Conference on Sustainable Energy Education – SEED 2024
Valencia, Spain, 3 - 5 July 2024

Enabling the flow of knowledge for the Energy and Hydrogen Transition

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Abstract

With this paper, we describe the Dutch strategy on skills development - based on successful approaches of Energy Innovation NL (EINL) and GroenvermogenNL (GVNL) for the energy and hydrogen transition. To achieve success in these transition, substantial new knowledge is required. To apply this new knowledge in the labour market, research and innovation must increasingly intertwine with regional learning communities (LC) where innovation, learning, and work are harmonised. This way, skill valorisation will be realised: valorising new knowledge from research and innovations through developing professionals', students', and teachers' skills and practice-oriented research through public-private partnerships. We argue that skills valorisation is an imporant part of the knowledge and innovation policy and a strong collaboration between Universities of Applied Sciences and Vocational Institutions are needed to strengthen education and research. The next step is the recognition of acquired skills through the LC approach. The goal of this solution is to bring together several effective approaches: the development of a national approach to enable individual learning pathways towards skills profiles, across the different educational partners and regional public-private campuses.

Keywords: Human Capital, Learning Communities; Skill Valorisation; Hydrogen.

[1] https://topsectorenergie.nl/en/

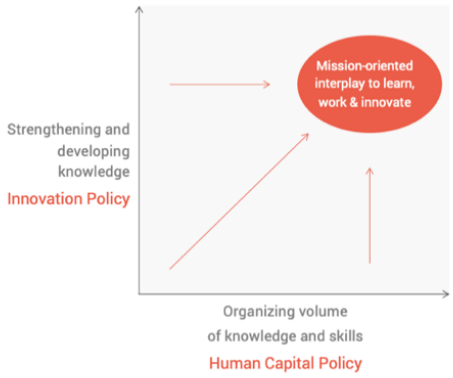
[2] https://groenvermogennl.org/en/, this is one of the programs of the National Growth Fund in the Netherlands: https://www.nationaalgroeifonds.nl

Introduction

Energy Innovation NL (EINL) and GroenvermogenNL (GVNL) are two of the driving forces behind the innovations needed for the transition to an affordable, reliable, and sustainable energy system for the Netherlands. The success of the energy and hydrogen transition requires significant new knowledge. To apply this new knowledge in the labour market, research and innovation must increasingly intertwine with regional learning communities (LCs) (Topsectors, 2017], where innovation, learning, and work are harmonised. This way, skills valorisation will be realised: valorising new knowledge from research and innovations through developing professionals', students', and teachers' skills and practice-oriented research through public-private partnerships (Ministerie van Economische Zaken en Klimaat, 2023).

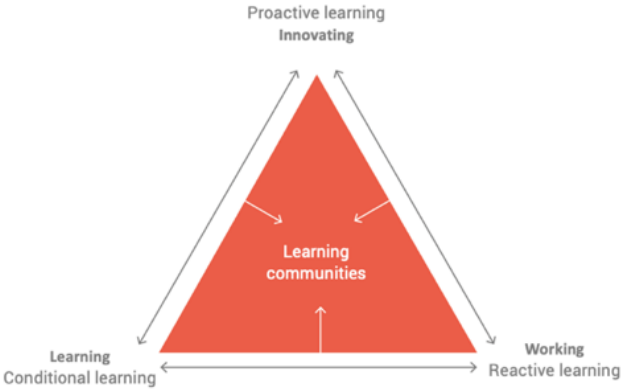
This strategy originated since innovation seemed to exist in a parallel universe, disconnected from the challenges associated with skills development. Research shows that if you don't translate knowledge and innovation development into skills, the employment opportunities that arise from it usually migrate abroad. There is a proven causal relation between a robust cognitive embedding in the region creating opportunities (for smaller emerging clusters that offer limited employment) and strengths (for larger existing clusters that provide substantial employment) of economic clusters. But if skills are a critical factor in economic growth coming from new knowledge and skills, why is skill development not (always) an integral part of research and innovation? (Giessen, A., 2017). The 'learning communities' strategy has been developed in the Netherlands (Energy Innovation NL, 2023). This approach aims to foster synergy between knowledge and innovation policy and human capital policy (Figure 1). This synergy is implemented within so-called learning communities. The implementation of this synergy occurs within so-called learning communities (Figure 2).

Fig. 1 – Synergy between Innovation- and human capital policy.



Source: Qeam (2019)

Fig. 2 – Converging innovating, learning and and working.



Source: Topsectors (2017)

In the Netherlands, 134 LCs are emerged in the last six years and are still growing in numbers. LCs inhibit two main concepts: the three functions of lifelong learning (informal, formal, and proactive learning) and the definition of knowledge (implicit and explicit knowledge). These LCs allow professionals to work on their skills and operate as partners in innovation.

Innovation projects will form a rich breeding ground for developing skills of students and professionals. The recently started program 'Learning Communities System Integration' (Energy Innovation NL, 2024). is built on this concept and works with 'use cases' (The Green Village, 2022) to innovate solutions for system integration within our energy system and as an enabler for the skills development of professionals and students.

Skills Valorisation as part of the knowledge and innovation policy

To implement skills valorisation, EINL and GVNL encourage consortia applicants for R&D- and innovation subsidy calls to seek collaboration with regional learning communities. This fosters cooperation and an approach between companies, researchers from all sectors, students, and (researching) teachers from the entire spectrum of (vocational) education (universities, colleges, and vocational schools). Together, they can develop approaches for each research and innovation project where innovation, learning, and work converge. In this way, EINL and GVNL continuously feed the regional LCs with use cases, which leads to skills development that enables innovations to grow economically.

Simultaneously, they collaborate closely with the Dutch Research Council (NWO) (Dutch Research Council, 2024) to realise and fund research into learning communities. Over the past four years, more than 7.5 million euros have been invested in this type of research. These have been successful researches. An example is "Gas erop!" where research is conducted by the University of Twente and Saxion University of Applied Sciences in collaboration with MBO Twente and a network of SMEs (Applied University Saxion, n.d.). This research shows its value to transfer knowledge to practice.

Translation into Education and SMEs

To achieve this, 'professors from universities of applied sciences' and 'practors' (see appendix 2) from vocational institutions are essential in research consortia. It is their speciality to conduct practice-oriented research and translate it into the education of students and professionals. Together, they play a central role in ensuring success. Furthermore, they are closer to SMEs through practical research and can initiate projects with SMEs to shape knowledge development and valorisation towards SMEs. Special attention is needed to harness vocational education's (unknown) potential. Vocational teachers, students and professionals participating in knowledge development can easily make new knowledge practical through applied research, making it applicable to (SME) companies.

Strong Collaboration between Universities of Applied Sciences and Vocational Institutions

Thus, in a new, challenging approach to strengthening connections, universities of science, applied sciences and vocational institutions are necessary for education and research. In many regions, universities of science and, applied sciences and vocational institutions have already developed successful and proven approaches for this purpose. These approaches have proven effective and are valuable to research and innovation.

New forms of collaboration like these, integrating skills and knowledge development, can inspire even more concrete new collaborations where the triangle of learning, working, and innovating develops integrally. Each form depends on the context and is designed to achieve optimal regional impact. However, in all these examples, the University of Applied Sciences plays a central role, and there is added value through the involvement of vocational institutions.

Challenges in Vocational Participation in Public-Private Partnerships for knowledge development and innovation

There are still challenges experienced in vocational education participation in public-private partnerships like learning communities. One of these is that vocational institutions are also considered economic entities for their research under the state aid rules, resulting in lower subsidy rates than universities of applied sciences and universities. Additionally, recognising vocational institutions and their public-private partnerships as attractive collaboration partners must catch up. It is essential to address these challenges to improve the participation of vocational institutions and thus increase the added value of the innovation ecosystem (see appendix 2).

Skills validation

The implementation of the vision described above is well underway in all regions of the Netherlands and for all innovation themes aimed at achieving a sustainable, affordable, and reliable energy system. The next step is the recognition of acquired skills through the LC approach. This is an exciting innovation because there is currently no ready-made solution for this. GVNL will soon launch the program 'Make Hydrogen Work' focusing on this aspect. It is developing a national solution that will simultaneously further support international and European collaboration. The goal of this solution is to bring together several effective approaches: the development of a national approach to enable individual learning pathways towards skills profiles, across the different educational partners and regional public-private campuses:

1. The foundation for adapting 'Make IT Work' (Make IT work, n.d.). to hydrogen learning pathways will be based on the skill profiles established within the EU that students and professionals need to acquire for the hydrogen economy.
2. Adapting Smart Makers Academy (Smart Makers Academy, 2022) to hydrogen, which aims at SMEs and professionals for orientation and inspiration on digitalisation in smart industry. This academy consists of a vast campus network that supports small and medium-sized enterprises (SMEs) in taking steps toward the smart industry.
3. Utilising the system(s) for micro credentials so that both learning paths and orientations and introductions are recognised in the job market.

This will be an innovative program and can become the prerequisite for organising skills validation for education and lifelong learning in the future.This program leans and makes use of the 'Coordinated approach to Human Capital' which is embraced by the public investment funds in human capital for the energy transition, such as the Just Transition Fund from Europe, and the programs LLO Catalyst and Upscaling PPS Vocational Education (Energy Innovation NL, 2024). The regional liaisons of GVNL initiated and work within the regional ecosystems that arose for the hydrogen economy and. They put the coordinated approach to implementation in their region and integrated this in the regional roadmaps (GroenvermogenNL, 2024).

Concluding

With this abstract, we started describing the Dutch strategy on skills development for a flourishing society. Predicting the future is impossible. We are in an era of 'shocks.' Each shock has a different cause (credit crisis, COVID-19, war in Ukraine, war in Gaza, etc) and consequence (economic brakes applied, 'Swiss cheese' economy with overheating and job loss, energy poverty, and high inflation). Not only does addressing the immediate consequences take priority, but so does organising ourselves, learning from each other, and enhancing collaboration within the European Union to better cope with these and future shocks. We aim to have this discussion with multiple countries during the SEED Conference.

Acknowledgements

No funding has been received for the development of this research.

Conflicts of interest

The authors declare that they have no known competing financial interests or personal relationships that could have influenced the work reported in this paper.

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Appendix 2 – Explainer 'practors' and professor of 'applied science'

Practor	***Professor of applied science***
A practor is a figurehead, inspirer, and engine of a practorate in a vocational institution. A practor is responsible for developing, applying, and disseminating knowledge within the vocational institution and beyond. Conducting practice-oriented research and professionalising teachers are also essential tasks. Practorates are multidisciplinary teacher teams installed in VET institutes which carry out applied research to explore new professional practices (practoraten.nl, n.d-a). 117 practorates are currently active across 54 VET institutes[3]. The goal of practorates is to stimulate a research mindset within the VET institutes they are working in and eventually stimulate innovation in the vocational sector (practorates, n.d-a). They carry out two types of research: research specialised in an educational topic or a didactic theme[4], and research in occupational domains[5]. In both cases, they focus on clarifying questions, looking at what is known about a specific topic, analysing data, making knowledge applicable and workable, bringing teachers and students into contact with professional practice and developing creative forms of education. Although practorates aim to stimulate innovation in the vocation sector, in practice, many practorates are, to this date, more focused on using research to improve the quality of education and further develop curricula and are, to a lesser extent, involved in stimulating innovation in the vocation sector.	Universities of applied sciences appoint professors of applied science. The core tasks of the professor are related to research, education, and professional practice. A professor is responsible for initiating, developing, and conducting practice-oriented research. In interaction with professional practice and connection with education, the lecturer stimulates knowledge innovation and the professionalisation of teachers. Practice-oriented research at universities of applied sciences links inherently to education. The research aims to enhance the quality of students, align education with current developments in practice, and introduce innovation into the (professional) practice. Therefore, research always occurs in the triad of research, education, and the field. The professor of applied science plays a pivotal role in this triad. The lectorates underpin applied research. Each lectorate consists of one or more professors, teacher researchers, PhD candidates and support staff. They sometimes involve external experts, too. Each lectorate focuses on one theme, such as technology in healthcare or the energy transition in urban areas. Students involved in research projects develop a questioning and critical attitude essential for their future professional practice. Applied research strengthens the quality of higher vocational education. It gives the students access to the latest knowledge, which finds its way back into practice through them.

[3] Not all mbo's have a practorates, as some count several practorates and others count none.
[4] such as citizenship, media literacy, work-based learning
[5] For example: logistics, mechatronics, care and welfare

Appendix 3 – Case studies

Case study: The Green Village (West region)

A sustainable future calls for innovative ideas and new practical methods and techniques. At The Green Village, knowledge and educational institutions, businesses, governments, and citizens explore, experiment, validate, and demonstrate their sustainable innovations. The Green Village is a regulatory-light "outdoor laboratory" on the TU Delft Campus focusing on the built environment, where testing can occur at the neighbourhood, street, and building levels. With access to the innovation ecosystem of TU Delft, science is literally around the corner. It is a place where people live, work, and learn.

Case study: Greenwise Campus (North-East region)

At the Greenwise Campus, the University of Groningen, NHL Stenden, and Drenthe College collaborate with companies to strengthen the region's innovative capacity and economic strength while retaining talent for the region. This includes regional production of green hydrogen from alternatives to pure water, such as seawater and sewage. Facilities have been built for conducting tests. Companies use the resulting hydrogen as an energy source.

Case study: Communities for Development (South-East region)

In Communities for Development (CfDs), students and experienced professionals work under the coaching of a researcher on a challenge from the field. The assignment is central to the research group, and an independent assessor assesses the learning outcomes. Using an experienced professional as a 'working leader' ensures the quality of the research outcome and a low threshold with the novice professional (student). In addition to building knowledge that flows back into education, this coach ensures continuity in longer projects involving multiple CfDs. Furthermore, the coach is essential for understanding and filling knowledge gaps (e.g., literature and networks).

The assignments connect innovation, professionalisation, and education in the themes of Molecular Health, Circular Materials, and Sustainable Chemistry. For the Applied Science program, this is a fixed part of the curriculum, but often, students from other academies or knowledge institutions from both within and outside the country also participate as part of a project, minor, or internship. Depending on the assignment, multilevel (university, college, vocational) interdisciplinary CfDs may exist. The assignment takes place where it is best suited. Usually, these are the state-of-the-art facilities of the Chemelot Innovation and Learning Labs at the Brightlands Chemelot Campus.

Case study: Celciushuis (Middle-Region)

Celciushuis Amersfoort: Within this Innovation workshop, companies, residents, students, travelers and researchers work together trans-disciplinary on area-specific innovations for a healthy, sustainable new city district. The challenges focused on are location specific problems based on questions from residents or the municipality.

With this Celciushuis Innovation workshop, we work transdisciplinary on area-specific innovations for a healthy, sustainable new city district. This innovation workshop is based in the upcoming Amersfoort city district of Hoefkwartier. The challenges we work on do not start from a technical innovation, but from a location specific problem. These questions usually come from residents or the municipality. The concepts developed are not merely reports, we always strive to create physical prototypes so we can let end users experience the future and provide feedback.

The subprojects of the Innovation workshop deal with three main themes which were identified in the beginning of the practice as most relevant among (future) residents and stakeholders. The themes were cross-referenced with the knowledge and innovation agenda of the Centre of Expertise Smart Sustainable Cities and the political agenda of the municipality. For now, these topics are: 1. Comfortable survival, a house without a safety net, 2. The city as a closed ecosystem, working on closed circles, 3. The creative neighborhood living room, building a community. Using these main topics, a steady stream of manageable subprojects and follow-up paths are generated.

Case study: Applied Research Team (East region)

The Applied Research Team (ART) works on innovation, with knowledge development, practical application, and knowledge sharing at its core. A research question from the field serves as the starting point, with close communication with the clients. Students play an active role at various levels (university, college, vocational). In addition to researchers, the team includes passionate students who make a crucial contribution.

Together with the Supervisory Board, the aim is to maximise the impact of the developed knowledge in the research. This advisory board comprises experienced and knowledgeable professionals from vocational education, academia and industry.

Innovation, work, and learning go hand in hand, forming a dynamic mix. The mission goes beyond research: the team develops tools and materials to transfer knowledge to teachers and professionals, contributing to a better future.

The Applied Research Team was initiated by the Sustainable Electrical Energy Centre of Expertise (SEECE). SEECE is a public-private partnership that focuses on developing an affordable, reliable and sustainable energy system. The partners from industry, vocational education and universities of applied sciences developed the Applied Research Team concept as an operational tool to accelerate innovations and its application serving the energy transition. Several ARTs are assigned to projects in heavy-duty equipment and energy hubs for the built environment.