. Especially relevant for ecosystems focused on social innovations.
Internal factors for effective ecosystems	• Variety of stakeholders • Quadruple helix: reflexive involvement of society • Knowledge transfer • Education opportunities • Shared vision • Ecosystem governance	• Variety of stakeholders • Knowledge transfer and management • Strong relationships among stakeholders • Shared vision • One ecosystem leader for governance • Willingness of partners to share resources	• Variety of stakeholders • Knowledge in ecosystem • Addressing local needs • Financial resources
Contextual factors for effective ecosystems	• Presence of stakeholders in a region. • Trans local connectivity to like-minded initiatives.	• Regional policies to foster innovation. • Trans local connectivity to likeminded initiatives.	• Experimental space • Social innovation culture • Trans local connectivity to likeminded initiatives • National policy

Table 2 - Summary of ecosystem frameworks analysis

3.3. Exploring insights from practice

In this section we explore how ecosystems address the factors for effective ecosystems identified in section 3.2. This exploration is based on insights from two key informants on ecosystems in practice: a coordinator of the Flemish cluster Flux50, and a coordinator of the International Cleantech Network (ICN) which networks 19 clusters of organisations. First, each key informant decided about the ecosystem framework based on which they would like to reflect, by identifying which framework is most applicable and relevant to their ecosystems. Next, the key informants reflected upon their ecosystems' approaches to our theoretically identified factors for effective ecosystems. This section continues with the exploration of Flux50 in section 3.3.1, and the exploration of ICN in section 0, after which conclusions are drawn based on these explorations in section 0.

3.3.1. Flux50 reflections on factors for effective innovation ecosystems

The first reflection is done by the coordinator of the Flux50 cluster. Flux50 is a Belgium cluster that aims to let the region Flanders flourish as a Smart Energy Region. The cluster fosters cross-sector collaboration on different aspects: energy, IT, and building (Flux50, n.d.-c). **The Flux50 coordinator reflected on the factors for effective ecosystems put forward in the *innovation ecosystem framework*, because one of the ways in which Flux50 supports its members is by facilitating innovative projects** (Flux50, n.d.-a). Flux50 aims to foster innovative and fully integrated energy products and services to the market (Flux50, n.d.-c). Their cluster brings together stakeholders from academia, industry, and government (Flux50, n.d.-c), which is also in line with the focus of the innovation ecosystem framework. Furthermore, we theoretically identified that the innovation ecosystem framework is especially applicable for digital-energy ecosystems that focus on collaboration to bring new innovative solutions to the market, which also fits with the work of Flux50. Next, Flux50 reflected on their approaches to the theoretical factors for effective innovation ecosystems, as shown in Table 3.

Factors for effective innovation ecosystems	**How does Flux50 approach this factor for effective innovation ecosystems?**
Internal factors	
Variety of stakeholders	Flux50 is strong on this aspect as we are organised following the quadruple helix model, because we do need collaboration and exchange amongst this variety of stakeholders to facilitate innovation. To ensure a full coverage of stakeholders within a field of innovation, **we map the value chains of these innovation topics to ensure a full coverage of stakeholders within that field of innovation**. This is often a cross-sectoral collaboration as well. When mapping value chains and innovation roadmaps we identify gaps in our stakeholder relations. When these stakeholders are critical in the realisation of the roadmaps, we should engage with them.
Knowledge transfer and management	Flux50 is the beacon in the complex and fast-moving world of energy. We guide members towards the right information, sources, and partners to accelerate their innovation agendas. **This is done on an ad-hoc basis, as well as in a structured manner through project dissemination, inspiring events, round tables, etc.**

	Furthermore, Flux50 understood the call for skills and training to up and reskill workforce to realise the energy transition. To contribute to this shortage**, we participate in 'educational projects' such as competence prognosis, training, and other educational tools development.** Moreover, **the partnership between business and educational and learning institutes is crucial to grow and invest in the skilled workforce needed for the energy transition. Projects help in achieving common action plans.** Flux50 is building a network of start- and scale-up advisors, investors, etc., and working towards strategic partnerships with innovation accelerators.
Strong relationships among stakeholders	Flux50 can be seen as the spider in the web of the complex energy transition field in Flanders. Flux50 is a network organisation facilitating collaboration amongst stakeholders. To grow, and value the network we organise for example **inspiring events, knowledge exchange and member exposure.** Besides, **we recently updated our membership model to valorise more each stakeholder's position and input.** Members can choose for a basic membership to follow what is happening from the sideline, but could also decide to participate more actively on a business or strategy level. We offer them for example more tailored services, exposure, thematic challenges, and matchmaking events. This will strengthen the relationships between these active stakeholders.
Shared vision	**Together with its members, Flux50 designs and maps innovation roadmaps on priority topics** which are translated into action plans as well as policy documents to advise government. In addition, **Flux50 organises thematic working groups and learning networks on important topics such as batteries, digitalisation, energy communities.** This enables exchange amongst the involved stakeholders and contributes to a shared vision of the way forward. In this work, emerging trends may lead to new priority topics to focus on. Therefor it remains important to detect and follow-up on these strategic priorities within the network.
One ecosystem leader for governance	**Flux50 is mandated to organise the regional energy cluster**. As energy might be a topic in other sectors such as food, health, logistics, harbours, we often collaborate with the clusters operating in the specific domain.
Willingness of partners to share resources	Members are open to share when it benefits their own agenda, and as far as their project allows. **In general, the topics discussed are interesting and wide enough to allow valuable interaction.**
External factors	

Regional policies to foster innovation.	Flux50 is mandated by the regional (Flemish) government to accelerate the energy transition in Flanders through innovation and collaboration. **The Flux50 roadmaps are translated into policy documents to share the sectoral view with and advise the government.** Politics are biased, by definition, uncertain, and not so long-term. **Flux50 works towards more structural positioning in the innovation and energy arena and maintains strong relationships with the relevant public actors.**
Trans local connectivity to like-minded initiatives	Besides its regional scope Flux50 has an international agenda to support local innovation worldwide and to connect with the international energy innovation action. **We accomplish this through participation in and coordination of a variety of international projects funded by the European Union. In addition, we are a structural partner of the regional foreign affair services (Flanders Investment & Trade) to contribute to their energy innovation agenda.**

Table 3 - Flux50 reflection on factors for effective innovation ecosystems

3.3.2. ICN reflections on factors for effective helix ecosystems

The second reflection on the theoretical factors for effective ecosystems is done by coordinators of the International Cleantech Network (ICN). ICN is a network of 19 cleantech cluster organisations (ICN, n.d.-a). The ICN coordinators thus have insights on a variety of cleantech cluster organisations. They will assess the ICN ecosystems based on what they see as general trends among the variety of ecosystems, which provides insights in a range of ecosystems. First, an ecosystem framework had to be selected to reflect upon. **As ICN explicitly includes clusters that are based on a triple-helix structure** (ICN, n.d.-a)**, this is what all ICN member clusters have in common, it was decided that the helix model framework would be most relevant to guide the reflection.** The reflection of ICN on the factors for effective helix ecosystems is presented in Table 4.

Factors for effective helix ecosystems	**How do ICN clusters approach this factor for effective innovation ecosystems?**
Internal factors	
Variety of stakeholders	To join the International Cleantech Network (ICN) clusters are required to be triple helix organisations, meaning that the clusters should engage industry, academia, and the public sector. This requirement is based on the assumption that innovation happens in the intersection between different helices. The clusters might have different approaches to engaging the different stakeholders, and some might have a stronger focus on one of the categories. In general, many clusters have a stronger focus on SMEs, but all include the wider innovation ecosystem. **All clusters in this way engage a variety of stakeholders to connect the entire innovation ecosystem. This is a key feature of the cluster organisations and necessary for them to be able to function.**

	In ICN, as all clusters are somehow within the cleantech area, the natural environment (as in the quintuple helix) is almost always considered. However, this is a result of the thematic focus on cleantech, and within the digitalisation of energy area many projects/activities would also include a focus on the natural environment.
In case of quadruple helix: reflexive involvement of society	**Most oftens society stakeholders (citizens) are not included as members of clusters, however, some cluster activities could have an element of citizen engagement**. E.g., needs assessment workshops and co-creation workshops around challenges in cities, would often include users'/impacted citizens' perspectives.
Knowledge transfer	Clusters facilitate knowledge transfer in a number of ways. It could be through topic specific events or webinars, or through matchmaking sessions that can lead to longer collaboration between stakeholders from different spheres. **The cluster organisation can often function as a mediator of the knowledge transfer**. As clusters are used to collaborating with many different stakeholders, clusters can sometimes engage in facilitating dialogues and help mitigate the challenges caused by difference in stakeholders' organisation, norms, priorities, etc. The cluster organisation can often also guide a member to the right partner or place if they are looking for specific knowledge that they do not know where to find. In this way the clusters have the overview of where different knowledge is in the ecosystem.
Education opportunities	Clusters provide training and support on a lot of different areas. **Most clusters will offer some kind of training and capacity building through their activities, but some clusters are more focused on this than others.** Examples could be accelerator programs where businesses can receive support in scaling their business, funding workshops or guidance to navigate available funding for internationalisation, innovation partnerships, piloting etc, or webinars where participants can learn about a specific topic. Another example is capacity building for e.g., municipalities in how to do tenders more aimed at SMEs and/or Innovation, or for SMEs on how to navigate public tender processes. These are examples of capacity building activities that would at the same time strengthen knowledge transfer capabilities in the ecosystem.
Shared vision	The clusters are often topically focused e.g., on energy. This focus can be more or less broad. **The clusters will have a vision guiding their activities and priorities and the cluster is instrumental in engaging the ecosystem around this vision.**
Ecosystem governance	The cluster organisation governs the ecosystem it networks. The priorities and direction of the cluster might be influenced by national/regional cluster strategies, or national competitiveness strategies. **Where the cluster is anchored might also affect the direction of the cluster. We see examples of some clusters being a part of the city/municipality, some being strongly mandated by the local/regional/national authorities, and some being anchored in universities.**
Contextual factors	

Presence of stakeholders in a region	The geographical focus of the clusters varies. Some are regionally focused, e.g., Tenerrdis in Grenoble, France, is focused on the Auvergne-Rhone Alps region, CLEAN in Denmark is nationally focused, and Green Tech Valley in Graz, Austria, has been expanded from covering one to two regions: Styria and Carinthia. **This means that sometimes the cluster organisations do connect stakeholders who are present in a specific region however, sometimes they also do this engagement across quite large geographical areas**. The idea of the cluster organisation is largely to mimic the synergies which can naturally occur in a physical cluster (Silicon Valley being the most famous example). The cluster organisation in this way, eliminates the need for the stakeholders from across the helices to be present in geographic vicinity. The cluster organisation will help facilitate the collaboration that could also have happened by these organisations knowing each other through being located close. **This of course means that cluster organisations in general need to be very aware of their innovation ecosystem to be able to help make these connections effectively.**
Trans local connectivity to like-minded initiatives	**Clusters being a member of ICN is a clear way of connecting to initiatives outside of the cluster's own ecosystems.** Clusters in the ICN in general favour international collaboration and are happy to bring opportunities to share with each other. **By connecting and collaborating through the ICN, the clusters are able to better support their local cluster ecosystem.** This enables the clusters to connect actors in their local ecosystem with relevant stakeholders across the world. The ICN also encompasses cluster organisations with different thematic focus. The cluster are broadly within the area of cleantech. Through the ICN, collaboration can be facilitated e.g., in the nexus between energy and water, or energy and circular economy. Examples could be collaboration on limiting water use in energy production, or recycling of batteries. **Outside of the ICN, many cluster activities are part of projects which also include collaboration across regions.** From the ICN, it is therefore clear that the clusters have a strong outlook and capability of connecting their own ecosystem with likeminded initiatives.

Table 4 - ICN reflection on factors for effective helix ecosystems

3.3.3. Conclusion on insights from practice

The exploration of approaches for effective ecosystem factors in practice has provided us with first insights on the way in which ecosystems operate. As shown in the analysis, the reflections based on the theoretically identified factors create an understanding of the activities that ecosystems undertake to address those factors. **This is helpful for our work in the Every1 project, as the identified factors are thus a valuable lens to explore the operations of the ecosystems with whom we engage.** The identified factors have shown to be relevant for the ecosystems in practice.

Second, the exploration shows us approaches those existing ecosystems use to address those factors for effective ecosystems. **This gives us insights in concrete example approaches that can also be beneficial for other ecosystems we will engage with**. In this way, those insights can thus help us in supporting ecosystems in their work through ecosystem design guidance.

Last, this exploration we now focused on cluster organisations, which are a key type of ecosystems we will engage with. **This can also be a starting point for exploring approaches used by other types of ecosystems we will engage with, like energy communities and local authorities.**

4. Ecosystem engagement strategies

In this chapter, we draft the engagement strategies that we will use in the Every1 project to support ecosystems in the digitalisation of energy. **Through the engagement with ecosystems, the everyone project aims to support everyone to take up their role in the digitalising energy system.** We build upon D1.1 and D1.2 in which we already specified the ecosystem types with whom we aim to engage with in the Every1 project. We make a distinction between existing digital-energy ecosystems and new-to-digital-energy ecosystems:

1. **Existing digital-energy ecosystems** already work on the topic of energy and digitalisation. By engaging with those ecosystems, we thus engage with ecosystems for whom digital energy is close to their daily business. D1.2 identified three types of existing digital-energy ecosystems on which we will focus in the project: energy communities, local authorities, and clusters of organisations.

2. **New-to-digital-energy ecosystems** are not working on the topic of energy and digitalisation. These ecosystems will be engaged to reach stakeholders who are less familiar with the energy and digitalisation. The Every1 project can support the new-to-digital-energy ecosystems to become digital-energy ecosystems who are familiar with the topic. In D1.2 several new-to-digital-energy ecosystems were identified to engage with in the Every1 project, with specific focus on reaching marginalised groups. The identified new-to-digital-energy ecosystems explore engagement opportunities with are the following: social welfare organisations, religious communities, elderly associations, disability associations, sport associations, consumer, and producer organisations.

We engage with both types of ecosystems. The purpose of ecosystem engagement in the Every1 project has two components:

1. **Tailormade learning materials through co-creation approach.** This component of engagement has the specific focus of developing tailormade learning materials to support the ecosystem members and coordinators to take up their role in the digitalising energy system. By engaging with ecosystems, we can co-create the learning materials to ensure the learning materials address needs from practice. The outcome of this component is the developed tailormade learning materials that can support ecosystems. The co-creation of learning materials takes place in *WP3 From knowledge gaps over learning paths to identifying training material needs* and *WP4 Knowledge creation, capacity building, and training materials.*

2. **Ecosystem design guidance through the EXPLORE-SHAPE-UNITE approach.** With this component we offer broader support to the ecosystems. With the EXPLORE-SAHPE-UNITE approach we aim to support ecosystems in their work, by stimulating and facilitating the creation of new initiatives, business cases, and projects that the ecosystems can take up. First, in the explore stage, ecosystems explore the opportunities for new initiatives. Second, in the shape stage, the initiatives are shaped into more concrete viable initiatives. Last, in the unite stage, different stakeholders are united to operationalise the new initiatives. Through this support to ecosystems, we aim to offer support to their members. Especially the explore and shape stage can valuably benefit from the learning materials developed in the first component of engagement. The EXPLORE-SHAPE-UNITE approach is supporting both existing and new-to-digital-energy ecosystems, but is especially valuable for new-to-do-digital-energy ecosystems, as those ecosystems have no experience with setting up new digitalisation of energy initiatives with which the approach aims to support. This support will be offered with the EXPLORE-SHAPE-UNITE approach as part of *WP5 Maximising impact.*

To understand how we can practice engagement that can support these ecosystems, we answer in this chapter **sub-question 2: *what engagement strategies can be used to support ecosystems with the Every1 project?*** To answer this question, we take an encompassing understanding of engagement. **We understand engagement with ecosystems as all forms in which the interaction of ecosystems with the Every1 project can unfold.** This has two implications for the engagement strategies we develop in this chapter.

First, this encompassing understanding underlines that there is a variety of ways in which ecosystems can interact with the Every1 project. We do not assume that there is one ideal engagement strategy that fits all ecosystems. Instead, we will adjust our engagement strategies to the needs of the variety of ecosystems that we will engage with, and address the needs as they evolve during the project. In this way our engagement approaches are guided by state-of-the-art critical literature about engagement. This state-of-the-art critical engagement literature emphasises the importance of context sensitivity and flexibility in engagement approaches. In order to approach engagement in a contextualised and flexible manner, it is key to critically reflect on the way engagement evolves over time, and be open for unexpected responses from ecosystems (Chilvers & Kearnes, 2020). This critical state-of-the-art understanding in engagement literature aligns with findings from the BRIDGE initiative that put forward the need to assess engagement over time, to flexibly respond to stakeholder needs as they unfold (d'Herbemont et al., 2022). **Therefore, we focus in this chapter on the identification of potential building blocks of ecosystem engagement, that can provide starting points to develop the engagement strategies in more detail during the project. This enables us to respond to the needs for engagement as they unfold. We will therefore iteratively update our engagement strategies, in close collaboration with the ecosystems we engage with.**

Second, our encompassing understanding of engagement highlights that engagement starts from the moment an ecosystem interacts with the Every1 project for the first time, which is when we first reach out to ecosystems to enrol them in the Every1 project (Chilvers & Longhurst, 2016; Felt & Fochler, 2010). This encompassing understanding also means that we need to be responsible for the future implications of our engagement with the ecosystems (Chilvers & Kearnes, 2020). **Therefore, in our identification of engagement strategies we focus on the entire process of interaction between the ecosystems and the Every1 project, from the first contact till beyond the project ending.**

To structure our development of engagement strategies from the first interaction till beyond the project ending, **we distinguish three phases that each ecosystem can follow in their engagement with the Every1 project.** We distinguish these phases to be able to operationalise our encompassing theoretical understanding of engagement in the organisational structure of the Every1 project as set out in the project proposal. The different phases belong to different work packages and tasks in the structure of the project. As summarised in Figure 2, we distinguish the following three phases in engagement in the Every1 project:

1. **Enrolment**. First, the ecosystem needs to enrol in the project. The engagement starts at the first interaction between the Every1 project and the ecosystems, when opportunities for engagement are explored. When an ecosystem is enrolled in the project, this means that the ecosystem has formally committed to participate in the Every1 project. The enrolment phase is prepared and initiated in *WP1 Stakeholder and ecosystem characterisation* and continues in *WP5 Maximising impact.*

2. **Collaboration.** When the ecosystem is enrolled in the project, the phase of collaboration starts. This phase entails two parallel but related components:
    a. ***Tailormade learning materials through a co-creation approach*** in *WP3 From knowledge gaps over learning paths to identifying training material needs* and *WP4 Knowledge creation, capacity building,*

and training materials. This component specifically focuses on the co-creation of tailormade learning materials.

b. ***Ecosystem design guidance through the EXPLORE-SHAPE-UNITE approach*** in *WP5 Maximising impact*. This component offers broader support to ecosystems by supporting in the development of new initiatives, projects, and business cases. This component is especially relevant for new-to-digital-energy ecosystems to become more acquainted with setting up new initiatives in the digitalisation of energy. Additionally existing digital-energy ecosystems can also benefit from this approach. The tailormade learning materials can be an asset in the EXPLORE-SHAPE-UNITE approach to help ecosystems exploring and shaping new initiatives.

In this collaboration phase the details of the engagement strategies for the specific ecosystems will be drafted further together with the ecosystems, which will be iteratively updated depending on needs as they unfold during the project.

3. **Sustaining action.** When the project is about to end, we aim to sustain action to take responsibility of future implications of our engagement with the ecosystems. This means that we ensure that the efforts both the ecosystem and the Every1 project have put in the engagement have a long-term positive impact. This phase is explicitly embedded in WP5, *T5.5 Towards sustaining action.*

This chapter is structured according to the three phases of engagement we distinguish in the Every1 project: section 4.1 about enrolment of ecosystems, section 4.2 about collaboration, entailing both the tailormade learning materials and the ecosystem design guidance, and section 4.3 about sustaining action. For each of the phases, first the theoretical background that informs our strategies for that phase are elaborated upon, after which the strategies for the Every1 project are outlined.

Figure 2 - Phases an ecosystem moves through when collaborating with the Every1 project

4.1. Phase 1: Enrolment

The first phase of interaction between the Every1 project and ecosystems, is the enrolment phase. In this phase we aim to enrol both existing digital-energy ecosystems, and new-to-digital-energy ecosystems. **This phase starts at the moment the project reaches out to an ecosystem for the first time** (Chilvers & Longhurst, 2016; Felt & Fochler, 2010). In our pragmatic structuring of engagement in phases, this first phase of enrolment ends when ecosystems formally commit to participate in the Every1 project. This formal commitment is materialised by signing a commitment letter and move on to the collaboration phase.

4.1.1. Enrolment background

When asking ecosystems to participate in the Every1 project, the ecosystems need to decide if they would like to participate. This means that the ecosystem needs to assess if they are interested and able to participate in the Every1 project (Felt & Fochler, 2010; Irwin et al., 2012). The capacity to participate is not evenly distributed through society (Felt & Fochler, 2010). **To enable a variety of ecosystems to participate, we discuss with the potential ecosystems that we would like to define the engagement strategies in more detail during the project, to align this with their specific needs. At the same time, we aim at any time to be transparent about the boundaries of this flexibility to tailor-make the engagement strategies.**

4.1.2. Enrolment in the Every1 project

The preparations of the enrolment of ecosystems are embedded in WP1 *Stakeholders and ecosystem characterisation* from M1 until M12, where the stakeholders and their networks are mapped in D1.1, ecosystems are mapped in D1.2 and engagement strategies are developed in this D1.3. In line with this the enrolment process is initiated. The outreach to potential ecosystems continues in WP5 *Maximising impact* from M9 until M42 where additional ecosystems are reached out to.

By combining theoretical insights with practical considerations, we identified the following steps of enrolment of ecosystems:

1. **First outreach to ecosystems.** To start the interaction with the ecosystems, we reach out to them. In this first outreach we ask if the ecosystem would be interested in exploring opportunities for collaboration further in a meeting. We have three different strategies for this, to reach out to different ecosystems:
    a. ***Direct mails to ecosystems within the networks of our consortium partners.*** Our consortium consists of a variety of partners who are actively involved in the energy system, and have experience with collaborations with other actors in the energy system. Due to this active involvement and experience in the energy system, our consortium partners have valuable connections with ecosystems who could potentially benefit from engagement in the Every1 project. Reaching out to ecosystems who are in the networks of our consortium partners therefore offer a valuable starting point to engage with ecosystems in the digitalisation of energy. Part of the ecosystems to potentially engaged with mapped in D1.2 are from the networks of our consortium partners.
    b. ***Direct mails to ecosystems to ecosystems outside the networks on our consortium partners.*** Furthermore, because we want to be open for all ecosystems, we reach out to ecosystems who are not in

the networks of our consortium partners. D1.2 also maps potential ecosystems to engage with who are not in the networks of our consortium partners.

c. ***LinkedIn posts.*** To open up the enrolment in the Every1 project further, we made the opportunity to engage publicly known through our Every1 LinkedIn channel.
d. ***Involvement in single activities in the EXPLORE-SHAPE-UNITE approach.*** Once a suitable number of ecosystems are enrolled in the project and participating in activities in the support to the ecosystems through the EXPLORE-SAHPE-UNITE approach, new ecosystems who are not yet participating, will be asked if they would be interested in following some single EXPLORE-SHAPE-UNITE activities. When those ecosystems become interested in full enrolment in the project, they can continue to participate in additional other engagement activities of the Every1 project. This way of reaching ecosystems is part of WP5 *Maximising impact*.

2. **First meeting with the ecosystem.** When an ecosystem is interested in exploring the opportunities for collaboration with our project, we set up a meeting of approximately 30 minutes with the ecosystem. In this meeting we aim to inform the ecosystem about the opportunities for collaboration, learn from the ecosystem what their needs and wishes would be from engaging in the Every1 project, and brainstorm together on where we could help each other. This is an explorative meeting, without any obligations for the ecosystem to commit further. After this first meeting the ecosystem is asked to think about their decision to participate in the Every1 project.

3. **Signing a commitment letter.** When an ecosystem decides to participate in the Every1 project, the Every1 project and the ecosystem sign a commitment letter. This commitment letter entails one page in which an overarching outline of the participation is agreed upon, to make the engagement of the ecosystem in the Every1 project formal.

4.2. Phase 2: Collaborating

Once an ecosystem decides to enrol in the project and has signed the commitment letter, the ecosystem moves to the, what we call, collaboration phase of engagement. This phase addresses the main aim of engagement with ecosystems in the Every1 project, which is the support to ecosystems on two components.

1. First, we aim to develop **tailormade learning materials with the help of a co-creation approach**, as explained in section 4.2.1. The component has the specific aim of developing tailormade learning materials, for both existing digital-energy ecosystems and new-to-digital-energy ecosystems.
2. Second, we offer **ecosystem design guidance through the EXPLORE-SHAPE-UNITE approach**, to foster new initiatives in the digitalisation of energy, as explained in section 4.2.2. This component offers broader support to ecosystems, by fostering and facilitating new initiatives, business cases and projects in the digitalisation of energy. The EXPLORE-SHAPE-UNITE approach can benefit from the tailormade learning materials developed with the co-creation approach. The EXPLORE-SHAPE-UNITE approach targets both existing digital-energy ecosystems and new-to-digital-energy ecosystems, but is especially key for new-to-digital-energy ecosystems, as those ecosystems lack experience in setting up new initiatives for digitalisation of energy and therefore could benefit most from the support, we offer with the EXPLORE-SHAPE-UNITE approach.

4.2.1. Tailormade learning materials through co-creation approaches

In the first component of engagement, **we focus specifically on the development of tailormade learning materials about the digitalisation of energy through co-creation approaches.** In line with our encompassing understanding of engagement, we take an encompassing understanding of co-creation. **We understand co-creation of learning materials in the Every1 project as all activities that actively involve stakeholders in the development of the learning materials.**

4.2.1.1. Co-creation background

The co-creation concept originates from business and marketing contexts, where co-creation refers to a process in which consumers are contributing to the development of a product (Leino & Puumala, 2021). The concept of co-creation expanded its popularity to other sectors of society, as a method to foster democratic processes in knowledge production (Leino & Puumala, 2021). In the public context, co-creation holds promise to create fairer and more sustainable societies. **Public sector policy makers increasingly adopted co-creation as a way of citizen engagement and participation. In the public sector the terms co-creation and co-production are often used interchangeably, both referring to active citizen involvement in various phases of a development process** (Leino & Puumala, 2021; Voorberg et al., 2015). Co-creation in the public sector is found in various policy disciplines, of which education is one of them (Voorberg et al., 2015).

When analysing insights on co-creation to develop education, the Every1 project is less interested in the development of educational programs and curricula for schools and universities, but instead is especially interested in co-creation of learning materials that are openly accessible for a wide range of stakeholders, in line with our project aims. A relevant discussion guide and toolkit for co-creation of open learning materials was developed by the Open University and the ACCESS consortium, which informs the co-creation process in the Every1 project (Charitonos et al., 2021). The guide informs about key principles and tools to use when aiming for co-creation of learning and learning resources (Charitonos et al., 2021).

In this guide developed by the Open University and the ACCESS consortium, co-creation is understood as *"the critical mix of activities and knowledge/expertise that lead to the development of new or adapted programmes, resources, products, or services through regular, long-term relationships established between various stakeholders, where all these groups and individuals together make substantial contributions to, and use of the knowledge and other outputs generated"* (Charitonos et al., 2021, p. 5). This understanding underlines that continuous reflection is key during co-creation, because the mix of co-creation activities depends on the context, and co-creation does not always run in a predictable manner (Charitonos et al., 2021). This is in line with the flexibility in engagement strategies we aim to take based on our encompassing understanding of engagement as explained at the start of this chapter. **Therefore, we focus on the identification of building blocks that together outline a variety of ways that can be mixed and matched with the needs of ecosystems as they emerge during the project. The development and adjustments of the co-creation processes will be done in collaboration with the ecosystems themselves, to ensure that the co-creation process aligns with their preferences** (Charitonos et al., 2021).

Furthermore, the co-creation of learning materials will be informed by our insights on effective ecosystems in chapter 3. The factor ***knowledge*** was identified as relevant factors for effective ecosystems, showing the need of ecosystems for acquainting knowledge and transferring knowledge within the ecosystem. Our tailormade learning materials can contribute to addressing this need. Furthermore, the analysis of effective ecosystems provides insights on the ways in

which ecosystems operate. For example, the factor ***variety of stakeholders*** highlights that we should be aware that co-creating with an ecosystem often means that we co-create with a variety of stakeholders with different needs.

4.2.1.2. Co-creation in the Every1 project

In the Every1 project, the co-creation of learning materials takes place in *WP3 From knowledge gaps over learning paths to identifying training material needs* and *WP4 Knowledge creation, capacity building, and training materials.* **We structure the co-creation process for the development of tailormade learning materials in three elements.** This structure is based on the organisation of the project work in the proposal, and informed by the theoretical background on co-creation. We distinguish the following three co-creation elements:

1. **Understanding stakeholders.** First, focus is on the identification of the readiness level, knowledge gaps and capabilities of stakeholders for whom we will design the learning pathways and learning materials. This is done in *T3.1 Identifying knowledge gaps, and capabilities for all stakeholders,* which runs from M6 until M22.
2. **Learning pathways.** Furthermore, learning pathways will be designed in close collaboration with the ecosystems. Learning pathways entail the chosen route that a stakeholder takes through a variety of learning materials, allowing them to build their knowledge progressively. This will be done in *T3.3 Designing flexible, equitable open learning pathways for informing, engaging, upskilling and reskilling stakeholders,* which runs from M9 until M36.
3. **Learning materials.** Separate learning materials are co-created together with the ecosystems. The learning materials populate the learning pathways as identified in WP3. The separate learning materials will be co-created with the ecosystems, which means that the ecosystems can use the latest learning materials on digitalisation of energy, whilst the Every1 project gains insides in learning needs of the variety of engaged stakeholders in the ecosystems. First, the ecosystems will be engaged early on when the conceptual designs of the learning materials will be presented to the ecosystems for feedback, after which the materials will be developed and tested by the ecosystems. In the co-creation of learning materials, a distinction is made between online and offline materials.
    a. **Online learning materials.** The online materials are conceptualised and presented for feedback to the ecosystems in *T4.1 Developing online material*, which runs from M11 until M36. Next, once online materials are developed, the materials are tested by the ecosystems in *T4.2 Piloting, testing and validating the online training materials,* from M12 until M36.
    b. **Offline learning materials.** The co-creation of the offline materials starts in the conceptualisation of the materials in *T4.4 Developing information and engagement material,* in M12-M36. When the offline materials are developed, the offline materials will be tested by the ecosystems in *T4.5 Pilot, test and validate,* running from M12 until M36.

For each of the three elements of the co-creation process, we mapped activities that can potentially be used for co-creation in that component, as shown in Table 5.

Furthermore, we identified six overarching principles that will guide the full co-creation process and are important in all activities in all elements of co-creation. These principles are informed by the guide for co-creation by the Open University and the ACCESS consortium (Charitonos et al., 2021). We focus on the following principles:

1. **Start at early stage.** The co-creation starts with workshops to identify the readiness level, knowledge gaps and capabilities of stakeholders for who will develop learning materials. This ensures that we engage with the

stakeholders' experiences at an early stage of the learning material development, to give stakeholders power to impact the learning materials from the beginning and avoid power imbalances and ungrounded assumptions about stakeholders (Charitonos et al., 2021).

2. **Critical reflections.** During the entire co-creation process, we will critically reflect upon the implications of our process, and adjust and refine the process where needed. Reflections will for example focus on the power relations in the co-creation, and the distribution of interests and benefits from the co-creation activities. Based on the reflections, we will adjust and refine our co-creation strategies to the needs as they emerge (Charitonos et al., 2021).
3. **Create a common understanding by clear communication.** We aim for clear communication, to ensure all stakeholders share a common understanding of co-creation, the end-goal of our co-creation (Charitonos et al., 2021).
4. **Offer different formats to provide contributions.** As some stakeholders feel more comfortable in certain formats than others, we offer various ways in which stakeholders can contribute, to support contributions on equal basis (Charitonos et al., 2021).
5. **Be aware of language and translation.** We do not expect all stakeholders to speak proficiently English, so therefore we are aware that we will adjust the co-creation activities to local languages when considered needed by the ecosystem (Charitonos et al., 2021).
6. **Be aware of the difference between online and offline co-creation.** Although the purposes may be similar, online and offline co-creation activities differ in their set-up, which needs to be taken into account (Charitonos et al., 2021). Focus of our co-creation activities will be online, to be able to cover the wide geographical spread of ecosystems with whom we aim to engage. But, as we acknowledge that online co-creation will not be the most suitable format for every ecosystem and every type of learning material, we will also organise offline co-creation activities. The format of co-creation activities will be decided upon together with the ecosystems.

Co-creation elements	Aim	Potential activities
1. Understanding stakeholders	Identify readiness level, knowledge gaps and capabilities of stakeholders. Insights feed in the learning pathway and learning material development.	- Workshops with groups of stakeholders to discuss needs. - Interviews with key informants in the ecosystem, who have insights on important issues in the ecosystem. - Surveys to bigger groups of stakeholders, to understand the variety of needs among stakeholders.
2. Learning pathways	Develop learning pathways in collaboration with ecosystems. Learning pathways entail the chosen route that a stakeholder takes through a variety of learning materials, allowing them to build their knowledge progressively.	- Workshops with groups of stakeholders to explore learning pathway needs and verify potential learning pathway designs. - Interviews with key informants in the ecosystem. - Surveys to bigger groups of stakeholders, to understand the variety of needs.

3. Learning materials	Test the learning materials and receive feedback on it from the ecosystems.	- Workshops can be organised with various purposes:
		  ○ To use a learning material together as group, and discuss together how it can be improved.
		  ○ To have a generate feedback on learning materials when participants have tested several materials.
		- Interviews can be organised, to create in-depth feedback after the participant have been testing various learning materials. The interviews could potentially be conducted with the same participants that were interviewed earlier about their knowledge gaps in component 1, to see if their needs are met with the learning materials.
		- Surveys can be spread in various manners.
		  ○ After each tested learning material, the participant can be asked to fill in a short survey to provide their feedback.
		  ○ In addition, a more extensive survey could be sent after participants have been testing various learning materials.

Table 5 - Co-creation approach outline

4.2.2. Ecosystem design guidance through EXPLORE-SHAPE-UNITE approach

In parallel to the co-creation of tailormade learning materials, we offer a broader second component of support to the ecosystems. This second component entails ecosystem design guidance through the EXPLORE-SHAPE-UNITE approach. **The EXPLORE-SHAPE-UNITE approach aims to support ecosystems in developing new initiatives, business cases and projects in the digitalisation of energy.** The EXPLORE-SHAPE-UNITE approach consist of the following stages:

1. **EXPLORE.** The explore stage aims to explore knowledge, technologies, best practices, and solutions for ideas for new projects, business cases and activities that an ecosystem can take up.
2. **SHAPE.** This stage helps ecosystems to shape their ideas into improved potential solutions, offers, services and projects.
3. **UNITE.** This stage unites solution seekers and providers to bring the potential solutions, offers, services and projects further.

This approach helps thus to set up new activities in the ecosystem, which can be especially valuable for new-to-digital-energy ecosystems, as they are not familiar with this in the digital energy field. But, existing digital-energy ecosystems can also benefit from this approach and are welcome to participate. Furthermore, **the tailormade learning materials that are developed in parallel can be a valuable asset in the EXPLORE-SHAPE-UNITE approach,** to offer ecosystems the capabilities and knowledge to explore and shape the new initiatives, projects and business cases.

4.2.2.1. EXPLORE-SHAPE-UNITE background

The EXPLORE-SHAPE-UNITE approach used in the Every1 project, builds on the well-proven EXPLORE-SHAPE-DEAL approach and EXPLORE-SHAPE-ACT approach. These approaches offer a valuable structuring of the process of developing new initiatives, projects, and business cases in the digitalisation of energy.

1. **The EXPLORE-SAHPE-DEAL** approach from the ***Smart Cities Marketplace*** aims to support cities by supporting them in the development, implementation, replication, and upscaling of smart city solutions (European Commission, n.d.; Smart Cities Marketplace, n.d.). The EXPLORE-SHAPE-DEAL approach supports cities by first ***exploring*** opportunities for new projects in a city, ***shape*** these explored opportunities into more mature project proposals and make ***deals*** with suitable investors to finance the project.
2. **The EXPLORE-SHAPE-ACT** approach from the ***Clean energy for EU islands secretariat*** aims to support islands in their transitions towards clean energy. The ***explore*** stage targets islands that just started their clean energy transition, and guides the exploration of a vision for clean energy on the island. The ***shape*** stage the explored visions are further developed into more concrete projects. The ***act*** stage concretises the projects by setting up collaboration with relevant partners and obtaining suitable funding (Carrero et al., 2022).

In the Every1 project we are inspired by the EXPLORE-SHAPE-DEAL/ACT approaches, and adapted this for the Every1 project to the EXPLORE-SHAPE-UNITE approach. **This offers an insightful overview of the stages that ecosystems go through when exploring and initiating new initiatives, projects, and business cases to foster the digitalisation of energy.**

Furthermore, the operationalisation of the EPLORE-SHAPE-UNITE approach will be informed by our findings on effective ecosystems identified in Chapter 3:

- The factor **knowledge** is important for effective ecosystems, which includes both the availability and transfer of knowledge within the ecosystem. Insights on this factor are especially relevant for the **EXPLORE** stage that is focussed on offering capacity building opportunities.
- Next, the factor ***shared vision*** in the ecosystem was found to be relevant for effective ecosystems, which can offer valuable insights for the **SHAPE** stage in which the ideas for new projects, business cases and initiatives are shaped into more concrete proposals, thereby leading to a clearer shared vision.
- Moreover, we found effective ecosystems to be built on synergies between a ***variety of stakeholders***, showing a need to include stakeholders in the ecosystem that complement each other. Insights on factor of variety of stakeholders will be especially addressed in the **UNITE** stage, where stakeholders are united that can support each other.
- Furthermore, the factor for effective ecosystems ***trans local connectivity to likeminded initiatives*** shows another need to network ecosystems with each other. Insights on this factor will especially inform the **EXPLORE** stage, in which ideas are exchanged among different ecosystems. Insights on this factor can inform also the **UNITE** stage, in which initiatives are connected to work together on digital energy solutions.

4.2.2.2. EXPLORE-SHAPE-UNITE in the Every1 project

In the Every1 project, the EXPLORE-SHAPE-UNITE approach to offer ecosystem design guidance takes place in *WP5 Maximising impact,* from M11 until M42. We identified key aspects of the EXPLORE-SHAPE-UNITE approach for the Every1 project. These elements are informed by the EXPLORE-SHAPE-DEAL/ACT approaches from the Smart Cities

Marketplace and the Clean energy for EU islands secretariat, in combination with pragmatic considerations that align with the outline of our Every1 project structure as outlined in the project proposal.

Key aspects of the EXPLORE-SHAPE-UNITE approach in the Every1 project are:

- **The ecosystem design guidance is structured in three stages by the EXPLORE-SHAPE-UNITE approach.** In the explore stage, we support ecosystems in exploring opportunities for setting up new initiatives, projects, and business cases in the digitalisation of energy. In the shape stage, we support ecosystems in concretising the new ideas into viable new concrete initiatives, projects, and business cases. In the unite stage, we offer matchmaking between solution seekers and solution providers, to bring stakeholders together in operationalising the new initiatives, projects, and business cases. In Table 6 we provide an outline of the activities the Every1 project will offer in the different stages of the EXPLORE-SHAPE-UNITE approach.

- **In addition to these activities dedicated to the different stages of the EXPLORE-SHAPE-UNITE approach, we offer continuous support activities to the ecosystems that surpass the distinct stages of the approach.** These continuous support activities entail contact with a dedicated Every1 partner as a guide, for regular interaction, evaluation, and exchanges. Moreover, we will organise quarterly activities engaging the main local ecosystem leaders in e.g., joint webinars, an online café, networking on European and regional events. These continuing activities aim to make the EXPLORE-SHAPE-UNITE approach comprehensive across the three stages.

- **The EXPLORE-SHAPE-UNITE approach will be tailored to the specific needs of individual ecosystems.** The presented outline offers building blocks that can be 'mixed and matched' with the specific needs of engaged ecosystems. In this way, we can address the needs of ecosystems as they unfold during the project, in line with our comprehensive understanding of engagement.

- **The ecosystem design guidance offered by the EXPLORE-SHAPE-UNITE approach is key in our guidance to new-to-digital-energy ecosystems.** The new-to-digital-energy ecosystems are not active in the field of digital energy, and therefore have no experience with initiating new initiatives, projects, and business cases in the digitalisation of energy.
    - **Each of the EXPLORE-SHAPE-UNITE stages offers valuable guidance when aiming new-to-digital-energy ecosystems to become existing digital-energy ecosystems.** In the explore stage, the new-to-digital-energy ecosystems acquainting the necessary capabilities and knowledge about digitalisation of energy, with which they are not familiar when entering the project. In the shape stage, the ecosystems are guided in what it means to concretise initiatives in the field of digitalisation of energy. In the unite stage, the networks of the new-to-digital-energy ecosystems are boosted when we unite them with other stakeholders in the field of digital energy that the new-to-digital-energy ecosystems aim to enter.
    - **Moreover, ensure that the ecosystem design guidance is addressing the needs of the new ecosystems as they emerge, more detailed support strategies will be developed and iteratively updated together with the new-to-digital-energy ecosystems.** Potential initiator organisations will be contacted to discuss, evaluate and further co-design the approach and initiate its effective establishment as part of WP5. In this support to new-to-digital-energy ecosystems we will be informed by our findings on what makes effective ecosystems as explained in Chapter 3.
    - **Additionally, the EXPLORE-SHAPE-UNITE approach also targets existing digital-energy ecosystems.** The ecosystems who are already active in the field of digitalisation and energy are expected to benefit from the structure that our approach offers to the development of new initiatives. Moreover, engaging both

existing digital-energy ecosystems and new-to-digital-energy ecosystems is expected to create valuable synergies between the different ecosystems. For example, in round tables organised in the explore stage, it is valuable to include existing digital-energy ecosystems who can inspire and share best practices to the new-to-digital-energy ecosystems. Also, in the unite stage it is valuable to include both existing and new ecosystems, because this enables new-to-digital-energy ecosystems to collaborate with ecosystems that are more familiar with digitalisation of energy, from which the new-to-digital-energy ecosystems can learn. At the same time, this collaboration is also beneficial for existing digital-energy ecosystems, as the new-to-digital-energy ecosystems expand the market of digital energy, offering new business opportunities to the existing digital-energy ecosystems.

- **A valuable asset in the EXPLORE-SHAPE-UNITE approach will be the tailormade learning materials that are co-created in parallel to the EXPLORE-SHAPE-UNITE approach.** In the explore and shape phase, emphasis is on capacity building and knowledge sharing that can help the ecosystems to explore and shape their new initiatives, projects, and business cases. The tailormade learning materials developed in parallel can be a valuable way to foster the capacity and knowledge of the ecosystems.

Stage	Aim	Activities
1. EXPLORE	The explore stage aims to explore knowledge, technologies, best practices, and solutions for ideas for new projects, business cases and activities that an ecosystem can take up.	To enable ecosystems to explore, the Every1 project offers the ecosystems networking and capacity building opportunities, including: - Articles in different languages; - Round-table discussions with selected ecosystems; - Participation in local ecosystem events; - Enabling networking between the diverse ecosystems; - Webinars targeting local ecosystems or a grouping thereof; - Cascade promotion for the ecosystems with paid social media campaigns; - Social media ambassador networks; - Video training; - Short story telling movies in at least 10 different EU languages. The tailormade learning materials developed in the Every1 project can be valuable asset in this stage.
2. SHAPE	This stage helps ecosystems to shape their ideas into improved potential solutions, offers, services and projects.	This stage includes a sequence of webinars and online and physical workshops, informed by: - Identified best practices; - Methods for assessing the ROI and CBA of proposed solutions; - Continuous discussions with regulators, DSOs, and policy makers. The tailormade learning materials developed in the Every1 project can be valuable asset in this stage.

3. UNITE	This stage unites solution seekers and providers to bring the potential solutions, offers, services and projects further.	This stage is focussed on matchmaking and joint procurement, through: - Expansion of the already existing ICN marketplace platform, which will be linked to the project website and opened for linking to the websites of the local ecosystems to match solution seekers with solution providers locally and on the above-local level, and facilitate networking for joint procurement or collaboration initiation between solution providers; - All consortium partners will take topical responsibilities in the support of the interactions on and the promotion of this platform, while selected partners will unite solution providers and seekers to the matchmaking and unite cities and energy communities for joint procurement and collective purchase actions though matchmaking events inspired by the successful approach in the Smart Cities Marketplace.

Table 6 - EXPLORE-SHAPE-UNITE approach outline

4.3. Phase 3: Sustaining action

In this last phase of engagement with ecosystems in the Every1 project, we aim to sustain our action and end the project in a responsible way.

4.3.1. Sustaining action background

The state-of-the-art engagement literature that informs our engagement strategies underlines that engagement has future implications. This calls for the anticipation of future developments of engagement. To bring this into practice, ongoing reflection, and attention on the future impact of the engagement efforts are key (Chilvers & Kearnes, 2020). This is in line with findings from BRIDGE, that emphasise that attention to project impact beyond the project duration are likely to have a positive impact (d'Herbemont et al., 2022).

4.3.2. Sustaining action after the Every1 project

The further impact of the Every1 project after project duration is part of the conceptual design of the project. **To ensure sustained action and a responsible project ending, the Every1 project dedicated T5.5. *Towards sustaining action* in *WP5* to this.** T5.5 prepares for project ending, and runs from M36-M42. The specific ways in which the activities in this task will be performed will be detailed in this task towards the end to of the project, in close collaboration with the ecosystems to ensure we address their needs.

Nevertheless, we do have an overarching outline for the sustaining of action, as outlined in the proposal. **This outline of sustaining action consists of two aspects, that follow-up our two main components of engagement:**

1. **Sustaining the learning materials developed with the co-creation approach.** To ensure that the learning materials developed by the Every1 project continue to be used in the future, the Every1 project takes up activities that ensure that the materials remain available, and foster the reuse of the materials. To sustain the learning materials, the Every1 project will take up the following:
    a. **Availability of learning materials**
        i. The learning materials will remain available, amongst others on the OpenLearning platform from the Open University.
        ii. Three consortium partners, ICCS, ICN and FLUX, will support the maintenance of the training material for at least 3 years after project duration.
    b. **Reuse of the learning materials**
        i. Training will be provided and made available on how to develop learning pathways, and how to adjust, adapt and re-use the learning material. This will enable stakeholders to re-use and update learning materials in the future as needed.
        ii. The learning materials will be prepared for further independent integration in the curriculum of the Open University and diverse curricula of different institutions and initiatives.

2. **Sustaining the connections between ecosystems that result from the EXPLORE-SHAPE-UNITE approach.** The EXPLORE-SHAPE-UNITE approach fosters new connections and networks between stakeholders and ecosystems, which are envisioned to continue to be valuable in the future. To ensure the sustaining of these efforts, the Every1 project focusses on making the connections sustainable, with special attention on the role of the marketplace. The marketplace is part of the unite stage of the EXPLORE-SHAPE-UNITE approach, and offers a platform on which solution seekers and providers can find each other. We outline the following activities to sustain the connections between ecosystems:
    a. **Make the connections sustainable**
        i. During the project, the networks set up between the ecosystems are aimed to foster a culture of exchange and collaboration that is sustainable. This will be supported from early on in the project, depending on the needs as they unfold.
        ii. In T5.5, special attention will be on maximisation of the networking between the ecosystems. This is done through evaluation and further optimisation in T5.5. The networking will be further matured for post-project operation by dedicated partners ICN, RdA and FLUX.
    b. **Sustaining the marketplace**
        i. The marketplace will remain operational under ICN coordination, independent of project financing.
        ii. The marketplace which is already available on the website from ICN will receive a last update before project closure and remains available as an active platform for further market support after the project ends.
        iii. Before the end of the project, the platform will be updated with solution providers. Moreover, to spread the platform among potential solution seekers, a social media campaign will be set up to maximally spread it among potential solution seekers.

5. Conclusion

In this deliverable, we answered the research question: ***how can ecosystems be supported when engaging them in the Every1 project?*** In the Every1 project, we understand ecosystems as any networks, initiative or cluster that can be valuably engaged in the digitalisation of energy through the Every1 project. By engaging with ecosystems, we can reach the members of those ecosystems. In this way, the engagement with ecosystems enables the Every1 project to support the wide range of stakeholders in the digital energy system. We make a distinction between **existing digital-energy ecosystems**, who are already active in the digitalisation of energy, and **new-to-digital-energy ecosystems**, who are not yet involved and familiar with the digitalisation of energy. This deliverable answers two sub-questions, in order to answer the main research question.

5.1. Sub-question 1: what are factors that shape effective ecosystems? (Chapter 3)

In this analysis, **we first identified three theoretical frameworks that help us to understand ecosystems: the helix models framework, the innovation ecosystem framework, and the social innovation framework.** Each framework offers a related but distinct perspective on ecosystems. When aiming to understand specific ecosystems in practice, it depends on the context and aim of the ecosystem which frameworks are valuable to use, as each framework offers a unique perspective. By focussing on these varying perspectives, we created insights that help us to understand the variety of ecosystems we will engage with.

Furthermore, we identified factors for effective ecosystems with the help of those frameworks. **We found that ecosystems in practice should be understood in their own context and in relation to their own objectives, because factors for effective ecosystems are not a one-size-fits-all. Nevertheless, we identified factors for effective ecosystems that are key starting points for understanding effective ecosystems.** Those factors for effective ecosystems are derived from the three frameworks for understanding ecosystems. As each framework had a different emphasis, some findings are unique to that framework. However, we also found some factors that are put forward to be key for effective ecosystems in all three frameworks: synergies between a variety of stakeholders, knowledge availability and sharing, policy context matters, and connecting to trans local likeminded initiatives.

This analysis on effective ecosystems ends with an exploration by ecosystems in practice on the factors for effective ecosystems. This exploration showed that the factors offer a valuable lens, gave insights in concrete example approaches those existing ecosystems use to address those factors, and provide a starting point for further exploration of those factors in other ecosystem types.

Insights created in this analysis feed into the support activities that we aim to offer to the ecosystems through our engagement strategies. As the insights show how ecosystems operate and what factors shape the effectiveness of ecosystems, we understand what factors we need to pay attention to when supporting ecosystems. The insights on this first sub-question thus informed our analysis on sub-question 2, and will continue to inform our ecosystem engagement activities throughout the project.

5.2. Sub-question 2: what engagement strategies can be used to support ecosystems with the Every1 project? (Chapter 4)

In this analysis we outlined and concretised the engagement strategies that the Every1 project will use to support ecosystems. We take an encompassing understanding of engagement, informed by state-of-the-art engagement literature. **We understand engagement with ecosystems as all forms of interaction of ecosystems with the Every1 project that can unfold. This means that there is not one ideal engagement strategy for all ecosystems, but instead we need to reflect during the project on the evolving needs of the different ecosystems we engage with.** The identified engagement strategies are therefore focussed on providing an overarching approach with building blocks that can be 'mixed and matched' during the project.

We identified three phases of the engagement process, by synthesising literature on engagement, insights on effective ecosystems from Chapter 3, and the Every1 project outline as agreed upon the project proposal. **Those three phases of ecosystem engagement strategies entail:**

1. ***Enrolment.*** First, ecosystems need to be enrolled in the project. This starts from the moment the ecosystem interacts for the first time with the Every1 project, until formal agreement on the engagement when the ecosystem signs the commitment letter to the Every1 project. The enrolment phase starts in *WP1 Stakeholder and ecosystem characterisation* and continues in *WP5 Maximising impact.*

2. ***Collaborating.*** When the ecosystem has agreed on collaboration, the core of the collaboration starts. This aims to support ecosystems with two parallel components of engagement:
    a. ***Tailormade learning materials through co-creation approach.*** This first component specifically focuses on the co-creation of tailormade learning materials with and for the ecosystems. In line with our encompassing understanding of engagement, we take a broad understanding of co-creation by being open for all forms of co-creation that can unfold in the project. Our co-creation approach therefore aims for critical reflections that help us to adjust and refine the co-creation approaches during the project. The co-creation strategies outline activities that can potentially be used in the co-creation approaches depending on the needs. The co-creation activities are organised by *WP3 From knowledge gaps over learning paths to identifying training material needs* and *WP4 Knowledge creation, capacity building, and training materials*.
    b. ***Ecosystem design guidance through EXPLORE-SHAPE-UNITE approach.*** This second component offers broader support to the ecosystems. The EXPLORE-SHAPE-UNITE approach aims to foster and facilitate the development of new initiatives, projects, and business cases in the digitalisation of energy. The approach first supports in exploring new opportunities, then shapes these opportunities into concrete initiatives, after which stakeholders are united to bring the initiatives into practice. This approach is especially key for the new-to-digital-energy ecosystems, who are less familiar in the field of digitalisation of energy and setting up new initiatives in this field. Nonetheless, existing digital-energy ecosystems can also benefit from this component by receiving extra support. Moreover, the EXPLORE-SHAPE-UNITE approach benefits from the tailormade learning materials co-created in the other component, because the exploration and shaping of new initiatives is building on stakeholder capabilities and knowledge about digitalisation of energy, on which the learning materials can provide support. The ecosystem design guidance through the EXPLORE-SHAPE-UNTE approach is offered in *WP5 Maximising impact*.

3. ***Sustaining action.*** This last phase aims to sustain our work after project ending, to end the project in a responsible way. The sustaining of action entails two aspects, each following up one component of the collaboration in phase two. In the first element, we will **sustain the learning materials developed with the co-creation approach by ensuring that the materials remain available,** and by facilitating the reuse of the materials. In parallel, we aim with the second element for **sustained connections between ecosystems to follow-up the EXPLORE-SHAPE-UNITE efforts.** This is done by making the connections sustainable from the start, and by sustaining the marketplace that facilitates the unite component of the EXPLORE-SHAPE-UNTE approach. The responsibility for this last phase is taken up in WP5, *T5.5 Towards sustaining action.*

The three phases of engagement that we identified help to structure our work with ecosystems, in line with the work package structure in which we organise the Every1 project. In Chapter 4, we outlined and concretised the overarching ecosystem engagement strategies, pointing out our overarching vision on ecosystem engagement. The overarching ecosystem engagement strategies take a comprehensive, contextualised, and flexible approach to engagement. Therefore, we will develop and refine our engagement activities further during the project, empowering us to respond to the ecosystem needs as they unfold during the project. Our structuring according to the three phases of engagement helps to allocate responsibilities in the project, and point out which work packages and tasks will be responsible for the development and refinement of engagement activities in each phase.

5.3. Future outlook

This deliverable identified how ecosystems can be supported when engaging them in the Every1 project. **Key finding in both parts of this deliverable, is that in order to support ecosystems with our engagement strategies, we need to address the specific context, objectives and needs of ecosystems as they unfold during the project.** First, the analysis on factors that shape effective ecosystems shows that there is not a 'one-size-fits-all' approach for effective ecosystems. Nevertheless, we did identify key factors for effective ecosystems that provide a valuable understanding of factors to consider when aiming to support ecosystems. Second, the identification of engagement strategies puts forward the need to take contextualised and flexible engagement approaches, to be able to address the needs of ecosystems as they evolve during the project. Nonetheless, we did identify an overarching structure of our engagement strategies and identified activities that can 'mixed and matched' to address specific needs from ecosystems as they evolve during the project. **So, although we do aim to critically reflect, respond, and refine our engagement strategies during the project, this deliverable identified guiding principles and overarching approach to engagement, from which we depart in our engagement efforts in the project.**

Next steps in ecosystem engagement in the Every1 project will be guided by this deliverable, while detailing and refining the engagement strategies in response to the ways in which engagement evolves during the project. First, we are reaching out to ecosystems to discuss opportunities for enrolment in the Every1 project in *WP1 Stakeholders and ecosystem characterisation,* which will be continues in *WP5 Maximising impact,* following the process presented in this deliverable. Once ecosystems are enrolled in the project, the core of the collaboration can start. The learning pathways and materials will be co-created together with the ecosystems in *WP3 From knowledge gaps over learning paths to identifying training material needs* and *WP4 Knowledge creation, capacity building, and training materials.* The co-creation principles and building blocks identified in this deliverable will guide the co-creation processes. In parallel, the EXPLORE-SHAPE-UNITE approach will offer ecosystem design guidance, especially for new-to-digital ecosystems. The identified factors for effective ecosystems offer valuable insights in this support to ecosystems that we offer. Last, we will ensure that our project can end in a responsible manner with efforts in *WP5 Maximising impact*

on sustaining our actions, informed by the strategies we identified in this deliverable. **In this way, this deliverable will guide the engagement efforts in the Every1 project, with which we aim to support everyone to take up their role in the digitalising energy system.**

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