Start-up activities Learning communities HCA Green powerNL
Final report

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Foreword

Making connections in the region between learning, innovation and work, in other words building a powerful knowledge ecosystem, is what college and mbo are working on together with companies and governments.

Exactly that is what is needed to create solutions to the large and complex issues we face as a society. Issues for which there is no one answer. Issues in which cooperation with each other is a necessity, which require multidisciplinary and cross-sector solutions. The energy transition with an important role for green hydrogen is such a complex issue.

By the end of 2022, 6 colleges[1] have been jointly awarded the SIA research project "Start-up activities learning communities." This project resides under the banner of GroenvermogenNL, the large Growth Fund program for the hydrogen transition. The focus in this project was on both the development of learning communities and the changing role of teachers within vocational education in the region. Important activities were: how do we achieve actual upscaling of learning communities and how do we ensure knowledge development about learning, working and innovation in learning communities in order to achieve good exchange and a jointly supported approach with all regions.

The participating colleges see learning communities as an important lever to combine different perspectives, knowledge and goals for value creation for major transition issues, such as the hydrogen transition. The focus here is on creating a dynamic of learning *with* each other on complex issues. This is one way to work together to find the necessary answers. Moreover, learning communities offer the possibility of providing an alternative to more traditional forms of training for the pressing human capital issue.

I am therefore pleased to present the results of this study to you. Another step towards effective cooperation in the region in order to contribute together to the great challenges of our time.

On behalf of the participating colleges
Rob Verhofstad, chairman of the Executive Board of Arnhem and Nijmegen University of Applied Sciences

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[1] Hanze University Groningen, Amsterdam University of Applied Sciences, Rotterdam University of Applied Sciences, HZ University of Applied Sciences, Zuyd University of Applied Sciences and Arnhem and Nijmegen University of Applied Sciences (as sponsors)

1   Introduction

The Netherlands is working hard on the energy transition with a leading role for green hydrogen starting in 2030. It is a complex issue that crosses all boundaries of disciplines and organizations, and there is no one answer. At the same time, the urgency is great and acceleration is needed.
More people with skills are needed for green hydrogen to be the building block that the energy transition needs. To this end, the program Human Capital Agenda GroenvermogenNL (further abbreviated as HCA GVNL) was created.

Working, learning and innovating in learning communities is one way to work together simultaneously to acquire competencies as well as find the necessary answers.

The national project Start-up activities Learning Communities forms the preparation for the main phase of the HCA GVNL program, resulting in a recommendation for the approach of the main phase aimed at actual upscaling of learning communities and knowledge development about learning, working and innovation in learning communities.

1.1   Accountability

This document is the final report of the national "Getting Started Learning Communities" project.

The start-up activities were carried out during the period April 2023 - April 2024 in and by the GroenvermogenNL regions, represented by:
Hanzehogeschool Groningen - North region
Hogeschool van Amsterdam - North-West region
Hogeschool Rotterdam - West region
HZ University of Applied Sciences - South-West region
Zuyd University of Applied Sciences - South region
Hogeschool van Arnhem and Nijmegen (principal) - East region

The "development and realization of start-up activities for the scaling up of learning communities" is one of the three key activities in preparation for the second phase of the Human Capital Agenda of Green PowerNL, alongside the "appointment of regional liaisons and the development of regional roadmaps" and "the realization of a National Hydrogen Knowledge Platform.[2]

The project was funded from the Regional Liaisons, Learning Communities and National Knowledge Platform Hydrogen scheme for Green PowerNL phase 1. This scheme falls under the responsibility of the National Regieorgaan Praktijkgericht Onderzoek SIA (hereafter Regieorgaan SIA) and was created in a collaboration with the Rijksdienst voor Ondernemend Nederland (hereafter RVO).
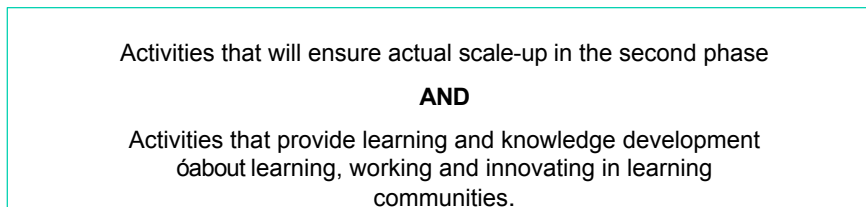
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[2] See Appendix 1 for the structure of the HCA GVNL program and its position in Green PowerNL.

The project period is a preparatory year in which an ecosystem is being built in 6 regions to realize the Human Capital Agenda of GroenvermogenNL. In addition to the regional development, there are two national projects, the present one on learning community development and a project building a knowledge platform.

1.2   Purpose and approach

The "Getting Started Learning Communities" project aims to carry out broadly two intertwined main activities in preparation for the second phase, namely

> Activities that will ensure actual scale-up in the second phase
>
> **AND**
>
> Activities that provide learning and knowledge development óabout learning, working and innovating in learning communities.

To achieve a collectively supported approach in the second phase, it is important to connect to ongoing developments: developments in knowledge about learning communities and developments in the regions and nationally.
To this end, a literature study and explorations in the regions were conducted. The regional situations at that time (IST) were explored through a questionnaire per region (May 2023) and the desired regional developments (SOLL) through landscape sessions in each region (June - September 2023). From the literature review, a conceptual analysis framework was chosen through which the results of the explorations in the regions were analyzed. Together with representatives from the regions, the yields and analyses were sharpened and discussions were held in order to arrive at a recommendation for an integrated approach in the main phase based on the analysis, the knowledge base from the literature review and the nationwide comparison of the regional roadmaps.

The "Getting Started Learning Communities" project also included work on teacher professionalization. The need for facilitating teacher professionalization in order to achieve adequate teaching and continuing education had been felt for some time. As early as 2020, Noorderpoort College, Centre of Expertise (further CoE) EnTranCe and the Centre of Expertise SEECE (Sustainable Electrical Energy Center of Expertise) sought each other out on the topic of hydrogen. A network was created in which other CoEs and knowledge institutions also joined. Teacher professionalization was seen as a prerequisite for the human capital agenda. By including teacher professionalization pilots with a train-the-trainer approach in the "Start-up activities learning communities" project, the urgency could be acted upon.

Teacher professionalization activities have provided insights that, along with other needs from the regional roadmaps, fit into the recommended integrated approach for the sequel.

Figure 1 shows the approach schematically.

Figure 1
Project approach
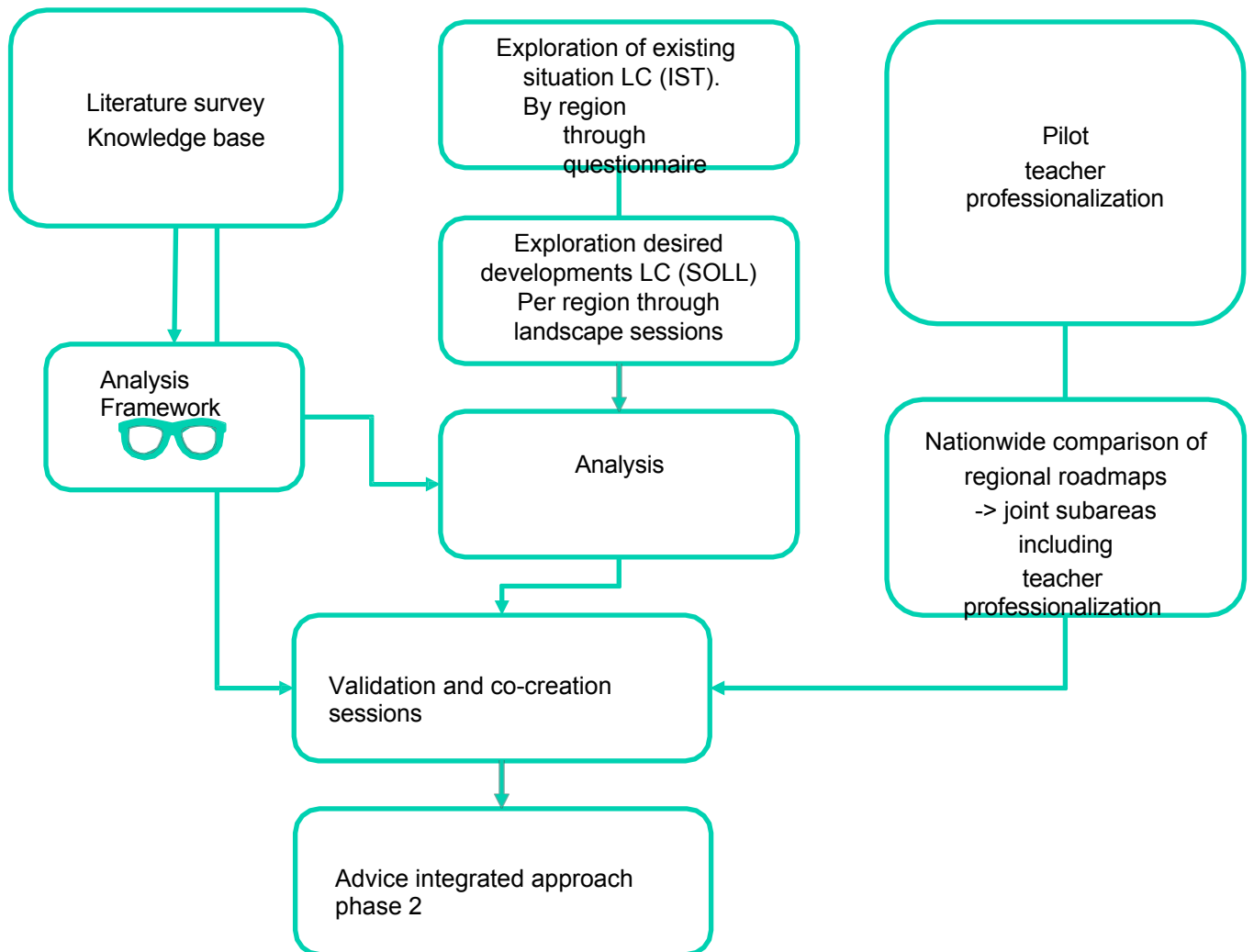
1.3   Reading Guide

The chapter layout follows the approach. Chapter 2 describes the knowledge base from the literature review and the conceptual analysis framework. The exploration of the six regions and the findings from the analysis are presented in Chapter 3. Chapter 4 reports on the teacher professionalization pilot. Based on the explorations, the knowledge base, the nationally conducted comparison of regional roadmaps and validation and co-creation sessions, an advice was formulated for the main phase. This advice can be found in Chapter 5.

2   Literature review
Learning communities

To arrive at an analytical framework that provides guidance for identifying scale-up factors and knowledge development on the learning communities hydrogen, a literature review was conducted. We do not intend to provide here a complete overview of the state of research on learning communities; for this we refer to the Learning Communities Network that is responsible for knowledge circulation on this theme. At this point we highlight the insights that are relevant for getting a grip on the divergent developments in the six hydrogen regions involved. We bring these together in a conceptual framework that helps to interpret the results of the regional exploration in the light of further strengthening of initiated developments.

2.1   What is a learning community

In recent years, several studies have attempted to define learning communities (see, for example, Dialogic, 2022 and Network learning communities, 2023). These show that it is difficult to unequivocally define exactly what a learning community is; rather, it is a thought model (or starting point) that commits to a powerful connection between working, learning and innovation. The Learning Communities Network states that, at its core, it is about partnerships between organizations and other (non- or less organized) parties that enhance the collective capacity of learning, working and innovation, also called the WIL triangle. This capacity refers both to the capacity of the (professional) population to adapt to changing occupations and work practices and the innovation and earning capacity of organizations and companies.

These collaborations are given various designations in practice. The HU Joint Knowledge Centers Working Group (2022) observes that the concepts used for these forms of collaboration vary widely across domains and also come from different science domains and traditions. They arrive at the following overview:

| |
|---|
| **Lab**: living lab, urban lab, innovation lab, social lab, open lab, urban lab, change lab, knowledge lab, field lab urban living lab. |
| **Community**: learning community, community of practice, community of learning, community for development; learning community, professional learning community. |
| **Workshop**: innovation workshop, learning workshop, academic workshop, research workshop, professional workshop, development workshop, creative workshop. |
| **Network**: learning network, learning network, action learning network, learning innovation network (LIN), open innovation network, care innovation network (ZIN), sometimes care innovation center (ZIC), knowledge network. |
| **System**: ecosystem, innovation ecosystem, learning ecosystem, mission-driven innovation system, hybrid learning system, learning system. |
| **Learning environment**: hybrid learning environment, in society learning environment, challenge based learning environment, regional learning environment, multi-stakeholder learning environment, community based learning environment, learning work environment, embedded learning environment. |

Working Group on Joint Knowledge Centers HU (2022)

Because the concepts are embedded in different knowledge domains and traditions, they place different emphases in their focus on learning, working and innovation. The picture below makes that clear:

Figure 2

Typology of social (learning) systems in relation to Learning communities
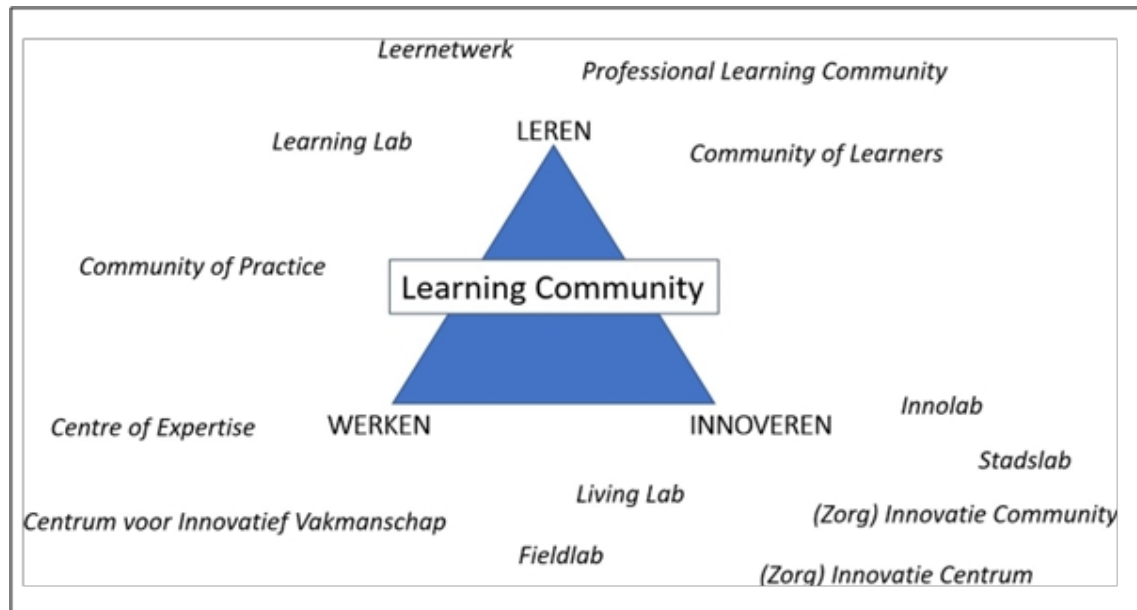
Note: Adapted from Dauphin & Wallner, 2021 in: Network Learning communities, 2023

Thus, the concept of learning communities is an umbrella under which various initiatives fall with the following characteristics (Dialogic, 2022, p. 16, see also Network Learning communities, p.18 and beyond).

- The collaboration is an (in)formal public-private partnership;
- In the collaboration, learning, working and innovation are approached integrally;
- The partners in the collaboration - apart from their individual ambitions - have a shared ambition that is being worked on;
- In collaboration, work is done directly or indirectly on a social issue, the solution to which is not clear in advance due to factors such as complexity, uncertainty, fragmentation and wickedness.

These characteristics are reflected in a diversity of initiatives, which vary in terms of partners involved and are sometimes more locally and sometimes more regionally oriented. Thus, there are different scales of learning communities. In other words, in practice we see a multitude of manifestations that all incorporate the above characteristics.

2.2   Mapping learning communities

Above we have seen that there are many different concepts for learning communities. This means that there is no single way to interpret and value learning communities. We therefore elaborate on three different perspectives from the knowledge base on learning communities: learning communities from *design features*; *aggregation level* and *development stages*.

Furnishing features

To make more specific sense of the design of learning communities, Mennens and colleagues (in Network Learning communities, 2023) have developed a conceptual framework, visualized as a Greek temple, in which they identify four pillars:

- Pillar 1 includes the objective: learning communities that manage to create impact have a common, overarching goal that is prioritized by the stakeholders involved.

- Pillar 2 includes the design structure of the learning community: structural aspects (such as size, composition, position of the facilitator, division of labor, etc.) are important predictors of knowledge creation and knowledge exchange.
- Pillar 3 includes the process: how is the process completed and aligned? Reflective dialogues among involved stakeholders can have a big impact on outcomes.
- Pillar 4 includes the culture within the learning community: creating a set of shared norms and values is crucial for broader and deeper knowledge sharing. For example: mutual trust, space for experimentation, valuing different learning.

These four pillars are founded in a specific context, distinguishing between micro (individual), meso (organizational) and macro (broader society) level factors. In other words, learning communities have a situated nature: the context determines the specific interpretation. Finally, they place as a roof on the temple the intended outcomes of working, innovating and learning together (the aforementioned WIL triangle).

Aggregation level
In addition to organizational characteristics, Learning communities can also be described based on the partners involved and degree of complexity of the issue. This leads to a characterization at the micro, meso and macro levels. At the micro level, we find locally organized learning communities focused on a concrete issue of a specific stakeholder (for example, a company) where other parties are connected to collaborate on a solution from different perspectives. At the meso level, regional issues are central and here several parties are joint problem owners. Finally, the macro level refers to cooperation across regions to find solutions for larger social issues. This is visualized in Figure 3 (Network Learning communities, 2023).

Figure 3
Distinction between micro-, meso- and macro-learning communities according to the degree of complexity of the joint task and diversity of partners involved
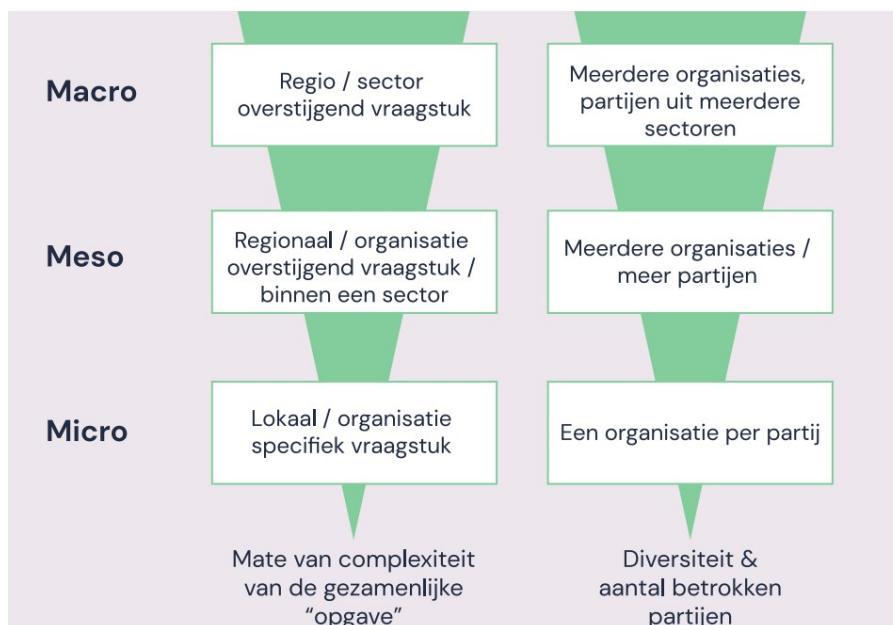
Development stages

Finally, it is important to recognize that learning communities are not static entities. They evolve over time. Therefore, a third dimension of description is the stage of development: starting, designing, implementing or sustaining (Learning Communities Network, 2023[3]). In summary, the concept of learning communities is complex and can be described on several dimensions: design, degree of complexity and diversity or the level of aggregation and development stage. We used these to make the first inventory, using the Temple model of Mennens and colleagues (2023) as a guide (for a more detailed description see section 3.1.1). This experience taught that - precisely because learning communities are not so easy to describe unambiguously - it can be a pitfall to lose oneself in increasingly complicated descriptive frameworks and/or the observation that there are so many forms that anything can be a learning community.

2.3   Learning Communities as a tool for energy transition

The purpose of this exploration is to interpret the developments in regions as well as possible in the light of further development: where are the opportunities for acceleration in human capital development needed to realize the hydrogen transition. In doing so, it is good to keep realizing that learning communities are not an end in themselves - for that reason, we want to describe exactly what a learning community is - but focus much more on what it aims to achieve. The core of a learning community is the collaboration across boundaries of various groups, stakeholders, organizations, bodies and stakeholders from different perspectives (HU working group, 2022) on complex social issues, in this case the issue of energy transition.

The model Organizational Networks of Value (Platform 31, 2020) puts collaboration for the purpose of social value creation at the center, see Figure 4. It provides a coherent analysis framework that also pays attention to the stratification (strategic-administrative, tactical-managerial as well as operational-professional, comparable to micro, meso and macro levels). A strong point of this model is that it pays attention to both the design of the intended cooperation and its actual functioning. As such, this model provides a good starting point for analysis of what is envisioned in hydrogen regions and what is actually happening, and thus for identification of the "gap" between desire and reality. This model explicitly considers establishment characteristics, but at a somewhat more abstract level, thus offering a somewhat looser variant of description than the Temple model.

The Organizational Networks of Value model has 4 focus areas:
I)   Value**:** the social value to be created together in and through the organizational network.
II)   Design: the intended architecture or configuration of the network.
III) Functioning: from design - the course of actual functioning and realizing value in (daily) practice.
IV)   Legitimation: the social support for, visibility of, involvement in and anchoring of the network in the participating organization and its environment.

The figure below shows the relationship between the four focus areas:

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[3] From Katapult, an action scan has been developed for public-private partnerships such as Centres of Expertise (CoEs) and Centers for Innovative Expertise (CIVs) to further clarify the stage of development in collaboration, see https://www.wijzijnkatapult.nl/tools/actiescan-learning-communities

Figure 4
Components of organizational networks[4]
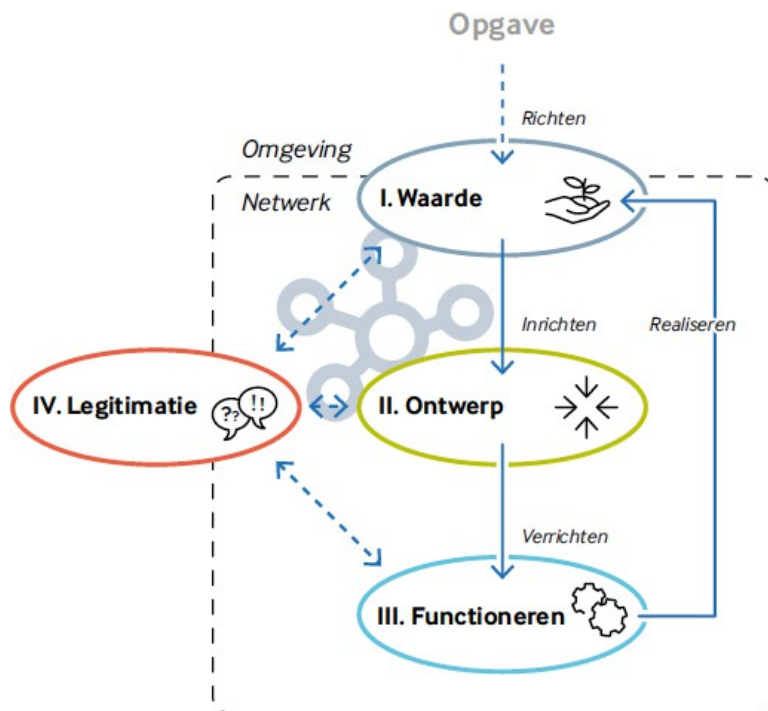
The model distinguishes between direct social value in the living world (solutions) and indirect social value, being learning by professionals, innovating at the level of organizations and transforming at the system/institutional level.

The importance of value creation is also stressed from the Learning Communities Network, where value creation is understood as a dynamic, cyclical process with 6 cycles that should not be seen as hierarchical or sequential (Learning Communities Network Core Group, 2023, p.34). This involves multiple value creation: the pursuit of added value for different stakeholders, with diverse backgrounds, agendas and interests (HU Working Group, 2023). The knowledge that is gained and can lead to value can be divided into human capital, social capital, tangible capital, reputational capital and learning capital (Learning Communities Network Core Group, 2023, p.34). It is noted that value creation in different silos takes (too) long and that densification and acceleration is desirable (HU Working Group, 2023). This is the reason that learning community development has been employed as a means of connecting the silos.

2.4 Towards an analysis framework

An important starting point for analysis is that Learning Communities are not an end in themselves. They are a means to energy transition. The Organizational Networks model helps to keep that social value in mind at all times. Therefore, we take this model as the starting point for our analysis framework, in which we include the elements of value, design and functioning, and legitimacy as the main categories for analysis. With the design element, the design dimension has a

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[4] Note: taken from Platform 31 (2020)

place; by linking directly to value, there is less risk of focusing too much on furnishing details. By distinguishing between design and function, it has an eye for the difference in what is intended and what actually happens. This can help identify points of leverage for development. The elaboration of these two elements pays attention to layering in levels of aggregation. Although the feedback loops in the model make it clear that it assumes a development process, the stage of development is not explicitly mentioned. We therefore add this descriptive dimension as a separate element in our framework of analysis.

3   Region Exploration

GroenvermogenNL's Human Capital Agenda aims to achieve sufficient availability of professionals with knowledge and skills of hydrogen and its application. Learning Communities are seen as a useful vehicle to realize this ambition. Much is already happening in the 6 regions and at the national level. In many ways, various forms of cooperation are already underway to address human capital issues related to the hydrogen transition. To arrive at a collectively supported approach in the main phase, the ongoing developments in the regions have been mapped with the aim of getting a picture of the current state of affairs and a look through to the intended development in the 6 regions. In this chapter we report on this exploration.

3.1   Research approach

To gain insight into what is happening in the regions with learning communities, the regions were surveyed in the period May-September 2023 to describe the (currently) active learning communities in their region (IST situation) and what further developments they see as desirable for the future of the learning communities (SOLL situation). In the design of the study, an approach was sought that, in addition to data collection, also does justice to the intention behind the start-up activities, namely to work together to investigate, co-develop and stimulate other forms of learning aimed at strengthening a learning approach and interpretation of forms of transformative learning. Therefore, as a central method of data collection for mapping the SOLL situation, an interactive format with various stakeholders involved in the learning community was chosen. In addition, data was collected through written questionnaires. Below we further explain the methods of data collection used.

Research method
Exploration of existing situation (IST).
A written questionnaire was developed to assess the status of the already existing learning communities in the six regions involved.
The questionnaire is based on the Framework for Public-Private Learning Communities (Mennens et al., 2021 in Network Learning Communities, 2023). The framework is shaped like a temple and contains four pillars: a goal-setting pillar; a structure pillar; a process pillar; and a culture pillar. Each pillar is composed of several building blocks important to the functioning of a learning community. The four pillars are topped by a "roof" of outcomes (in the areas of working, learning and innovation). The foundation of the temple consists of contextual factors at the micro, meso and macro levels. The questionnaire walks through the pillars and consists of 26 questions (see Appendix 3).
Sample questions are: "Has a common goal for the learning community been determined? And if so which one?"; "Which parties are represented in the learning community?"; "Is there an agreed upon division of roles and/or tasks within the learning community? If so which?"; "Are decisions made in the learning community meetings?"
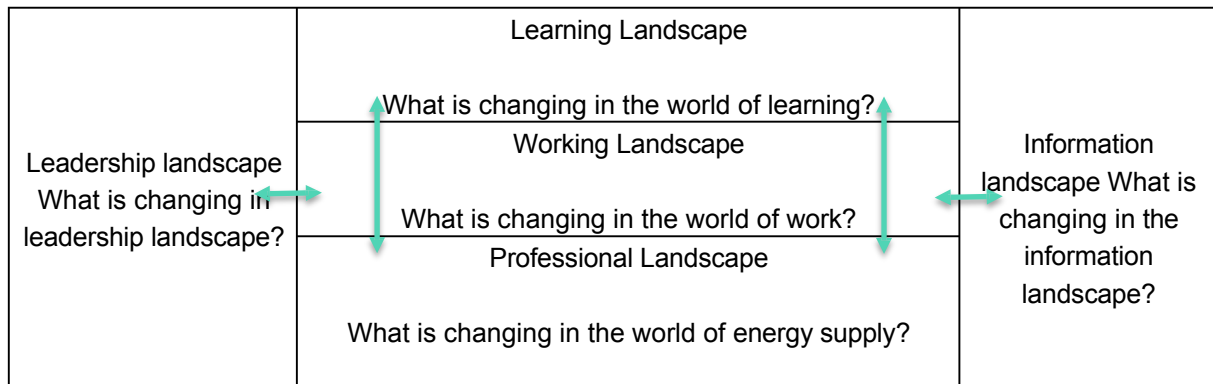The questionnaire was sent through liaisons to the six regions in May 2023.

Explore desired developments learning communities (SOLL)
To question the desired situation, so-called "landscape sessions" were organized in the six regions. A landscape session is an interactive working form in which various stakeholders in the region enter into discussion with each other to jointly give meaning to the social

developments in relation to the human capital task. The session will be structured from Nieuwenhuis' (2013) landscape model, see Figure 5.

Figure 5
Landscape model

Leadership landscape What is changing in leadership landscape?	Learning Landscape What is changing in the world of learning? Working Landscape What is changing in the world of work? Professional Landscape What is changing in the world of energy supply?	Information landscape What is changing in the information landscape?

Source: Nieuwenhuis (2013)

The model consists of five "landscapes": a learning landscape; a work landscape; a professional landscape; an information landscape; and a leadership landscape. The model helps to systematically think through the changes in the professional domain itself (technology, policy, socioeconomic developments) in terms of their implications for changes in the work landscape (different division of tasks, new functions, new work routines) and the required changes in the learning landscape (what does that mean for learning and training professionals). The central question in a landscape session is always what developments are taking place in the relevant landscapes (what changes are coming our way?) Once the landscapes have been colored, on the basis of a collective interpretation in the last step during the session, it is possible to reflect together on what this means for the SOLL and thus for one's own learning community. In all regions we organize a **landscape** session with members of the learning community. Preferably all members of the learning community participate. If this is not possible (e.g. due to agendas), it should be monitored that the group of participants is a good reflection of the different stakeholders participating in the learning community (reflection of heterogeneity across the board). The relevant liaison takes charge of the actual organization of the landscape session and decides who will be invited and when and at what location the session will take place. The session itself is led by researchers from the University of Arnhem and Nijmegen. Two researchers were present at each session; one fulfilled the role of facilitator and the other of reporter[5] . The session reports were returned to the contact person for validation.

The interactive form is interesting from the perspective of data collection because it brings to the surface the different perspectives that exist in the region and thus gives indication of the degree of collectivity that exists. From the perspective of transformative learning, this interactive form contributes to stimulating a collective process: it is a starting point in which the various stakeholders (from education, business, research, government) create a common ground to start learning, working and innovating **together**.

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[5] At the landscape session in Region North, there were so many participants that it was decided to divide the group in two to maintain the interactive nature. The researchers each facilitated and reported on a partial session.

The landscape sessions were held in all Green PowerNL regions from June to September 2023:

- East - H2hub Twente
- North - EnTranCE Groningen (Energy Transition Center of Expertise).
- Southwest - Learning community intended.
- South - CHILL Geleen (CHemelot Innovation Learning labs)
- West - Envisioned is a learning community Rotterdam
- Northwest - Envisioned is an ecosystem of five clusters of collaboration

Analysis

The answers to the written questionnaire were included in an analysis table in which the answers per item were clustered on the main themes of the Temple model. After the landscape sessions, all collected data (from both questionnaire and landscape session report) were organized into an analysis framework based on the "Organizational Networks of Value" model (Platform 31, 2020), see Chapter 2. It contains the following components:

1. The 4 focus areas of organizational networks of value: value, design, functioning and legitimacy[6];
2. The development stages of learning communities: Starting - Designing - Implementing - Sustaining

The descriptions using this analysis framework were fed back into a group session with representatives from the six regions (Nov. 20, 2023) to jointly identify patterns. The regional roadmaps were also analyzed for additional information. Finally, the completed analysis frameworks were sent to the regions asking them to correct inaccuracies and add items where necessary. Additional information was requested on ongoing cooperation in the education column (MBO-HBO-WO)[7].

3.2 Results

In this section, we successively describe the results from a) the Exploration "existing situation learning communities (IST) by region and b) the Exploration "desired developments learning communities (SOLL) by region.

3.2.1 Outcomes exploration of existing situation learning communities

In this section we describe the results of the questionnaire focused on the exploration "existing situation learning communities. We describe the results by theme. The complete questionnaire can be found in Appendix 3.

Reason for the creation of the learning community

The learning communities cite various reasons for their establishment. Sometimes it is a concrete knowledge question about training for the hydrogen economy, sometimes a specific question from industry about, for example, the scaling up of flow processes and the use of light as a reagent/energy source. In other cases, an ongoing (research) project is shaped in the constellation of a learning community, for example the RAAK MKB HYGENESYS project in which engineers from industry, lecturers/researchers from knowledge institutions and students

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[6] The aforementioned dimensions of design, degree of complexity and diversity are organized into these 4 areas of interest. The descriptive dimension stage of development is included as a separate category.
[7] A parallel inventory track specifically on cooperation in the education column. Due to personal circumstances, this was not realized as a separate line. Therefore, this additional inquiry was made from this line.

from different courses and levels working together to develop and build a 70 kW electrolyser.

Learning community initiators
The colleges involved are the main initiators of the learning communities in the regions.

Common goal
The learning communities studied have formulated goals for themselves. The common goals relate to the exchange or connection of knowledge and/or joint learning for the benefit of the hydrogen transition. In a number of cases, connecting working, innovating and learning is explicitly mentioned as an objective. For example, "to quickly apply new knowledge in education and the field". In addition to knowledge and training goals, learning communities have also formulated substantive innovation goals in a number of cases. For example, investigating possibilities for becoming natural gas-free or realizing an electrolyser setup.

Duration of learning communities
The duration of learning communities varies widely. Some operate for 3 months, others for 5 years.

Specific focus on collaboration and learning as a learning community?
Collaboration and learning as a learning community have been discussed in the learning communities studied, usually at the front end, during an initial meeting or during preparation. What is striking is that this hardly seems to be made explicit. There is a reflection on how cooperation takes place, whether or not established in a blueprint; how this leads to a learning group (learning community) seems to remain undiscussed. In one of the learning communities described, there has been exploratory discussion of connecting Innovation and Learning, Innovation and Work & Learning and Work. They have also determined an assessment system together and which professional product will be delivered by the students. They base this on the principles of challenge-based learning. Interestingly, this relates to students participating in the learning community.

Attention to specific design features of the learning community?
Previous research on learning communities has shown that it benefits the 'learning' and 'knowledge-producing' nature of a learning community if, when setting up and starting a learning community, explicit attention is paid to 'cultural aspects' such as creating a common language; fostering mutual trust and establishing a shared set of norms and values with each other. The learning communities in the hydrogen regions studied expressed expectations at the start, explicitly paying attention to speaking the same language does not seem to be going on. On the one hand because it is perceived as less necessary because "engineers speak the same language anyway" as one of the respondents put it, on the other hand because it is considered to be a process that "naturally arises by working together." Fostering mutual trust happens very variably. In one learning community, for example, this is not necessary "because there is an already existing successful collaboration", in another learning community no direct attention is paid to it "but by discussing the expectations during the kick-off and the concrete blueprint, mutual trust has grown indirectly" is the assessment. In yet another learning community, ample attention has just been paid to fostering mutual trust. It is considered conditional here because "there may be competing parties in the learning community and yet there must be participation from an open attitude." Establishing with each other

a shared set of norms and values does not happen explicitly (yet). In1 learning community it did come up indirectly and in another learning community it will be put on the agenda later in the process under the topics 'collaboration & structure'.

Composition of learning community

The composition of the learning communities studied is diverse. In particular, the number of participants included in the learning community varies widely, ranging from 12 to more than 40 people. However, partners from the triple helix are represented in all learning communities, except for one learning community consisting of students, researchers and work field, in which no representation from government agencies participates. Government (municipality, province), semi-government, sector organizations, local initiatives, knowledge institutions (higher professional education, vocational education, university), private parties are all recognizable in most learning communities. In all cases, the lead of the learning communities lies with a University of Applied Sciences. Most learning communities consist of a fixed core group with, in some cases, a changing group. These are basically the students. They flow in and out of the community after usually one semester. Most of the learning communities have a (permanent) facilitator. The role of the facilitator is to structure and stimulate the process, monitor goals and progress. He/she connects, directs, questions and moderates.
One of the learning communities indicated that they have not invested the role of facilitator "because we are a little less college and a little more field-oriented. Depending on the nature of the challenge, an experienced professional, coach, business developer, or someone from the program/lectorate can facilitate." In another learning community, the role was originally there but never got off the ground properly and the project leader now also serves as a direct facilitator.

Learning community meetings

The participants of the learning communities meet physically and online. In addition, in some cases there is also "in-between contact" (by phone, email, Whats-app group). The frequency of meeting varies from daily, weekly, once every 3-4 weeks to 4 times a year. It was also indicated that the frequency is still evolving.
The meetings of the learning communities are filled differently but in all cases prepared in advance, except in one case. There, they start with a 2-minute stand-up by the students, "otherwise there is no agenda. Occasionally there are specific appointments, these are then prepared by the people involved." In one of the learning communities, discussions are based on a list of question points and the meetings are "quite loose and run organically." In another learning community studied, there are different types of meetings: work meetings in which the young professionals present progress, resulting in discussion and agreement on further research; lab sessions in which the young professionals, the experienced professional, and the occasional coach work together on the assignment or advice is given; coffee mornings for quick questions and coordination, sometimes culminating in longer consultations; and cross-cutting meetings in which different Communities for Development present a month's progress to each other. Separate from these meetings are also monthly appointments with the field. Yet another learning community meets weekly for a morning segment: "after the 2-minute stand-up in which the students involved present what they have done during the week, what the planning is for the following week, and what questions they have, the learning community continues to work in groups and these questions are often resolved. The groups are not fixed, and the dynamic effect actually allows each person to take out what is needed at that moment and continue with the assignment."
In all learning communities, decisions are made and further (follow-up) agreements are made. In two cases, minutes are taken.

3.2.2 Outcomes exploration of desired developments learning communities by region

The inventory of learning communities shows great richness across regions. Learning communities differ in terms of occasion, duration, number of participants, and approach. This picture was reinforced by the landscape sessions that followed completion of the IST questionnaires. These showed that some learning communities seemed to be at the very start, stakeholders meeting for the first time, while other learning communities run like a well-oiled machine and are standing practice (which might raise the question of how the learning community differs from a regular project). Formulating a common SOLL seemed more complicated in a number of cases than previously conceived because people simply hadn't gotten that far yet or because there wasn't yet a common purpose. This has made us decide not to present the SOLL situations of the learning communities sec because in doing so we do not do justice to the activities being undertaken. We present here the results of an in-depth analysis we made per region, based on the data from questionnaire and landscape session together. We analyzed these data using the analysis framework described in section 2.1.4. This yields the following region portraits.

GroenvermogenNL region North - EnTranCE Groningen (Energy Transition Center of Expertise).
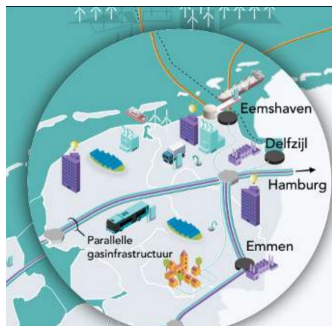
This region focuses on creating an ecosystem in the northern provinces (Drenthe, Friesland and Groningen). This region builds on long-standing collaborations between education, knowledge institutions, companies and the government.

EnTranCe is a Centre of expertise (CoE) affiliated with the Hanze University of Applied Sciences Groningen. CoEs are public-private or public-public partnerships (PPPs) between universities of applied sciences and the professional field.) The **value** intended by this partnership is twofold. First, the partnership focuses on developing knowledge that contributes to the energy transition: realizing a sustainable energy economy in which hydrogen is important but not a goal in itself. But it goes beyond knowledge development alone; important aim is to circulate this new knowledge and make it available to the entire hydrogen chain.

EnTranCe is part of Hanze University Groningen and has a number of consortium partners including the New Energy Coalition (NEC), a growing network of (now 150, spring 2024) knowledge institutions, companies, governments and NGOs in the North. Both the CoE and NEC have their own resources. The learning community has a layered **design.** EnTranCe positions itself as the overarching Learning Community for this region, as a trigger and organizer of partner learning across the full breadth of the energy transition. Learning communities at the micro and meso level form the basis for day-to-day **functioning**. These are time-limited projects education-research-working field meet in concrete research questions/assignments in different forms of complexity. In a micro learning community, individual students work on single questions from practice under the guidance of EnTranCe researchers. The meso learning communities are multidisciplinary teams of students working on complicated issues from practice or from research projects of professorships. The learning processes are guided by a facilitator.

The results are (actively) shared both internally and externally or translated into new products/services/education. EnTranCe takes the lead in bundling the results of the

micro and meso-learning communities and make them available to stakeholders in the region. A method for achieving this knowledge circulation is still under development.

Five **collaborative projects** are currently underway **with educational partners** with different focal points of collaboration; from joint education in the form of multilevel student challenges, joint retraining and continuing education programs, joint professionalization (knowledge sharing and curriculum development teach the teacher) to developing a regional multi-level infrastructure

The partnership is in the **Phase of** Sustainability. Those involved observe that the collaboration is sufficiently secured at the strategic level, but that continuity at the implementation level is still vulnerable because it is supported by specific individuals. One of the development directions for the coming years is therefore to work on better securing the cooperation in the organizations especially at the tactical and operational level (and thus less dependent on individuals). Other directions identified for additional value and sustainability are:
• Bringing together more perspectives (legal, social, economic, ecological, technological)
• Achieve more continuity in sub-questions; implement knowledge circulation
• Facilitate integration of learning and working, shared lab facilities

Green PowerNL Southwest region - learning community envisioned.

This region focuses on the delta region of Southwest Netherlands. The learning community is still in formation. A deliberate choice was made to use existing networks as a starting point: liaison team GroenvermogenNL Zeeland, Smart Delta Resources, VNO-NCW Brabant-Zeeland and work field representatives of the professional field committees of the technical colleges in Zeeland. Citizens and SMEs are seen as important partners.

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Value (intended)
Deploying alternative energy sources as a replacement for fossil fuels, hydrogen being one of the possible ways (parent task)
Shared hydrogen infrastructure for large international companies, SMEs and citizens Greening of industry
(Collaborative) training and retraining, including through multidisciplinary learning and working
Design & Functioning
Deliberately chosen to use existing networks as a starting point: team GVNL Zeeland, Smart Delta Resources, VNO-NCW Brabant-Zeeland and field representatives of the professional field committees of the technical colleges in Zeeland. Citizens and SMEs are seen as important partners.
Representatives from Hogeschool Zeeland UAS and Scalda have joined the Hydrogen Delta Sounding Board of Smart Delta Resources, a sounding board of key industrial parties in Zeeland
**Education cooperation:** no information
Stage = desire and initiative to create a learning community.

Assistance request:

Create necessary conditions to have a meaningful role in training and retraining for a sustainable society and taking responsibility by the 3 large international companies (Dow, Yara and Delta) and the province.

Listed possible connecting activities for the purpose of the task:

- Organize excursions to look elsewhere in the country
- Workshops for SMEs, e.g. on sustainability of heat demand. This will also clarify questions and needs
- Organize day excursion for the college and high school team to DOW Chemical.

GroenvermogenNL Southeast region - CHILL Geleen (Chemelot Innovation Learning labs)
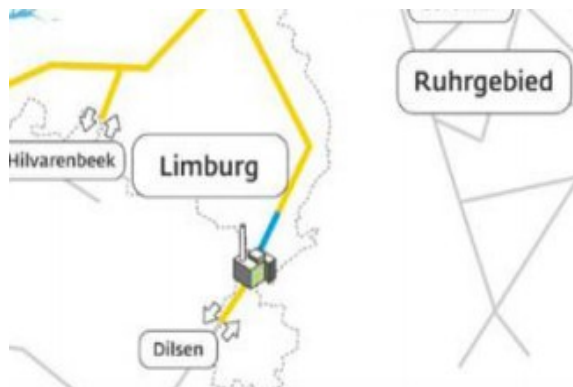
This region is anchored in Limburg, where cooperation between education and business is already being built since 2010. The cooperation is pulled from CHILL in collaboration with Zuyd University of Applied Sciences. CHILL is an independent entity registered at the Chamber of Commerce and has its own resources and location with facilities. CHILL aims to connect education and business to learn from each other in terms of subject matter and to innovate with each other. The organization grew out of initiatives of Zuyd University (known as Zuydlab).

The stakeholders, when introduced to the landscape conversation, indicated that you can look at a Learning Community in different ways. One perspective is the learning community as an ecosystem of parties from the quadruple helix. From this perspective, the intended **value** is Learning and Innovation on the theme of sustainable chemistry. Among other things, the use of sustainably produced hydrogen (and other raw materials) for chemical conversions in a sustainable process. The other perspective is to consider a learning community as a methodology to educate (future) professionals. From this perspective, the intended **Value** is student learning in projects so that enough future professionals are trained. Within CHILL, a learning community is considered a methodology.

To create an ecosystem, CHILL has a number of program lines including the "sustainable chemistry" program line. This is pulled by a senior researcher from the Material Sciences lectorate of Hogeschool Zuid. Together with the lector, he directs the network of companies and research institutions that collaborate in this. The following partners are jointly involved in this cooperation: Zuyd, CHILL, University of Amsterdam, TNO, Beartree Automation, Brightlands, Chemelot Campus, Chemtrix, Creaflow, De Heer BV, Ecosynth, Innosyn, Mettler-Toledo, Peschl and Swagelok.

As indicated above, the concept of learning communities is seen as methodology. This methodology was developed in 2011 by the Material Sciences lectorate. In its **implementation**, it works with so-called Communities for Development (CfD). Questions from the field on the broad theme "'sustainable chemistry" are translated into subprojects on which a project group is formed (= CfD). In a CfD ca. 3 students work as part of the curriculum (starting professionals) with their own responsibility together with an experienced professional (ca. 5 years of experience,

"cooperating foreman") and are supervised by a coach (teacher/researcher, mostly PhD level). The students can come from a variety of academic, professional and vocational programs. Given the theme and positioning, mainly HBO (and MBO) molecular studies.

The assignment is central, if it is picked up well then all participants learn naturally. The learning output of all participants is mapped by an independent assessor (a teacher/researcher who is usually a researcher in another topic).

Performance takes place where it is best for the assignment. Usually these are CHILL's facilities. A broad network of CHILL can be used for expertise and facilities. These do not belong directly to the implementing community but are part of the larger community infrastructure. Knowledge sharing also takes place between CfDs on the same themes and with partners within the same projects. **Education column collaboration** is built into the CfD approach.

This methodology has been used for more than 10 years. Initially with students from higher education, in recent years cooperation has also been sought with secondary schools. The reason is that at this level in particular it is important to train people from the own region (because they will not easily work outside their own region).

In the continuing process of **sustainability**, stakeholders see the following challenges:

- In the field of hydrogen, there is limited expertise and no lab facilities at CHILL. Question is whether this should be made available in the region or through collaboration with knowledge institutions in other regions
- Ensuring continuity at tactical and strategic levels in the education column mbo-hbo-wo.

GroenvermogenNL region West - Intended learning community Rotterdam

This region focuses on cooperation in the Rotterdam Port Area.

Value (intended)
Implementation of hydrogen production, storage and use techniques in a socio-economic context.
Connecting learning/working/innovation within and outside the partnership. Quickly applying new knowledge in education and practice/work field.
Develop training and innovative education.
Focused on 5 core areas: (1) identify relevant knowledge areas, (2) mobilize education (mbo, hbo, private), (3) contribute to GroenvermogenNL National knowledge platform, (4) deliver to GroenvermogenNL National package of educational programs, (5) give impetus to knowledge development SMEs and strengthen training offerings for entire business community

Design & Functioning
Initiators: Rotterdam University of Applied Sciences, STC, The Green Village, NIPV. Hogeschool Rotterdam provides a facilitator. Intentions for participation have been expressed by companies, Port of R'dam, mbo's, Haagse Hogeschool, municipality, province.
The thought working method is to have a fixed core group (4x a year) and alternating working groups. This working method still needs to be developed. There is much focus on fostering mutual trust. The ambition is to draw up research programs together.

Education cooperation: no information
Phase = start/design
First step:
Starting a process to arrive at the goals described above. The first step in this process is to work on a shared picture (direction) about the form(s) of cooperation and the appropriate structure to go with it, in order to then be able to set up.

Green powerNL region Northwest - Intended: ecosystem of 6 clusters of cooperation
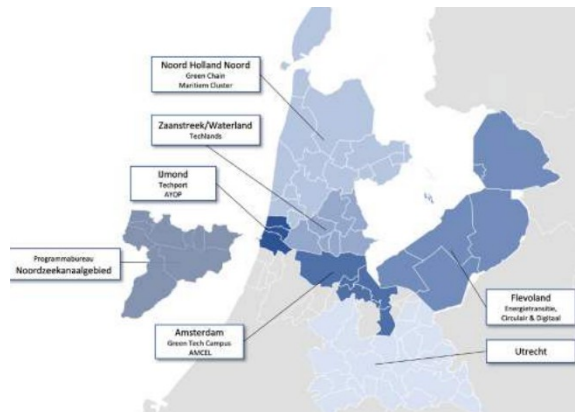
This region covers the area of North Holland, Utrecht and Flevoland. Like Region East (see below), a large area with many diverse initiatives with their own methods, agreements and forms. There is no single learning community here but 6 clusters of cooperation in the area from Den Helder, North Sea Canal area, Port of Amsterdam to the Zaanstreek, Schiphol, the metropolitan region A'dam, Utrecht and Flevoland.

Value (intended)
Connecting the 6 clusters of partnerships, where the clusters continue to create their own value and (new) knowledge circulates and is made available to the whole region in order to contribute to the development of an energy system in which sustainable hydrogen is integrated for various links of the hydrogen value chain (industry, mobility, agricultural context and built environment).
It is expected that strengthening the connections will lead to an acceleration of the sustainability of the region. Granting Hydrogen Valley European status provides legitimization and access to knowledge and funding from Europe to accelerate sustainability.

Design and implementation
Thus, further development is sought in strengthening the overall ecosystem. So there is no learning community design. Several places are working on the design and implementation of a learning community. Two learning communities specifically focused on the hydrogen transition have now been started in the Northwest region: the learning community Hydrogen by PPS Techport aimed at industry in the IJmond region and the learning community H2inAgri in the head of North Holland. The "North Sea Learning Community" was recently started on the initiative of Amsterdam IJmuiden Offshore Ports and focuses on renewable energy at sea including H_2 issues. The System Integration learning community facilitated by the Centre of expertise City Net Zero of the Hogeschool van Amsterdam focuses generally on energy transition and smart grids in which H_2 can play a role as a buffer. Specific initiatives from which learning communities could emerge in Flevoland and Utrecht are the "FLHY" initiative and the Utrecht Hydrogen Platform, respectively.

Cooperation in the education column
Efforts are underway to strengthen cooperation in the education sector. Within 4 of the 6 clusters, a "High Impact PPP" is under development (a cluster of collaborating PPPs funded from the National Growth Fund Scaling up PPPs (the Katapult Growth Fund), region deals or the Just Transition Fund). These High Impact PPPs connect local MBO and college

institutions. The collaboration includes the development of continuous curricula, cooperation in educational and research projects, and the sharing of testing and lab facilities.

GroenvermogenNL region east - H2hub Twente

Geographically, the East Region covers a large area characterized by great diversity. The region is not a naturally cohesive region but has several center regions: Arnhem-Nijmegen (Lifeport), Brainport, Twente and the urban triangle (Deventer, Zutphen, Apeldoorn). The East region has put a lot of work into extensive exploration of the region. Due to the vastness of the area, the liaison team East has chosen a development strategy based on already existing clusters that gradually work towards more cohesion between the different cores. From the present study, the choice was made to describe a working case, namely the H2hub.

Value

The value envisioned by H2hub is the development and application of innovative, decentralized hydrogen technology within the energy transition. Indirect value is also envisioned in relation to expertise building among students and professionals involved, knowledge development about the challenge bases learning community approach and network expansion for collaboration.

Design & Functioning

For the purpose of collaborating on concrete projects, some 15 hydrogen-oriented companies established a cooperative in 2019 and set up a physical location in Almelo, called "Waardemakers in hydrogen. The location is often referred to as the H2hub in everyday dealings, the same name as the learning community. In addition to the cooperative, the learning community involves industry associations, Hogeschool Saxion, University of Twente, ROC van Twente and Hogeschool van Arnhem en Nijmegen.

Representatives of these partners form the advisory board, which provides direction for the program and location. The cooperative provides the site manager.

H2hub uses the challenge-based learning community approach. This approach was developed as part of the first HYGENESYS project (September 2022 to September 2024) and is being researched from a TechYourFuture project. Saxion's lectorate 'Sustainable Energy Supply' and the cooperative are the initiators of the RAAK-SME project HYGENISYS. The project has work packages, which in turn consist of challenges, each with a client. The project leader comes from the lectorate.

There are 10-weekly consortium meetings in which key substantive decisions in challenges and decisions on planning and progress are made.

The challenges are conducted primarily by students with coordination by the principal of the challenge, from a company or knowledge institution.

Every Friday morning those involved in the challenges meet at the site for exchange, coordination, discussing challenges and, if necessary, adjusting goals within the challenges.

Cooperation in the education column
The H2hub involves an MBO institution, 2 colleges and a university.
Phase
Execute
Listed possible directions for additional value:
- Come up with successor projects together, with new "takers," keep learning and evaluating for sustainable cooperation, legitimize more to the outside world and improve the relationship with government.
- Developing ART concept: Applied Research Team. The Applied Research Team is intended to be a multilevel practice-oriented research team in which MBO and HBO students work together with professionals from hydrogen-related companies, a researcher/lecturer and a practor on hydrogen technology innovations. The concept is being developed by the joint liaison team in cooperation with the Centre of Expertise SEECE.

3.2.3   Results of analysis across regions

This exploration shows that in all regions, through various forms of learning communities, an infrastructure needed for the hydrogen transition is being worked on. In close cooperation between companies, educational institutions and research, initiatives are taken to get new knowledge from innovations quickly applied in the practice of companies and educational institutions. As the inventory above shows, the diversity between regions is great.

This diversity is partly the result of differences between the regions themselves. They differ in geographical size, in the degree of population growth or shrinkage, the extent of the demand for skilled professionals, the type of business activity but also in the number of educational and knowledge institutions operating in the region.

These regional context differences translate into differences in the number of initiatives and collaborative relationships between regions. In the North and South regions, we see that EnTranCe and CHILL, respectively, serve as the hub of a coherent network that has continued to expand over the past 10-15 years. In the Northwest region, we see not one but five cooperation clusters. Other regions are working hard to connect various initiatives and establish or expand collaborative relationships.

To interpret these differences in collaborative relationships and initiatives, we used the Organizational Networks of Value model as presented in Chapter 2. This model distinguishes between direct social value in the living world and indirect social value, being learning by professionals, innovation at the organizational level and transformation at the system level. The learning communities studied have clear added value for different stakeholders with diverse backgrounds, agendas and interests (HU 2023 Working Group). The intended direct social value of the learning communities differs by region: sometimes the goal specifically concerns the hydrogen transition, sometimes the energy transition in a more general sense and hydrogen is one of the options in the energy transition. In addition, the function of hydrogen that the region focuses on varies: use (application), generation, storage and/or transportation. And in doing so, the function(s) of hydrogen that a learning community focuses on determines who gets involved and which partners are logically attached/not attached.

In the intended indirect social value and functioning of the learning communities, learning (I) and innovation (L) from the WIL triangle are mainly recognizable. The interweaving of *working* (W) with learning and innovation is still hardly recognizable in realized practices. We do see corporate involvement but that does not mean that "working" can be interpreted as a verb. Involvement often shows itself in providing assignments for students or in participation in research and/or innovation.

The learning communities differ in their stage of development. These differences are also reflected in the scale, in the degree of strategic and tactical embedding, and in the stratification of the knowledge agenda (focus on micro, meso or macro level). The North and Southeast regions are building on long-term partnerships, working both on the development of learning community forms in which students work together with professionals on issues (meso learning communities or Communities of Development) and on an overarching ecosystem so that joint knowledge building with various stakeholders takes place at the regional level. They are in the phase of sustainability, where the challenge is both to further deepen (to secure collaboration at both strategic, tactical and operational levels) and to broaden (especially toward SMEs). At the other end of the spectrum, we see in the Southwest and West regions that learning community formation is in the start-up phase. The existing networks do not yet have a form in which learning, working and innovation come together and have yet to develop concrete practices for this. The East and Northwest regions are in between. These are both large regions (in geographical terms) in which several cooperation clusters can be distinguished. The Northwest region is working on building a regional knowledge infrastructure to shape collaborative working, learning and innovation across clusters. They are mainly focusing on strengthening the regional ecosystem. Region East has a concrete case in progress with the H2hub where a concrete challenge-based approach has been developed with which intensive experience is now being gained. Interestingly, they seem to be opting for different development strategies. The approach in the East Region is to further develop working initiatives around regional cores (e.g. Brainport and Lifeport). This could be characterized as a bottom-up strategy. The approach of the Northwest region is to build a regional ecosystem that will give direction to local learning community development.

The differences in intended value of the collaboration and stage of development translate into major differences in design (design and implementation). Learning communities defined at micro-level (local, concrete project), at meso-level (regional, common issue), at macro-level (cross-regional, societal issue) and/or at two or three of the levels in conjunction.
Also, the regions differ in terms of the complexity of the issue(s) and diversity of partners involved. This also means that each region chooses a (learning community) form that fits given the issue, the partners, whether or not there is a natural facilitator for implementation, etc.
Finally, what stands out is that role of colleges and Centres of Expertise in learning communities is seen as independent by most participants in the collaboration.

The representatives of the learning communities surveyed indicated a number of **needs that could be part of further development activities**:
There is a shared need for national organizational strength and facilitation of networking (as a verb) by the learning communities, i.e. meeting each other, exchanging knowledge and experience and being each other's critical friend. Forming a national learning community for this purpose is mentioned as one of the possibilities.
Importance of networking is felt for connection and valorization on themes, such as the human capital sub-areas[8] and for connection and exchange on knowledge about learning community design, development and facilitation (including working on the three layers strategic-tactical-

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[8] Sub areas as named during HCA GVNL 24-hour meeting in February 2024: learning community development, teacher professionalization, module and profile development, knowledge flow and facilities.

operational). This includes knowledge and experiences gained from their own practices and seeking to connect with knowledge from research[9] .

- There is a shared need to be able to give more hands and feet to the integration of the W (working) in the WIL triangle and to experiment investigatively to that end. Questions are: how can you really land innovation in the work context? How can we better connect SMEs to learning community development? How can we access knowledge about learning community development precisely in the area of integrating the W? What is known about this from other sectors? What does the literature say about it?
- There is a need to strengthen the integration of practorates and lectureships as part of working in the WIL triangle in the HCA subareas.
- There is a need to share lab facilities within regions and between regions for professionals to learn.

There is no need for customized support of the learning communities in the region from a national pool of experts or facilitators. They know how to find such support themselves in their own region.

3.3   Conclusion

The goal of this exploration was to use an analysis framework and landscape sessions in all regions to outline the current state of affairs and a look through to the intended development in the 6 regions. The mapping in the preliminary phase shows a great richness of cooperation relationships and initiatives in the regions and a great diversity. Regions are difficult to compare with each other, and neither are the learning communities within them. Doing justice to the ongoing developments in the regions also means doing justice to that diversity, with the consequence that regions partly follow their own path of (further) development.

In the validation sessions, stakeholders also indicated that diversity is a strength. The sessions showed that it is precisely diversity that makes learning from each other possible. This is best done by making joint agreements to experiment with the development of learning communities in different contexts through different approaches and then connecting these experiments across regions and learning from each other's experiences. This can be done both in content areas and in HCA sub-areas such as teacher professionalization as well as in further development of a responsive infrastructure.

Interweaving work, innovation and learning takes time and requires different routines of action. Although the desire to integrate all three processes is a starting point, in practice we often see one of the processes as dominant. In the case of the learning communities we examined, these are primarily initiatives focused on innovation and/or learning, with learning focusing primarily on student learning. The added value on the W is not yet clearly visible. So that also requires that experiments in the follow-up phase focus on that. How can integration of the three processes of working, innovating and learning take place optimally with explicit attention to the W? For example, can a focus on more cooperation or more mutual exchange or specific substantive issues accelerate the process of integration?

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[9] For example, the research within the NWO research program Learning Communities as Innovation Accelerators. This will investigate the functioning of learning communities in three contexts during the period 2023-2028, being Energy Transition & Sustainability, Health & Care and ICT. This as a follow-up to the research program and network learning communities mentioned in section 1.1.

4 Teacher professionalization

Teacher professionalization is obviously not a new topic. It is something that takes place on an ongoing basis. In the hydrogen transition in the region, teachers play an important role in learning and development, both in the training/nasking of professionals and in the regional development of learning communities around hydrogen. Teacher roles in a transition are dramatically different from what most teachers are used to. The focus of the teacher roles shifts in part to working together in the region, connecting with companies labs, professorships and other partners, designing new education together, responding to developments and giving direction to desired developments, guiding students in innovative learning, participating in practice-based research and more. Professionalization on these new roles is therefore urgent.

The question now is how this teacher professionalization, other than classical content professionalization, can take shape. To this end, a train the trainer approach to teacher professionalization on the topic of hydrogen was developed during the project period, with the intention of subsequently implementing it as a pilot in three regions and evaluating and adjusting the approach. This chapter describes the pilot conducted in the first half of 2023 and the evaluation results. The follow-up work carried out and what that means for the follow-up path to be deployed can be found in Chapter 5, advice for the follow-up.

4.1 Teacher professionalization pilot

4.1.1 Design and implementation of the pilot

At the national level, the hydrogen platform, a collaboration of 7 colleges, 1 university, 7 ROCs and a number of companies, already existed since the summer of 2020. The purpose of this platform was mainly to cooperate in the development of education, both initial and post-initial, the professionalization of teachers on the topic of hydrogen and knowledge sharing.

In order to take this more or less informal initiative several steps further and thereby shape teacher professionalization as a relevant and necessary part of learning community development, this was included as a specific goal in the project application.

The goal was stated ("Application for start-up activities Learning communities; page 8): "To organize teacher professionalization on the topic of hydrogen by:

    a) Developing a train the trainer approach
    b) Pilots to be conducted in three regions
    c) Based on the pilots, evaluate and adjust the train the trainer approach."

This was shaped as a national activity with pilots in the first year in 3 regions (North Netherlands; Rotterdam-Rijnmond; Southwest Delta). For this purpose, these three regions were allocated additional resources from the project.

A team was assembled from these 3 regions that, in coordination with representatives from intermediate and higher vocational education from across the country, designed an $_{MBO-H2}$ teacher professionalization program intended for intermediate vocational teachers who are going to implement or are already implementing the optional courses in hydrogen technology (basic and advanced). Partly as a result of the dynamics and diversity of developments in the

regions in the field of hydrogen, as the representatives had a view of them at the time[10] , the vision arose that professionalization should be organized regionally in the form of an "action learning track. In this way, teachers in the pathway could jointly develop education in line with hydrogen applications in the region, in cooperation with practicals, companies and other relevant stakeholders (see Figure 6).

Figure 6
Working together on the human capital agenda in the mbo
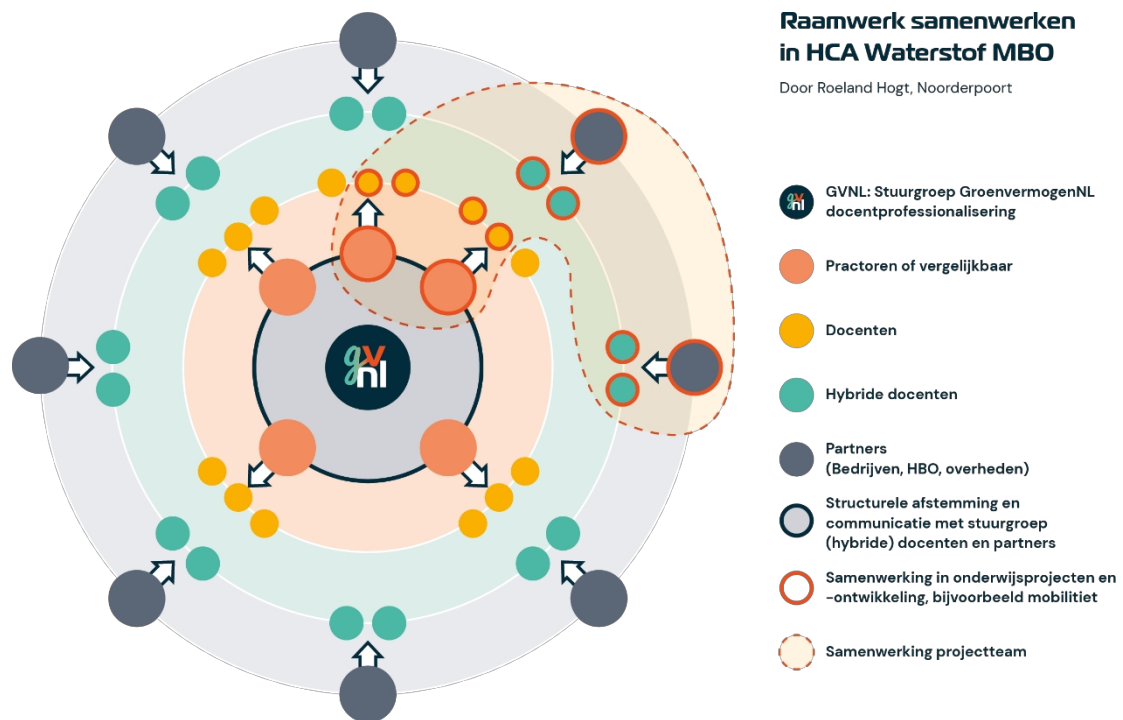
Because the developments are so rapid and diverse, in addition to a knowledge base it is mainly about learning to contribute to developments for the benefit of the transition and teaching students to contribute. Ideally, the education to be developed stimulates meaningful, innovative learning in the dynamics of the regional context, by having students work under the guidance of teachers on project assignments in cooperation with regional field of work partners and laboratories (see Figure 7). Teachers work together in the action learning process as a learning community, with the goal of being ready for regional implementation of education at the end and being part of a network, as shown in the figure below.
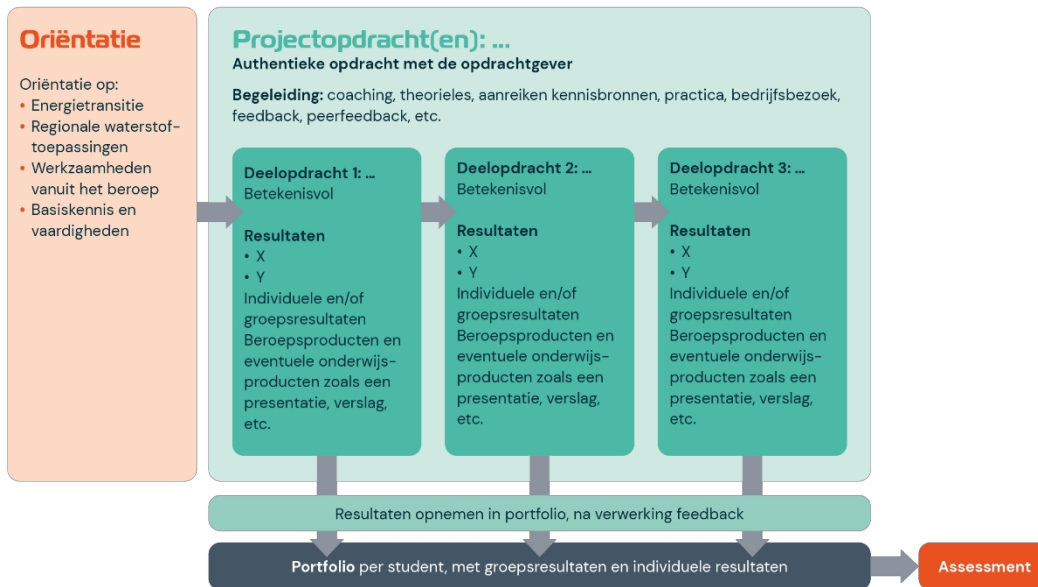
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[10] Confirmed by insights from subsequent exploration and mapped hydrogen application areas.

Figure 7

Example of possible regional elective course design

Van projectopdracht(en) naar resultaten in portfolio

Door Tanja Tankink, Hogeschool Arnhem Nijmegen

The objective of the professionalization program was defined as follows:

"After the implementation of this program, the instructor is ready for the regional implementation of the basic hydrogen technology elective to which the instructor will be assigned during the ...

1. together with regional teachers to form a community of practice in which teachers gradually move from learning from each other to learning and innovating with each other;
2. collaboratively shape the regional interpretation of hydrogen education (including assessment) so that it is focused on meaningful, innovative learning;
3. establishes and maintains connections with companies and practorates in its own $_{H2\ region}$ for collaboration on and in education, so that education is in line with regional developments and the contributions that its own student target groups can make to them;
4. Has the relevant professional knowledge, and
5. is practically competent to work safely on simple H2 systems and to supervise (hands-on) education in labs or at locations where safe work on simple H2 systems is ensured."

The program consists of a kick-off and 7 sessions of 4 hours each during a semester, in the form of physical meetings in the region. The sessions are facilitated by (preferably two) regional moderators. Assignments in a train the trainer "base folder" provide structure for learning and work during and between sessions. Educational materials and knowledge impulses already developed are available with the assignments. Nationally, there is a pool of experts that can be consulted.

Intended were three pilots with the setup described above in the Northeast Netherlands region and West and Southwest Netherlands. The intention was that the hydrogen network formed in these three regions would lead to the formation of regional participant groups. That is, regional groups of teachers who wanted to professionalize themselves toward implementing the mbo-

basic elective part or possibly a deeper elective part, facilitated by their education managers. This turned out not to be feasible. On the one hand, potential moderators proved to have too little time available and interested secondary school teachers were not yet facilitated in the start-up phase and therefore could not participate in the intended regional trainings.

On the other hand, in meetings with representatives from the three regions, it became clear that the goals of the track and the main elements of the track were emphatically endorsed, but that the form - regional implementation of a nationally designed professionalization track, as envisioned by the pilot - did not resonate.

This situation called for a major adjustment of the intended route. Now that pilots in the region turned out not to be feasible, work was done to adjust the route in such a way that a realistic and meaningful program could be carried out that would still achieve as many of the set goals as possible via a different route. The practor in hydrogen applications at Noorderpoort College took the lead in this, together with one of the researchers. He organized and moderated differently structured meetings, in which the focus shifted from direct train the trainer sessions based on the already developed approach to (online) meetings in which a number of goals were worked on together. This work was done with a group of participants from the aforementioned network with different roles/functions (teachers, researchers and practitioners) from both MBO and HBO. Predominantly forerunners with already relatively high expertise and involvement in national and regional projects in the field of hydrogen (education) and some MBO teachers who were only recently involved in hydrogen education. The following goals were achieved:

- The already mentioned train-the-trainer folder whose basic outline was available ("Assignments in a train-the-trainer 'basic folder' that structure learning and work during and between sessions for facilitation of teachers in the regions") was further developed in the online sessions.
- A development structure has been realized in which teachers can work independently to develop (hydrogen) education.
- An inventory of available educational materials was made.
- A link has been established with the fulfillment of the national H_2 knowledge platform GVNL, primary t.b.v. the mbo electives.
- Regional applications and facilities were exchanged.
- Knowledge was shared around working safely.
- Personas and use cases were created for the GroenvermogenNL National Knowledge Platform project.
- Descriptions of project assignments were made in the areas of mobility and safety in H_2 labs.

4.1.2 Evaluation of the pilot

To evaluate the pilot, data was collected through several activities. At the end of the pilot, the participants were asked evaluation questions via Microsoft Forms[11] and two evaluation interviews were held with two participants each on the basis of guiding questions. In addition, the evaluation made use of the reports of meetings made by the moderator, the researcher's log and the notes from the four progress meetings held by the project leader "Start-up activities learning communities", the moderator

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[11] In the 7 sessions, 15, 8, 11, 8, 7, 5 and 8 people participated, respectively.
7 participants answered the evaluation questions. 5 of the 7 work in mbo and 2 in hbo. 4 of the 7 participants are from North region, 1 from South region and 2 from West region.

and the researcher conducted during the pilot. The data collected were analyzed by the researcher. This led to the following results.

Participants appreciated getting to know each other, networking, building relationships, identifying and getting a picture of who is working on what, sharing knowledge and experience, getting to know useful available materials, the insight gained into innovative learning and the experience that others are experiencing the same struggles when innovating education.

Based on the evaluation, points of improvement for the path of teacher professionalization were drawn up. These, along with recommendations for follow-up, are included in Chapter 5.2, Advice for the Main Phase.

4.2   Follow-up pilot phase

As stated at the beginning of this chapter, teachers in the region's hydrogen transition play an important role in learning and development, and the teacher role in a transition is dramatically different from what most teachers are used to.

The need for this different role is also clear from the regions' roadmaps. In all roadmaps, teacher professionalization is one of the HCA sub-areas on which the regions want to focus; the focus is on MBO and HBO levels, both for initial and post-initial education (including education and training of professionals). At the same time, the regions are diverse in terms of content focus on applications of H_2, context and opportunities for teacher professionalization.

Regional interpretation of teacher professionalism
Therefore, after the first phase of the pilot, in the second half of the pilot period, the regions themselves fleshed out teacher professionalization from the regional context and the opportunities therein. Regions North, West and Southwest exchanged with each other about this.
In Region North, teacher professionalization continued in subsequent projects together with companies. In these projects, teachers come into contact with the companies and gain in-depth knowledge about hydrogen applications in practice. In regional sessions, teachers exchange knowledge about these projects and the projects they are conducting with their students. In addition, GVNL has been the stepping stone in the North Region for participation in new projects in which teacher professionalization is one of the activities, such as the H_2 Training & Learning hub project and the H_2 COVE European project.
In Region West, the learning community of lecturers from Hogeschool Rotterdam and the ROCs has been strengthened and expanded to include professionals from TU Delft who are connected to the Green Village Delft's learning community on energy transition. This has been functioning for some time and is also exploring the theme of learning and development in energy transition.
From this GVNL learning community development, Region West and Region Southwest hosted a teacher professionalization day. In spring 2024, companies from the Shipping and Transport College in Brielle gave presentations on hydrogen-related developments and teachers and companies had the conversation about collaboration.
Region Southwest is also continuing the professionalization of MBO and HBO teachers through its long-standing close ties with Ghent University.

National cooperation
In addition, during the past project period, work was done to form a joint (national) coordination/development team with the task of further developing the teacher professionalization approach developed so far, including by continuing to work on the

professionalization and teaching materials that can be shared nationwide, especially project assignments for students that deal with realizing setups.

The team consists of representatives from all regions who are also connected to the liaison teams and thus involved in drafting and implementing the roadmaps. The Hydrogen Applications Practitioner at Noorderpoort College chairs this group.

Appendix 2 contains an overview of one of the realized returns through March 2024, namely a knowledge environment (for now as a Teams environment because the already mentioned knowledge platform is not yet ready).

The results of the group will be used in further development within the regions. At the same time, the group provides an opportunity to coordinate regional developments nationally and to share experiences gained in teacher professionalization and in the development of new forms of learning and development both for initial training and for professionals, thus strengthening each other.

5   Advice for main phase

In this chapter we formulate recommendations for the design of the follow-up project based on the variants of learning communities studied in the 6 regions and the teacher professionalization pilot. The recommendations focus on giving the regions room to carry out (regional) experiments with jointly agreed and coordinated national direction on region-transcending knowledge development and knowledge sharing as a necessary condition. We recommend that this direction be based on the following principles:

- **The regions will engage in specific experiments in a focused manner. The experiments relate to two of the five named pillars: development of learning communities and teacher professionalization.**
- **A systematic evaluation research approach for the regional experiments with a focus on interweaving work, learning and innovation. This should lead to smarter and better training of people for the hydrogen transition. This requires a corresponding framework for the experiments so that through research the working mechanisms of experiments can be uncovered.**
- **To ensure organized and secured systematic knowledge exchange and dissemination, unambiguous design, approach and evaluation criteria are formulated at the front end.**
-

In the roadmaps, the regions show great ambitions. All regions focus on different application areas[12] regarding the role of hydrogen in the region. They see different subareas in relation to solutions to the human capital issue in which they want to be active within the region with national synergy. Subareas in which all regions want to participate actively anyway are:

- Teacher professionalization: professionalizing teachers, trainers and corporate trainers, especially focused on co-creation and guiding innovative learning in hybrid environments at MBO and HBO level.
- (Continued) development of learning communities with a focus on learning with each other.
- Profiles and modules: develop and utilize profiles for roles/functions/professions, learning/training modules, and learning pathway-independent assessments, so that future and current professionals (including lateral entrants) can have their own learning pathway that is recognized.

In the subarea "to allow knowledge from the GVNL program lines R&D and Scaling up[13] (including the shared facilities) to flow through to the other subareas of the human capital agenda," three of the six regions have formulated ambitions.

These subareas are seen as the main basis for the follow-up project.

5.1   From learning from each other to learning with each other

The "Start-up activities learning communities" project revealed that a multitude of activities and initiatives related to learning communities are taking place in the six regions studied.

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[12] As named during HCA GVNL 24-hour in early February 2024: production, storage/transfer, transportation, industry using hydrogen as a fuel or feedstock, manufacturing industry making hydrogen-related equipment, mobility and transportation, built environment, safety and systems integration
[13] See Appendix 1 for GVNL's program lines.

community (development) focused on reducing time-to-job in relation to green hydrogen. That richness is both in the quantity of initiatives & collaborative relationships, in the diversity, in the contextuality, and also in how the learning communities are framed. To do justice to this richness in the regions and the processes and initiatives already in place, but also to set in motion a targeted movement towards the integration of learning, working and innovation, it is advisable in the follow-up phase to focus on experimental pilots in the regions. Although the desired actions may differ somewhat from one region to another, it is important to maintain synergy and coherence throughout. Although the regional learning communities have their own content coloring and interpretation, they all relate to at least one of the five jointly defined HCA sub-areas: teacher professionalization; profiles and modules; letting R&D knowledge flow; test & lab facilities; learning community development. Specific attention to cooperation throughout the education column is important here. To accelerate and densify knowledge and value creation, the creation of "focus and "mass" is desirable. Focus is created by making choices: in the first phase, focus on two of the five named HCA sub-areas and group the experiments around teacher professionalization and learning community development (the other three sub-areas are derivatives of these). In addition, a unified approach and set of evaluation criteria can help create mass.

Experiments in different regions can thus benefit more optimally from each other and make use of the lessons learned.

Providing space for regional experiments does not alter the fact that explicit attention to linking innovation, work and learning is desirable. The baby should not be thrown out with the bathwater. Learning community development remains an important lever to combine different perspectives, knowledge and goals for value creation for the hydrogen transition. This requires more than just organizing and facilitating learning **from** each other, but a dynamic where learning is done **with** each other.

Figure 8

Innovating, working and learning in Learning Communities

Innoveren, werken en leren dicht
tegen elkaar aan organiseren

Investeren op de raakvlakken
en de overgangsgebieden

Realiseren van Learning
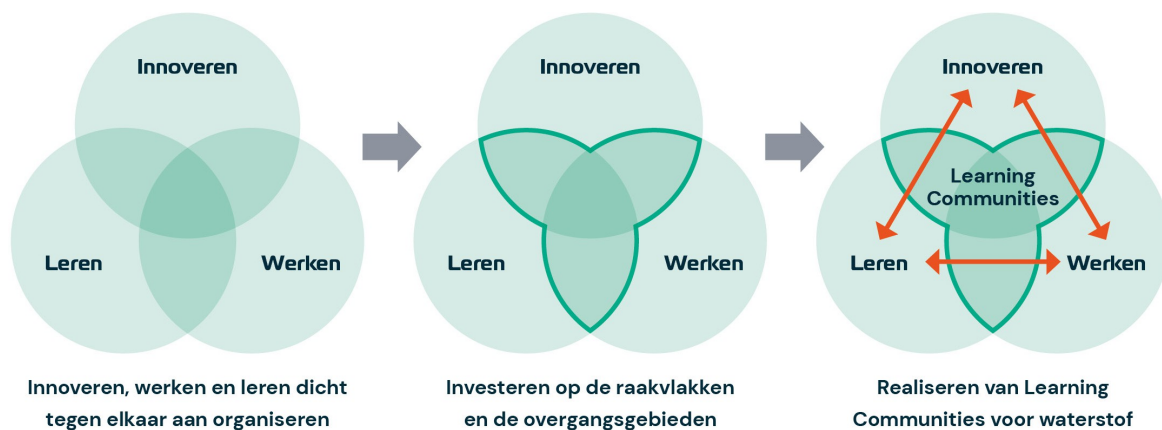Communities voor waterstof

Figure 8 outlines a beckoning perspective in which, more than **learning from** each other, there is **learning with** each other. On the left side in the picture, innovation, work and learning are organized close to each other and learning from each other. On the right side, the domains are systematically connected. Innovating, working and learning are actually connected with each other, learning *with* each other in complex issues. Current practice in the regions particularly shows examples of learning from each other. The question is whether that is enough: for acceleration and in relation to the complexity

of the challenges, we need much more learning *with* each other. See also the comment of the HU Joint Knowledge Centers Working Group (2023) that densifying and accelerating value creation is desirable.

At the same time, it has also become clear from this research that connecting all three parts of the WIL triangle to each other requires more time. For now, we mainly see initiatives focused on innovation and/or learning, where learning is particularly focused on student learning. The added value on the W is not yet clearly visible. In the main phase, extra time and attention for integrating the W is desirable. Important here is not only to focus on the W, but to take into account that this is essentially about further development of the process of collaborative learning, working and innovation and how to secure this. This is not easy and requires time and facilities as well as meters. Advice is therefore to pay explicit attention in these regional experiments to the strengthening of the WIL and more specifically to the integration of the W. So in addition to a substantive focus in the area of teacher professionalization or learning community development respectively, the experiment poses the question of what the experiment teaches us in terms of integrating the WIL triangle.

For the sake of national knowledge development, it is desirable that the experiments are set up systematically (e.g. with the breakthrough method[14]) and evaluated, so that there is insight into the working mechanisms of the pilots. Research shows that moving or repeating pilots in a different context does not necessarily become successful, however, the working mechanisms of an intervention are, under conditions, transferable (Denyer, Transfield & van Aken, 2008). It is therefore recommended that in the follow-up project, research is conducted that focuses on these mechanisms. More specifically, on mechanisms that contribute to shortening the time-to-job, as well as on mechanisms that contribute to connecting and strengthening the WIL triangle (innovate, work and learn). The questions then revolve around: What do the experiments learn from each other regarding teacher professionalization and learning community development, respectively? What do the different experiments teach us with regard to strengthening/integrating the WIL triangle?

In addition, a national "expert track" for those involved in learning communities hydrogen in the main phase could take shape. One could think of a traveling seminar in which each time in one of the 6 regions a predetermined topic related to H2 is central linked to specific WIL issues. Collecting and recording the knowledge sharing is a key recommendation in this.

The above calls for national direction in two ways.

1) In the design and evaluation of the regional experiments. This is necessary to make the knowledge, expertise and lessons learned applicable to the entire H2 domain in different contexts.

2) In nationally facilitated exchange between regions in the HCA sub-areas of teacher professionalization, learning community development, developing profiles and modules, R&D knowledge flow, and test and lab facilities.

In resumé

Energy transition is a complex issue that moves across all boundaries of disciplines and organizations. This requires integration and input from different areas of expertise and knowledge.

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[14] The breakthrough method is a systematic approach in which actual improvements in practice are realized on the basis of (scientific) knowledge. Important elements of the method include working with multidisciplinary project teams; working with measurable goals in a cyclical way; working with evidence-based guidelines; exchange between teams through work conferences; working with input from practice (Van Eck & Glaudé, 2010).

In addition, acceleration is needed. There is great urgency. The one answer does not exist. Integrating work, learning and innovation is one way to work together to find the necessary answers. This can take shape in public-private learning communities. Regions will experiment with forms and with the development of approaches to the integration of work, learning and innovation. It is very important that through the actual integration of working, learning and innovation, learning shifts from learning from each other to learning with each other precisely because of the complexity of the energy transition issue that is constantly evolving.

5.2   Teacher professionalization: recommendations for follow-up

In the recommendations regarding teacher professionalization, we start with the points for improvement from the evaluation of the first phase of the pilot (see also section 4.1.2). We then provide recommendations that should have a place in the design of (the experiments in) the follow-up project.

Areas for improvement from the evaluation

Based on the evaluation of the pilot, the following points for improvement for the follow-up have been formulated. These will partly be taken up by the national development team described above, partly these points for improvement will have to find a place in the experiments of the follow-up project.

a)   Determining the scope

At the start of the program, the scope was the basic mbo elective $_{H2}$. Later this was expanded to include the in-depth MBO elective $_{H2}$ and expansion to higher education also became a theme of the meetings. In addition, it was discussed that commercial courses should fall within the scope. A clear scope and clarity about the extent to which this scope can vary regionally is important for all involved. This requires clear delineation at the start with those involved. The roadmaps can play an important role in this. Finally, they describe the needs of the regional $_{H2\ ecosystem}$.

b)   Realizing preconditions

An important prerequisite, it turned out, is to ensure sufficient time and quality in the region so that the organization of professionalization can run smoothly. It is in any case a matter of reaching the target group, facilitation by their management, support from labs, availability of moderators and the timely planning of the professionalization trajectories, so that they can be taken into account in scheduling for education (by hours). One consideration may be to make moderators available nationwide.

c)   Improve manual

The teacher's manual (see Appendix ..) needs further improvement. An important aspect is to formulate the professionalization process in the clear existing process steps with less detailed instructions ("keep it simple"), such that the process is independent of the number of meetings. In this way, regional choices can be made. What should receive more and less attention and which step serves as a starting point or capstone. For example, consider situations where teachers already have a lot of hydrogen knowledge or already have a lot of experience with learning to work on project assignments. There may also already be good relationships with practitioners and/or interesting projects already available for students.

d) Looking into the kitchen

Teachers' own viewing and experience of hydrogen applications requires more encouragement. In addition to company visits, it is also useful to visit (each other's) projects and/or lab facilities. This makes opportunities for cooperation and/or joint use visible. Cooperation between MBO and HBO also requires explicit stimulation. In this way, regional learning communities can gradually emerge as the carrier of professionalization and knowledge sharing. The mbo and hbo lecturers play a pivotal role in this, alongside professionals from industry and researchers. This requires a different skillset, so that teachers, together with professionals, know how to develop and implement learning processes that combine innovation and learning.

e) Facilitate nationwide ancillary work.

Thanks to the project funds available from GroenvermogenNL, the topic of teacher professionalization is now firmly on the agenda in all GroenvermogenNL regions. The importance of this cannot be underestimated. The changing role of the teacher and support for its development that has already been mentioned help to shape the new interpretation that is necessary for regional development. At the same time, more is needed, more in the sense that there is a strong interaction here between what is happening nationally and regionally. The national developments in Make Hydrogen Work and H2inO cannot do without the regional developments concerning teacher professionalization and the corresponding national development team for teacher professionalization, and vice versa. Good materials from the teacher professionalization group are an important condition for Make Hydrogen Work. Conversely, the development of Make Hydrogen Work is equally important for regional development.

This requires a (mild) form of alignment and coordination. In addition, it requires:

- To arrive at a new manageable version of the dictation for students (and teachers) in the basic elective, supplemented by a basic set of slides for teachers.
- Further develop the sample project assignments (security, mobility, industry and built environment) with partial assignments and portfolio products to inspire teachers to create their own regional project assignments.
- Further professionalization in the field of safe working with hydrogen at different safety levels, taking into account differences between 18- and 18+ students with attention to certification. It is possible to build on existing safety training courses of Hogeschool Rotterdam for working safely at the RDM Energy Lab.
- To achieve validated and structured completion of the current knowledge base so that teachers can use literature and materials that are available and forthcoming at any time. This content can then later be transferred to the National Knowledge Platform, which is still under development.
- Make clear agreements about sharing materials (credit where credit is due): "This work is under a Creative Commons Attribution-ShareAlike 4.0 International license.").
- Explore the possibilities for practicing (by students) with process simulations and if possible realize them.

The sequel - accelerating teacher professionalism

Because of the rapid developments in hydrogen and the development of regional ecosystems in which learning community development has an important place, acceleration of teacher professionalization in the regions is important. Overarching national cooperation can bring this acceleration, with the aim of effectively organizing the professionalization process, achieving upscaling and securing it in the regions, so that the "time to job" for the teacher is as short as possible.

is. This national cooperation should focus on supporting the regions in the following areas.

- Developing and validating educational materials and making them digitally, nationally available (eventually through GVNL's national knowledge platform) so that they can be used by regional organizers of professionalization and directly by teachers. These include project assignments at different levels and different areas of application, project examples, forms of assessment, elaborations of work processes, examples of facilities with teacher guides, dictations for students/contents for syllabi, didactic "modules," and so on. In the coming years, linkage to H_2 skill profiles yet to be developed is obvious. Connection with Make Hydrogen Work is very important in this.
- Specifically, for the mbo basic elective in Hydrogen Technology: further develop the regionally already developed mbo basic elective in Hydrogen Technology into an educational package that (other) teachers can use regionally to implement the basic elective in order to enter hydrogen education relatively easily;
- Drive and organize practice-based translation of proceeds from R&D program lines so that they are available to teachers, students and their partners with whom they learn, work and innovate in projects;
- Develop and implement a basic hydrogen subject matter course for teachers from the regions, similar to the basic elective with the practicals at Level 1;
- Elaborate and provide professionalization for educational stakeholders in the area of working safely with hydrogen at different safety levels, taking into account differences between 18^- and 18^+ students and focusing on certification;
- Facilitate regional coordinators of teacher professionalization in exchanging experiences and learning from each other, both with respect to the way of organizing and implementing teacher professionalization itself (with associated expert teams and "lab" facilities), and of creating the preconditions;
- To support the regional coordinators come up with an improved, simplified manual for moderators of teacher professionalization that also puts more emphasis on co-creation with SMEs on both content and implementation of teacher professionalization and broadens the target group to include teachers, practical trainers and business trainers at the MBO and HBO level;
- Facilitate the pool of national experts who provide expert sessions in regional teacher professionalization programs;
- Maintain course and continue to drive the goals of teacher professionalization. In short: regional fulfillment of hydrogen education (including testing) in cooperation with companies, professorships and lectorates, whether or not in a hybrid learning-working environment, so that the education is in line with regional developments, is in line with the contributions that its own target groups of students can make to them, is aimed at meaningful, innovative learning that is supported with conditional learning and teachers remain in contact with the environment (networking);
- Exchange experiences and opportunities for grant projects in which teachers can participate in their region, giving them space to work with regional partners on developments. For example, through RIF or RAAK grant schemes.

It is important to shape this cooperation in an investigative way and to link it to flanking research aimed at the goal: "effectively shaping the professionalization process and arriving at scaling up and securing it in the regions, so that the "time to job" for the teacher is as short as possible."
Finally, we recommend looking at how regions can connect in application areas with respect to hydrogen.

Resource List

Dialogic (2022). *Strengthening Learning Communities within the TSE.* Report commissioned by Top Sector Energy (TSE) and Rijksdienst voor Ondernemend Nederland (RVO) and Network Learning Communities; https://topsectorenergie.nl/nl/kennisbank/versterking-leervermogen-learning-communities-within-the-topsector-energy/

Denyer, D., Tranfield, D., & van Aken, J. E. (2008). *Developing Design Propositions through Research Synthesis.* Organization Studies, *29*(3), 393-413. https://doi.org/10.1177/0170840607088020

Internal report HCA GVNL 24-hour 6-7 February 2024

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Nieuwenhuis, L.F.M. (2013). *Working on good vocational education.* Lecture speech. Nijmegen: University of Arnhem and Nijmegen.

Platform 31 (2020). *Organizational networks of value: A preliminary study on the functioning and future of organizational networks in the social domain.* https://www.platform31.nl/wp-content/uploads/2023/02/Organizational-networks-of-value.pdf

Van Eck, E. & Glaudé, M. (2010). *The Breakthrough Method in education; learning from yourself, learning from each other, learning from others. A reflection.* Amsterdam: Kohnstamm Institute. (Report 864, project number 10304)

Working Group Joint Knowledge Centers HU: Healthy & Sustainable Living, Social Innovation, Learning and Innovation, Digital Business & Media (2022). *Mission-driven environments. A conceptual model of the HU Knowledge Centers.* https://www.hu.nl/onderzoek/projecten/missiegedreven-omgevingen-een- conceptual-model-of-the-hu-knowledge-centers.

Appendix 1: HCA GVNL program.

The entire GroenvermogenNL program has three program lines: (1) Rapid and substantial scale-up; (2) Research and Innovation Program (TRL 2-8); and (3) Human Capital Agenda. The Human Capital Agenda is seen here as an 'enabler' for the ambitious activities regarding the production and transport, storage & transshipment of hydrogen and its (large-scale) application in industry and other application areas such as mobility & transport and the built environment.

Program HCA GVNL

The HCA GVNL program identified 5 work streams:
- The development of a national knowledge map;
- Scaling up learning communities;
- Development of a national knowledge platform;
- Development of a national education package;
- Realization of an innovation and training impulse.

In preparation for the main phase, a first year was planned for three core activities:
1. Appointment of regional liaisons and development of regional roadmaps
2. The realization of a National Hydrogen Knowledge Platform.
3. Developing and implementing start-up activities for scaling up learning communities

Sources:
Wagner, M. & Terwisga, H. van (2021). Human Capital Agenda Green Power NL: Bridge to the future. Link.
Oosting, J. (2022). Application for start-up activities Learning communities HCA Green PowerNL.

Appendix 2: H_2 -environment teacher professionalization

Author(s): Roeland Hogt Date:
March 2024

The Teams environment "NP-Hydrogen teacher training" is the shared environment for the teacher professionalization activity within the start-up activities Learning Communities Green PowerNL. The structure is as follows:

- Management and organization with reports of discussions and documents and planning of the pilot.
- Realization with:
  - Session 0-7, with a presentation, preparatory documents and report for each session.
  - Project assignments, elaborated in a working paper "hydrogen lab safety" and "hydrogen in mobility"
    The working documents are the basis for innovative learning: from the frameworks (regulations, optional subjects, qualification dossiers, examination) to the application (from simple to complex). In a working paper we share experiences and link to available literature (see knowledge platform).
    Project assignments have been developed on the themes of mobility and safety. This is to be followed by assignments on the themes of industry and built environment.
  - Knowledge Platform
    The knowledge platform consists of a knowledge index (excel workbook) and a folder of literature documents (PDFs). The knowledge index uses the classification: Standard/Directive, Policy/vision/plan, Research/projects, Book/instruction/knowledge sharing/news, Knowledge platform, Training/course, Film, Project formats/drawables/assignments, Project facilities, Project examples, Experts, Knowledge institutions, Collections education/course overview.
    The knowledge index links to folders in the team environment, websites, movies and more).

The administrator is Roeland Hogt. He also handles applications for access. By March 2024, the area will have 57 members and guests.

Appendix 3: IST questionnaire

In front of you is the questionnaire 'IST situation Learning Communities Green Ability'. This questionnaire is part of the inventory in the project 'start-up activities learning communities'. This survey **aims to identify the current state of affairs of the already existing learning communities in the six regions involved**, and it is being conducted by researchers at the Arnhem and Nijmegen University of Applied Sciences.

Based on the inventory of the IST situation, active learning sessions are organized at some of the learning communities to identify the SOLL situation. Together they provide input for needed professionalization activities and their implementation.

Learning Community

Following Schipper et al., (2022), we define a learning community as a manifestation of a partnership between organizations and other (unorganized or less organized) parties, which enhance the collective capacity of *learning*, *working* and *innovation*. The learning community is organized in the context of professional practice through which it can contribute to working differently, innovating and/or (jointly) learning ("WIL triangle" (Top Sectors, 2017)). It is not only about knowledge sharing, but also about knowledge production and application (Wenger, Trayner, & De Laat, 2011). We explicitly focus on public-private learning communities.

Questionnaire

The following is the questionnaire we use to survey the current situation of learning communities already in place in your region. The questionnaire consists of 23 questions. These are based on the Framework for Public-Private Learning Communities (Mennens et al., 2021). The framework has four pillars: a goal-setting pillar; a structure pillar; a process pillar; and a culture pillar. The questionnaire runs through these pillars.

When answering the questions, you are asked to assume the **current situation**. No normative values are attached to the answers. If you do not have an answer to any of the questions please indicate, "don't know.

You are kindly requested to complete the questionnaire for the individual learning communities each separately.

1.	What is the name of the LC?	
2.	What prompted its creation?	
3.	Who are the initiators?	
4.	Has a common goal been determined? And if so which one?	
5.	Has a deadline or term been set? If so, which one?	
6.	Has attention been paid to how you collaborate and learn as LC?	
7.	Has there been a focus on creating a common language?	
8.	Has there been a focus on fostering mutual trust	
9.	Has there been attention to arrive at a shared set of norms and values?	
10.	What is the composition of the LC?	
11.	How many people participate in the LC?	
12.	Which parties are represented in the LC?	
13.	Does the LC have a fixed or changing composition?	
14.	Does the LC have a facilitator?	
15.	If so, what is the role of the facilitator?	
16.	Is there a further division of roles and/or tasks? If so, which one?	
17.	In what ways do LC members meet?	
18.	At what frequency does the LC meet?	
19.	What do the meetings/meetings look like?	
20.	Are the meetings prepared? And if so, how?	
21.	Are meetings recorded in minutes?	
22.	Will further arrangements be made in the meetings?	
23.	Are decisions made in the meetings?	

Thank you so much for filling it out!

Appendix 4: SOLL work sessions script.

From Plan of Approach Commencement Activities:

"To be able to act in these encompassing transitions, it is necessary to work jointly, i.e. with as many stakeholders as possible, and from a broad perspective, to create the necessary experimental environment, preconditions, conditions and rule-free space and to be able to act proactively, flexibly and resiliently in relation to the relevant stakeholders in this. Only in this way can a joint contribution to the great social tasks be realized and at the same time learning in all places be innovated in such a way that it remains in step with the transition process. We are therefore going to work together to investigate, co-develop, stimulate, etc. other forms of learning. The focus here is on the concept of *learning communities* and the development of a related **learning approach** and on fleshing out forms of **transformative learning**."

To give shape to the above (practice what you preach), the SOLL situation was mapped by organizing so-called landscape sessions.

What is a landscape session?
An interactive form of work in which various stakeholders in the region engage in conversation to jointly give meaning to social developments (technological, socio-economic and policy) in relation to the human capital task.
The working form uses Nieuwenhuis' (2013) landscape model. See figure below:
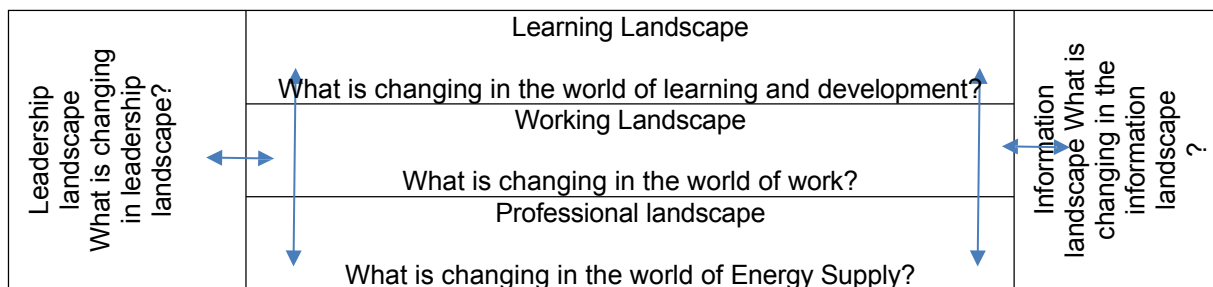

Figure 1 Landscapes model (Nieuwenhuis, 2013)

This model helps to systematically think through the changes in professional domain itself (technology, policy, socioeconomic developments) in terms of the implications for changes in the work landscape (different division of labor, new functions, new work routines) and the required changes in the learning landscape (what does this mean for learning and training professionals).

Approach
In all six regions we organize a working session with the members of the learning community. Preferably all members of the learning community participate, otherwise we aim at least for a group of participants that is a good reflection of the different stakeholders (reflection of heterogeneity across the board).
In the work session the participants will color the different 'landscapes' together, the central question each time being what developments are taking place in this landscape. This will be the prelude to a conversation about the shared task for the learning community and how they will work and learn on it.

Program

Part 1: Poster with landscape. Paste on that. Possibly in two groups. Step 1:
What relevant developments are going on?
Step 2: What do we see here? Which ones are shared? (Then imply "How do I relate to this?"). Step 3: Which ones are relevant to us as LC?
Completion of this section. Incl any exchange between the subgroups.

Part 2: using placemat: What is our task? And possibly exchange the groups. Hang the placemats side by side.
Identify shared task (and hang under it)

Part 3
'What assignment do you give yourself regarding learning and development as a
learning community? Check out in circle: what assignment do you give yourself? And
step out

Part 4 for facilitators! Take photo of placemat collage. Send this photo after about a week to those involved with/as a thank you

Duration: 2 hours
Place: physical meeting

Practical preparations
- Making support materials
  - Poster with empty landscapes
  - Placemat

- Bring
  - Yellows and markers

power | Innovation engine of the
green-hydrogen economy