TRANSLATING STRATEGIC COMPETENCE FORECASTS INTO TAILORED ULLL COURSES A CASE STUDY OF THE BATTERY SYSTEMS COURSE

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ABSTRACT

This paper presents a case study on the development of the 'Battery Systems course,' showing how strategic competence forecasts can be translated into relevant university lifelong learning (ULLL) programmes.

Rooted in a triple helix learning ecosystem that connects policy, industry, and academia, the course exemplifies macro-meso-micro alignment: from labour market insights (via the Flemish SCOPE initiative) to collaboration between KU Leuven and the tech federation Agoria, and down to pedagogical design.

The case study illustrates how institutional barriers to Lifelong Learning (LLL) - particularly the misalignment between ULLL offerings and the evolving competence needs of the workforce - can be addressed by making academic learning more responsive and future-oriented. It offers a transferable and scalable model for ULLL.

INTRODUCTION AND OVERVIEW: (UNIVERSITY) LIFELONG LEARNING

Low participation in (U)LLL – tackling institutional barriers

The need for LLL in today's rapidly changing world is beyond dispute. As European societies navigate major transitions - from digitalisation to the pursuit of sustainability - LLL is increasingly recognised as a crucial driver of adaptability and employability.

However, participation in LLL remains relatively low in practice, particularly in Flanders. According to recent OECD data, only 22.4% of adults in Flanders reported participating in learning activities in the past year, well below the EU benchmark of 60% (Flemish Monitoring Report, 2024). This underperformance is also visible within the domain of ULLL, where only a small proportion of adults return to higher education institutions after completing their initial degrees (OECD, 2019; VLOR, 2021; Flemish Government, 2021).

Understanding the causes of this participation gap is critical. Drawing on Cross's (1981) seminal typology, three categories of barriers to adult learning can be identified: situational

(e.g., lack of time), dispositional (e.g., low self-confidence), and institutional (e.g., misaligned educational offerings[1]). As *institutional* barriers fall within the zone of influence of universities such as KU Leuven, this paper is situated within that broader context - specifically, against the context of the mismatch between ULLL programmes and the real-world needs of adult learners and sectors. In terms of content, many existing ULLL courses lack up-to-date or demand-driven topics. Additionally, in terms of format, these courses are often not tailored to the complex realities faced by adult learners who must balance work, family, and other commitments.

Case study

This paper presents a case study that explores how institutional barriers can be reduced by making 'academic learning' more responsive and future-oriented. It focuses on the development of the Battery Systems course - a concrete example of how high-level insights into strategic labour market skills (via the Flemish SCOPE initiative) can be translated into a relevant ULLL programme through collaboration between academia (PUC - KU Leuven Continue) and industry (technology federation Agoria).

Structure paper

Before discussing the case study in more detail in section three, section two introduces the SCOPE programme as a policy initiative focused on strategic competence forecasting. Section four provides a set of critical reflections on both process and outcomes. Section five concludes by showing how the Battery Systems course demonstrates alignment across macro, meso, and micro levels within a triple helix learning ecosystem that connects policy, industry, and academia, and explores its potential as a scalable model for ULLL.

BACKGROUND: STRATEGIC FORESIGHT AND THE SCOPE FRAMEWORK AT THE MACRO-LEVEL

In the context of ongoing digital and green transitions, insight into future workforce competences is becoming increasingly essential. To support a more strategic approach to competence development, the Flemish government initiated the SCOPE programme (Strategic Competence Prognoses) during the European Social Fund operational programme period 2014-2020. This macro-level policy initiative sought to gather insights from companies of various sizes across Flanders, with the aim of identifying labour market trends and forecasting future competence demands.

Each SCOPE study begins by selecting a specific sector, value chain, or innovation cluster. All studies are grounded in the VLAMT predictive research methodology, which combines qualitative and quantitative approaches.[2] Importantly, each study is shaped by a broad steering group of Flemish companies - ranging from start-ups and SMEs to multinational corporations - ensuring relevance and practical validity. The SCOPE reports adopt a medium- to long-term perspective (5 to 10 years), and deliberately avoid narrow job

[1] According to the Flemish Monitoring Report (2024, 63 & 80), *institutional* barriers hinder 12.3% of respondents from participating in training. Moreover, one of the most frequently cited levers to increase participation is making the training offer more flexible, i.e., adapting courses to (individual) learning needs. This highlights the importance of aligning the course offering better with the needs of the workforce.

[2] The VLAMT methodology ('VLaams ArbeidsMarktonderzoek van de Toekomst', i.e., Flemish Labour Market Research for the Future), formally recognised by the Flemish government as a valid framework for labour-market foresight, follows a structured, multi-step process. It comprises project planning; the establishment of a steering group; desk research; exploratory workshops; interviews, case studies, or surveys; an analysis of the existing training offer; and, finally, the formulation of recommendations and an action plan; cf. https://www.europawse.be/sites/default/files/public/Documenten/methodiek_competentieprognoses.pdf

descriptions. Instead, they explore emerging competence needs across a broad range of functions and educational levels, including vocational and academic pathways.
The outcome of the SCOPE initiative is a set of 27 strategic reports, covering seven Flemish industries such as paper processing, liberal professions, and textiles (Cabus & Vansteenkiste, 2024).

The SCOPE study most relevant to the present case concerns the battery value chain. The study examined the full value chain, from raw material sourcing and cell manufacturing to battery pack integration and end-use systems - extending even to recycling and second-life applications:

This comprehensive mapping revealed the sector's structural complexity, characterised by a diverse range of companies occupying various positions along the chain, some of which were represented in the study's steering group (cf. supra).

Unsurprisingly, substantial competence needs emerged within the battery value chain, a rapidly expanding sector that plays a pivotal role in energy transition. These arise partly from the broader climate transition, which introduces growing technical, regulatory, and policy complexity - complexity that educational systems struggle to absorb at the same pace. This results in a mismatch between rapidly evolving sectoral demands and the slower adjustment capacity of educational provision. It is therefore significant that the European Pact for Skills emphasises competences for the green transition - alongside digital skills - as priority domains. This reinforces the strategic importance of developing specialised knowledge in emerging clean-energy technologies, such as those at the core of the battery value chain.

MAIN SECTION: CASE STUDY: THE BATTERY SYSTEMS COURSE

Institutional collaboration at the meso-level

While the SCOPE programme is rich in *macro-level* insights, their practical implementation depends on effective translation into *concrete* educational offerings. This requires strong meso-level collaboration between institutional actors across the education and industry landscape. In the case of the Battery Systems course, such translation took shape through a partnership between PUC - KU Leuven Continue and the technology federation Agoria, which will be further discussed below.

PUC - KU Leuven Continue: ULLL context & principles

It is widely acknowledged that ULLL can take many different forms, depending on the university's broader context and strategy (Bengtsson, 2013; de Viron & Davies, 2023). At KU Leuven, all LLL initiatives fall under the KU Leuven Association, which encompasses not only the university itself but also a network of university colleges, with 'Continue' serving as the umbrella organisation for these efforts. PUC - KU Leuven Continue operates within this broader context, focusing on designing and delivering academic-level programmes specifically tailored for (working) adults. It is the primary LLL provider within KU Leuven. To illustrate its scale, in the 2023-2024 academic year, PUC - KU Leuven Continue welcomed 8,237 participants across 204 activities (PUC - KU Leuven Continue yearly overview, academic year 2023-2024). Unlike degree-based programmes (bachelor's and master's degrees), which are subsidised by the Flemish government, PUC - KU Leuven Continue operates as a self-sustaining entity.

The approach of PUC - KU Leuven Continue is rooted in the following principles:

- Open enrolment: courses are open to individuals from diverse companies and backgrounds, unlike in-house corporate programmes, where training takes place alongside colleagues.
- Interdisciplinary approach: as a cross-faculty service of KU Leuven, the course offerings span multiple domains, including economics, psychology, law, and IT.
- Cohort-based learning: emphasis is placed on a cohort-based model, where participants begin, progress, and complete the course together as a group.
- Programme variety: while most programmes are focused on professional development, there are also offerings for those interested in personal learning.
- Course formats: the educational offerings include a range of formats - from webinars and study afternoons to year-long programmes. Both in-person, online, and blended learning options are provided to accommodate the diverse needs of learners.

Technology federation Agoria

Agoria is the national leading employers' federation for technology companies, representing sectors such as manufacturing, digital business, and telecommunications. With over 2,000 member companies, Agoria's core mission is to defend the interests of its members, operating on a business model based on membership fees. This mission is achieved through lobbying, advocacy, networking, innovation advice and support, consultancy, and tailored services.

University-industry collaboration as an analytical lens for the partnership

The partnership underpinning the Battery Systems course falls within the broader category of university-industry collaboration (UIC). Metareviews show that most UIC initiatives relate to technology transfer, including collaborative research projects and contract research (Bruneel et al., 2010; Perkmann et al., 2013). By contrast, collaborations focused on education for professionals constitute a smaller, though increasingly important, subset of UIC activities (cf. Laundon et al., 2024, which highlights the benefits of co-creation in ULLL). Much of the literature on barriers and facilitators in UIC is therefore derived from research-oriented collaborations. Nevertheless, several insights are transferable to ULLL-oriented cooperation. Perkmann et al. (2013), for instance, distinguish between individual-level determinants and organisational-level factors that facilitate successful collaboration - both of which proved relevant in the present case.

Role division

Both *organisations* involved exhibited a strong outward-facing orientation and extensive human-capital networks and are accustomed to collaborating with external stakeholders.

In practice, Agoria acted as a sectoral intermediary, bringing in companies, industry speakers, and practice-based expertise. Notably, Agoria had also contributed to the SCOPE study on the battery value chain (cf. supra: 2) and was therefore well positioned to ensure alignment between labour-market intelligence and concrete course content.
PUC - KU Leuven Continue, conversely, took the lead in educational design and delivery, drawing on its pedagogical expertise and proven approaches for adult learners. From the outset, it was agreed that PUC - KU Leuven Continue would serve as the financially responsible organiser, managing course administration and logistics, in line with what Ankrah and Al-Tabbaa (2015) classify as a 'formal targeted agreement.'

Successful collaboration was also strongly shaped by the characteristics of the *individuals* representing both organisations. Agoria is organised through business groups that focus on shared technologies and innovation needs. These groups are led by dedicated leaders who collaborate closely with companies to identify the required competencies in line with technological advancements. For the present partnership, the business groups Mobility & Vehicle Technologies and Energy Systems & Solutions played a central role. Their business group leader had prior research experience, which enabled him to translate industrial needs into academically meaningful insights - an attribute widely recognised in the literature as conducive to effective UIC. On the PUC - KU Leuven Continue side, the programme coordinator contributed extensive expertise in managing projects at the intersection of education and labour-market policy.

The process of pedagogical decision-making at the micro-level

While this section presents a structured, step-by-step account for analytical clarity, the actual development process was far from linear. Instead, it was marked by an iterative dialogue between academic and industrial actors, and between pedagogical considerations and real-world constraints.

Step 1: Focusing the thematic scope

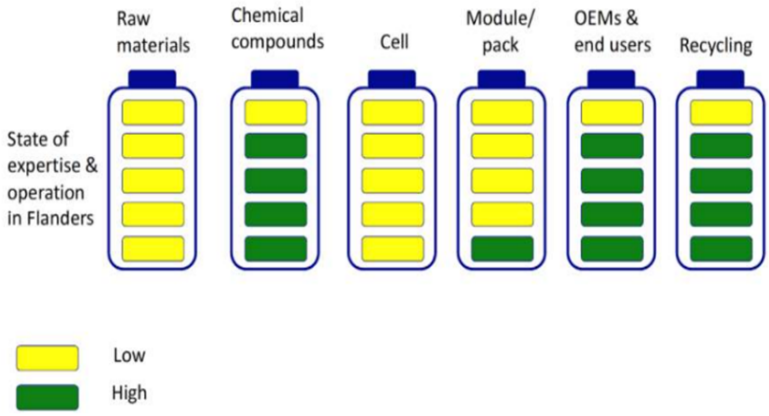
The first step in the design process involved narrowing the thematic focus of the course. Building on the findings of the SCOPE study, the programme targeted the right-hand side of the battery value chain - specifically the application and integration phase (battery packs in applied settings). To further refine the thematic scope, two core domains were identified:

- Automotive and e-mobility, including electric cars and trucks
- Stationary energy systems, such as battery integration in buildings and grid applications

This thematic narrowing was guided by a set of explicit selection criteria derived from the SCOPE mapping exercise:

(1) Relevance to the Flemish industrial landscape,
(2) Concentration of active companies within specific segments of the value chain, and
(3) Documented competence needs related to application-level battery technologies.

As the mapping visual illustrates overleaf, the strongest clusters of Flemish companies (highlighted in green) are predominantly situated within the application and integration phase. Alternative thematic routes - such as raw materials or cell chemistry - were evaluated but discarded due to their limited presence in the regional industrial context.



Step 2: Defining learning outcomes in line with the target audience

With the thematic focus established, the subsequent step involved defining (and refining) the intended learning outcomes, in accordance with the didactic concept of *constructive alignment* - that is, the alignment of intended outcomes and learning activities with outcomes formulated *prior* to the design of teaching activities (Biggs & Tang, 2011; 2014; cf. infra: step 4).

While the SCOPE study addressed (competences across) multiple educational levels (cf. supra: 2), it was essential to specify the educational level for this particular course. In line with the established target audience of PUC - KU Leuven Continue, the course was positioned at the academic 'postgraduate' level and explicitly tailored to a clearly delineated group: highly educated technical professionals, specifically engineers.

Step 3: Mobilising academic and industrial expertise

In line with the collaborative nature of the project, both academic and industrial expertise were actively engaged in the design and delivery of the course. PUC - KU Leuven Continue was able to benefit from the overarching KU Leuven Association, coordinated under the 'Continue' umbrella (cf. supra: 3.1). This structure enabled PUC - KU Leuven Continue to engage and hold exploratory meetings with potential lecturers from both university colleges (e.g., Odisee) and KU Leuven faculties and research units. As such, practice-oriented and fundamental research could be combined, ensuring that the course content reflects different technology readiness levels (or TRLs).

At the same time, Agoria mobilised its industry network, in particular the Mobility & Vehicle Technologies and Energy Systems & Solutions business groups. The business group leader played a central role, leveraging formal and informal networks to identify, select, and engage relevant companies and industry speakers for company visits and other course components (cf. infra: step 4). Importantly, the leader maintains direct contact with CEOs and other key decision makers. This individual-level contribution was instrumental in shaping how industry insights were integrated into the course design (cf. supra: 3.1 on the importance of the individual level in UIC).

To ensure coherence and complementarity, each proposed academic expert, industry speaker, and company visit was reviewed jointly by PUC - KU Leuven Continue and Agoria.

The result was a complementary blend of research-based and industry-based lecturers, aligning with Cronholm's (2021) principle of integrating theory and practice in ULLL, and illustrating the benefits of collaborative, co-creative curriculum design (Laundon, 2024).

Step 4: Constructive alignment

The final step in the course design process involved ensuring **constructive alignment** between the previously defined learning outcomes (step 2) and the selected teaching and learning activities (Biggs & Tang, 2011; 2014). These activities were also evaluated based on:

- Suitability for adult learners, taking into account their full-time employment and professional experience;
- Connection between theory and practice, ensuring that abstract concepts were consistently linked to real-world industrial applications (cf. Cronholm, 2021).

Key design choices included:

- Co-teaching model: Academic lecturers first present the theoretical foundations, followed by industry professionals who illustrate these concepts through applied company cases. This joint delivery provides participants with complementary perspectives on the same topics, linking theory directly to practice (cf. supra: step 3).
- Use of case studies: carefully selected to exemplify challenges and solutions within the two thematic domains (automotive/e-mobility and stationary energy systems), enabling participants to apply theoretical knowledge to practical problems.
- Company visits: structured as active learning experiences, not merely as observational site tours.

Reflecting the principle of constructive alignment in *initial* higher education (cf. Biggs & Tang, 2011; 2014), various assessment strategies were considered to align with the learning outcomes and the participants' professional context. Despite their potential to enhance learning, provide meaningful feedback, and confer credible certification – in line with trends in microcredentialing (cf. Elling & Lam, 2025) - formal assessments were not implemented at this stage.

The resulting course structure comprised twelve sessions, organised into six modules, delivered in a cohort-based format. The sessions integrated theoretical lectures, held at the KU Leuven campus of Ghent, with on-site visits to companies across Flanders. The on-campus sessions are scheduled in the evening, thereby enabling working professionals to balance participation with their professional and personal responsibilities (cf. supra: 1: institutional barrier related to format).

Coordinated outreach

The final preparatory step involved the design of a joint marketing and communication strategy to ensure the course would effectively reach its intended audience of highly educated technical professionals. Our coordinated approach to promotion included a shared communication timeline, co-branding, and targeted outreach through each partner's respective channels, such as email campaigns, newsletters, social media (primarily via LinkedIn), etc.

Co-branding played an important role in strengthening visibility and credibility. By explicitly presenting the course as a joint initiative of a leading academic institution and a key industry federation, the partners were able to build trust among potential participants.

In line with its service model for members (cf. supra: 2), Agoria also negotiated exclusive benefits, such as reduced registration fees. This not only added value for participating companies but also served as a concrete incentive to enrol.

Outcomes and impact

The first edition of the course (2024) rapidly reached full capacity, with enrolment capped at 30 participants due to both didactic and logistical considerations, including the on-site company visits and the networking potential. The course attracted a notably diverse cohort, including economists and business developers. While the second edition (2025) was not fully booked (20 participants), it succeeded in attracting participant profiles more closely aligned with the course's intended target group - namely, highly educated *technical* professionals. The third edition (2026) is now open for registration.

Satisfaction surveys not only indicated improved conceptual *understanding* of battery systems, but also a capacity to *apply* this knowledge in their professional context. This corresponds to the application level in Bloom's taxonomy, a third-order cognitive skill (Bloom et al., 1956). These findings suggest that the course had an indirect impact on industrial innovation, and even on broader strategic domains such as geopolitics.

REFLECTIONS: CRITICAL CONSIDERATIONS FROM PRACTICE

In this section, we reflect critically on some of the considerations that emerged during the design and delivery of the course. These reflections relate to both the educational programme itself (4.1-4.3) and the collaborative process (4.4).

Safeguarding neutrality

One recurring concern during the course development was how to ensure the programme's independent and neutral positioning, particularly in light of strong industry involvement. This consideration touches indirectly on the dynamics described in UIC, where partners can have both individual and shared objectives (Ankrah & Al-Tabbaa, 2015, 396). In this case, the challenge lay in balancing the interests of the sector with the programme's independent educational mission. While sector engagement ensured applied relevance, the course deliberately avoided commercialisation, e.g., company visits were curated to serve educational purposes - not to promote individual firms.

Upholding educational vision

A second concern relates to the balance between demand-driven innovation and the broader - transformative - educational mission of ULLL. While responsiveness to professional needs was essential, efforts were made to avoid (hyper-)modularisation, which risks fragmenting learning and undermining systemic thinking (cf. Soltic & Seynhaeve, 2024: on the risks of 'nano-credentialing'). The decision to include an introductory module on the broader energy transition - featuring the trias energetica - illustrates this vision. Although not directly linked to any specific technical competence identified in the SCOPE study, the module helped anchor the programme in a broader sustainability narrative and societal mission, in line with ULLL's transformative potential.

Embedding feedback

Given the pace of technological change, ongoing responsiveness was built into the course design. Structured evaluation forms were used to capture participant feedback, which directly led to the inclusion of a new module on safety regulations in the second edition of the course.[3] The safety topic itself further illustrates the need for up-to-date awareness of regulatory frameworks. In addition, the partnership is currently exploring the development of an active alumni community to ensure ongoing feedback.

A more sustainable model of collaboration?

Finally, this case study raises broader questions about the sustainability of university-industry collaborations (UIC) focused on professional education. While the partnership with Agoria was highly productive, it remained project-based - focused on a single course development trajectory. This reflects a common limitation in many industry-university partnerships, which often take the form of ad hoc, transactional arrangements (Damoc, 2017). To move beyond this model, a more systematic and enduring approach is needed. A potential starting point could be the co-development of a joint mission statement, formalising a shared vision for 'industry-based' ULLL.

CONCLUSION: TOWARDS A TRIPLE HELIX LEARNING ECOSYSTEM

Complementary roles

The result of this case study is the emergence of a triple helix learning ecosystem[4], connecting policy, industry, and academia (a framework typically used in innovation contexts; cf. Cai & Etzkowitz, 2020[5]) with clear, complementary roles:

[3] The (growing) need for knowledge of safety issues had, in fact, already been identified in the SCOPE study (p22). However, during the design of the first course edition, we (wrongly) decided not to integrate this theme. *"It is crucial to be aware of the specific safety risks associated with working on battery and energy storage systems, and to act accordingly. Developers must be familiar with the standards, guidelines, and regulations applicable to electrical installations. Specifically for battery systems, the presence of direct current and increasingly higher voltages (>750V) are important factors. Fire safety and the ability to assess environment-related risks are also among the expected competencies."*

[4] While the notion of an 'ecosystem' has become widespread in innovation policy discourse, it suffers from conceptual ambiguity. As Van Bree et al. (2020:18) point out, terms like ecosystem, innovation ecosystem, entrepreneurial ecosystem and regional cluster are often used interchangeably without clear typological distinctions.

[5] In their master's thesis, Clifford and Rashid (2009) apply the triple helix model to the context of ULLL, exploring which business model a university could adopt to support LLL for its alumni. The focus on alumni engagement and feedback mechanisms also resonates with the principles of the *quadruple* helix model (Carayannis & Campbell, 2009), in which citizens - in this case, professionals - actively contribute to shaping future course iterations and, by extension, the learning ecosystem.

- Government, through the Flemish SCOPE initiative, took on the role of initiator and funder. By providing macro-level labour market intelligence and competence forecasts, the public partner laid the strategic groundwork for the programme.
- Industry, through the tech federation Agoria, acted as co-creator and intermediary. Beyond representing the needs of individual companies, Agoria ensured that the sectoral perspective remained central.
- Academia, represented by PUC - KU Leuven Continue, assumed the role of coordinator and knowledge integrator. PUC - KU Leuven Continue contributed research-informed expertise, didactic design, and quality assurance. Crucially, it also acted as an internal broker within the university, mobilising academic expertise and ensuring that the programme met institutional standards and values. Thus, universities can act not only as knowledge providers but also as brokers within a learning ecosystem.

Viewed through the UIC lens, this case shows how educational collaborations can broaden the traditional scope of UIC - from technology transfer and research-oriented projects to professional education in ULLL. Both organisational-level and individual-level factors highlighted in UIC literature (Perkmann et al., 2013) were instrumental in enabling this collaboration.

A triple win

This case represents more than a successful collaboration; it constitutes a triple win. For government, through the SCOPE initiative, it is a way to steer the process through strategic choices, aligned with key policy priorities.

For industry, the course answers an explicit need. For the technology federation Agoria, it even functions as a concrete service to its member companies. Additionally, the course presents an opportunity for Agoria itself to expand its membership by engaging companies previously affiliated only with the CRM university system, who through the course become familiar with the federation’s offerings.

For academia, the course expands the engagement with industry, bringing research, education, and societal relevance closer together, thereby strengthening the mission of ULLL.

A transferable model of macro-meso-micro alignment

Underpinning this triple win is a shared strategic anchor: the SCOPE initiative functioned as a fixed capstone, offering all stakeholders a clear starting point. This helped avoid vague discussions and enabled rapid convergence on a common goal.

The initiative is a textbook example of macro-meso-micro alignment: from strategic foresight at the policy (macro) level, through institutional collaboration between industry and university (meso level), to tailored, demand-driven training for engineers at the micro level.

This structured alignment within the triple helix framework offers a transferable and scalable model for ULLL. It demonstrates how strategic competence forecasting can be operationalised into relevant, responsive, and future-oriented course offerings, thereby helping to reduce an institutional barrier in ULLL: the mismatch between educational supply and (future) labour market demand.

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