

ASSESSMENT OF THE STATE OF MICRO-CREDENTIAL INTEGRATION INTO THE WBL-ACTIVITIES OF SMALL AND MEDIUM-SIZED ENTERPRISES

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Abstract. The competitiveness of small and medium-sized enterprises (SMEs) also depends on the qualifications of their employees. Microqualifications also play an important role in the development of their competencies. Despite significant support at the European level, their integration into work-based learning (WBL) remains weak. One of the reasons is insufficient empirical research. The article proposes a methodology that combines survey results with a formal mathematical transformation model. The study uses the Likert scale. Indicators were obtained that reflect the state of microqualifications both at the level of individual indicators and at the level of enterprises. The results obtained show that the overall situation is quite good (the index value is 0.67). To improve the situation, it is necessary to explain the importance of microqualifications for the development of employee competencies, increase motivation to participate in their programs, etc. The proposed methodology provides an opportunity to analytically assess microqualifications as an important means of developing employee competencies. The aim of the article is to propose a methodology for the quantitative assessment of the state of micro-credential integration into SME activities and to validate it using examples from specific enterprises.

Keywords: micro-credentials, indicator system, WBL, SMEs, quantitative assessment, Likert scale.

JEL Classification: J24, I26, M53.

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1. Introduction

Small and medium-sized enterprises (SMEs) constitute the backbone of the European economy, representing 99.8 per cent of all enterprises (Svobodova et al., 2024; Khan et al., 2023) and employing nearly 90 million workers across diverse sectors (Schulze Brock et al., 2025). Their distribution across rural, semi-urban and metropolitan regions reflects long-standing patterns of economic development, ownership structures and social embeddedness (Valenza et al., 2023). Beyond their economic role, SMEs are essential actors in training ecosystems. They host a substantial share of practical training placements, supporting learners in vocational and higher Education through exposure to authentic work tasks that complement school-based instruction (Jahn, 2018). This interconnection between SMEs and education systems is central to developing competences aligned with current labour-market needs.

The competitiveness of SMEs depends on innovation capability, process efficiency, quality management and customer responsiveness (Lafuente et al., 2020). These elements require continuous renewal of employee skills, yet SMEs often operate with limited financial and organisational resources. The importance of workforce competence is further heightened by demographic pressures, including ageing populations, declining fertility rates, labour migration, and skill shortages across Europe (Van der Gaag & de Beer, 2014; d'Albis et al., 2017; Ruin, 2021; Hogeforster & Priedulena, 2014). The limited workforce available needs to be trained as well as possible, since skilled employees contribute directly to productivity, innovation, technological adaptation and effective problem-solving, making competence development central to SME resilience and long-term performance (Schröder et al., 2022; Demirkan et al., 2022). However, traditional school-based programmes often struggle to adapt curricula to fast-changing workplace requirements, particularly in technologically dynamic sectors (Hamilton & Hamilton, 1994; Wolter & Ryan, 2011; Moore & Morton, 2017).

In this context, work-based learning (WBL) is particularly significant for SMEs. It focuses on practical on-the-job training and has long been recognised as a cornerstone of effective vocational education systems, particularly in countries with strong dual-training traditions such as Germany (Attwell & Rauner, 2002; Deissinger & Hellwig, 2005). WBL can be a practical approach for developing soft skills highly relevant to today's professional environment (Urkia-Basterra et al., 2025). It integrates academic content with practical experience in authentic environments, enabling learners to interact with real workflows, equipment and professional expectations (Perusso & Wagenaar, 2021; Cunningham & Dawes, 2016; Cedefop, 2021). SMEs are especially well-positioned to host WBL due to closer supervisory relationships, flatter hierarchies and opportunities for learners to experience diverse tasks. The German dual system exemplifies structured WBL supported by strong institutional cooperation and rigorous quality assurance (Pilz, 2009; Gessler & Howe, 2013). Although WBL has been developed as part of classical vocational Education, it is also implemented at higher education level (Lester & Costley, 2010; Hogeforster, 2012). WBL is consistently associated with improved employability, smoother school-to-work transitions, and greater alignment between training and labour-market requirements (O'Donovan, 2018; Chu et al., 2023). Nevertheless, SMEs may face barriers to participating in WBL due to limited resources, insufficient pedagogical expertise or regulatory complexity.

In addition to these structural challenges, rapid technological change has intensified demand for emerging skills, including digital, green and transversal competences, that traditional VET systems may address only slowly due to curricular rigidity and institutional constraints (Euler, 2013). To enhance flexibility and responsiveness, micro-credentials have gained prominence as short, competency-based certifications designed to recognise specific skills (Beverley, 2022). Their modular, stackable and often digital format aligns with European strategies to promote lifelong learning and labour-market adaptability. Micro-credentials align well with SME needs for targeted training and rapid upskilling. Nevertheless, their integration into WBL ecosystems remains nascent, raising important questions regarding quality assurance, recognition, pedagogical coherence, and the role of educational institutions (Wiemann & Pilz, 2020).

It is therefore essential to investigate the significance of micro-credentials for WBL in European SMEs by analysing their theoretical underpinnings, benefits, drawbacks, systemic implications, and challenges. To support empirical investigation, a mathematical and methodological framework is proposed to assess SME readiness and suitability for micro-credential integration, extending earlier indicator-based models for evaluating WBL implementation

(Hogeforster & Ginevičius, 2024, Hogeforster, 2025; Cherchye et al., 2018). The aim of the article is to propose a methodology for the quantitative assessment of the state of micro-credential integration into SME activities and to validate it using examples from specific enterprises.

The article consists of an introduction, literature review, research methodology, empirical study, and conclusions. It is based on 48 literature sources.

2. Literature review

While WBL is traditionally recognised for its structured, methodical framework, micro-credentials offer a more flexible, adaptive approach that can complement and enhance WBL programs. These short, skill-specific qualifications are designed to be agile and responsive to evolving industry needs, enabling learners to acquire targeted competencies without the extensive commitments often associated with conventional WBL frameworks. Given that micro companies, in particular, place significant emphasis on on-site training and informal training methods by the owner (Coetzer et al., 2019), incorporating these elements into work-based learning (WBL) curricula could be a valuable enhancement. By incorporating micro-credentials, WBL can become more accessible and customisable, allowing learners and organisations to address specific skill gaps incrementally rather than through comprehensive, long-term training arrangements.

A formal integration into WBL systems seems challenging, as micro-credentials lack a standardised definition and are understood quite differently across Europe (Bideau & Kearns, 2022; Oliver, 2022). They are short, focused units of learning that certify clearly defined competences acquired through assessed learning activities and awarded by a recognised provider (Tamoliune et al., 2023). They have standalone value and can complement or contribute to broader qualification pathways, provided they meet established quality assurance standards. Micro-credentials are modular certifications that validate discrete learning outcomes linked to specific competencies. Their proliferation is driven by the need for more agile responses to labour-market demands, lifelong learning imperatives and digital transformation (Hunt et al., 2020).

In contrast to full qualifications, micro-credentials are typically short, flexible, stackable and often digitally verifiable, enabling learners to accumulate evidence of skills over time. WBL emphasises learning in real-world occupational environments, supported by mentoring, supervision and structured reflection (Zimmermann et al., 2013). Its strength lies in experiential learning and direct engagement with workplace processes that are well-suited to micro-credentials. WBL formats include apprenticeships, internships, dual study programmes and structured in-company training.

The conceptual intersection between micro-credentials and WBL is grounded in their shared emphasis on competence-based skill development. Micro-credentials can certify specific skills acquired in WBL, provide modular curriculum elements within dual training programmes or support targeted upskilling in areas not yet fully embedded in traditional qualifications, such as emerging digital or sustainability-related competences (Martínez-Izquierdo & Torres Sánchez, 2022). This is also relevant to the role of WBL systems in higher Education, such as dual study courses that could benefit from micro-credentials for practical training, thereby empowering students (Pirkkalainen et al., 2023).

SMEs play a central role in European economies but often face structural disadvantages in training provision, including limited pedagogical capacity, time constraints and insufficient knowledge of education systems (Euler, 2013; Grooters et al., 2023; Gallo et al., 2024).

Micro-credentials may help address these challenges by offering short, focused learning modules aligned with immediate enterprise needs.

Their relevance for WBL in SMEs is threefold. First, micro-credentials may increase the visibility and recognition of competencies acquired in the workplace, strengthening motivation among learners and improving labour-market signalling (Pilz, 2009; Zimmermann et al., 2013). Second, their modular format allows SMEs to train employees incrementally without committing to lengthy full-qualification programmes, which may be difficult to reconcile with operational demands (Cedefop, 2021). Third, micro-credentials can accelerate adaptation to emerging technologies by enabling rapid design and deployment of new competency modules, for example, in digitalisation, cybersecurity or green technologies (Hogeforster, 2025). However, the potential of micro-credentials will only be realised if they are effectively integrated into existing WBL systems, recognised by employers and institutions, and aligned with broader qualification frameworks (Wiemann & Pilz, 2020).

Although micro-credentials offer promising benefits, several challenges hinder their adoption in WBL for SMEs. The first concerns standardisation and recognition. While the European Union promotes micro-credential frameworks, national systems maintain divergent regulatory and pedagogical standards (Cedefop, 2021). SMEs operating in local markets may find it difficult to assess the value or legitimacy of specific micro-credentials, especially when providers and platforms are numerous and heterogeneous.

The second relates to quality assurance. Without robust validation mechanisms, micro-credentials risk becoming fragmented, inconsistent or disconnected from actual workplace needs (Wiemann & Pilz, 2020). This can undermine trust among employers and learners and limit their role in formal qualification pathways.

A third challenge involves digital and administrative complexity. Many SMEs lack the infrastructure or expertise to manage digital credentials, integrate them into HR systems or interpret diverse formats (Martínez-Izquierdo & Torres Sánchez, 2022). In addition, micro-credentials designed without meaningful enterprise involvement may not align with operational skill requirements, thereby reducing their perceived usefulness.

Finally, micro-credentials may contribute to the fragmentation of learning pathways. If they proliferate without coordination, they risk obscuring the coherence of competence development and undermining the role of established VET qualifications, which provide broader occupational profiles (Euler, 2013).

When integrated thoughtfully into WBL systems, micro-credentials can yield substantial advantages for SMEs in a dynamic labour market, where in-demand skills may change faster than traditional Education (Bauer et al., 2024). Their modular, tightly focused design enables enterprises to address skill gaps with greater precision, enabling employees to acquire highly specific competencies in short, targeted learning cycles. This supports rapid skill acquisition and enhances the timeliness of training activities, particularly in sectors undergoing technological transformation where speed and adaptability are decisive competitive factors (Grooters et al., 2023). Micro-credentials also allow SMEs to tailor learning content to operational needs more effectively than traditional programmes, which often lack the flexibility required to respond to immediate workplace demands. Because micro-credentials typically require less time away from the workplace than longer qualifications, they minimise productivity disruptions and reduce opportunity costs for both employers and employees.

For learners, micro-credentials create more transparent and navigable learning pathways. Their incremental structure provides regular recognition of achievements, which can strengthen motivation, support progression, and improve individuals' ability to demonstrate

skill development across institutions and labour-market contexts (Zimmermann et al., 2013). Stackable micro-credentials may also facilitate upward mobility by enabling learners to combine multiple modules into broader competence portfolios that are recognised by employers across sectors or regions. This portability is particularly relevant in dynamic labour markets where workers increasingly change roles or employers over the course of their careers.

Despite these advantages, integrating micro-credentials into WBL systems presents significant challenges for SMEs. One major disadvantage relates to increased administrative burden. SMEs may lack the internal capacity to navigate diverse accreditation systems, interpret competency frameworks, manage digital credentials, or coordinate with external providers (Cedefop, 2021). Without dedicated HR or training personnel, these administrative tasks can place disproportionate strain on smaller firms. Closely linked to this issue is the risk of credential overload. The rapid expansion of micro-credential offerings – often from heterogeneous providers – can overwhelm SMEs, making it difficult to discern which credentials are credible, relevant, or aligned with sector-specific standards.

Uneven quality represents another challenge. Because micro-credentials vary widely in design, assessment methods, and quality assurance mechanisms, SMEs may doubt their reliability or struggle to map them onto existing occupational profiles. Inconsistent standards can undermine trust and reduce the likelihood that micro-credentials will be meaningfully integrated into recruitment, progression, or wage-setting processes. Limited employer understanding further exacerbates these issues: SMEs unfamiliar with micro-credential terminology or frameworks may underestimate their value or use them only superficially, undermining potential benefits.

Financial considerations constitute an additional barrier. SMEs already face resource constraints, and repeated investment in micro-credential activities may not be feasible without supportive public funding schemes. If micro-credentials are not subsidised or integrated into national VET funding structures, the financial burden may be borne disproportionately by SMEs and individual workers (Wiemann & Pilz, 2020). This risk of cost-shifting could widen inequalities between firms with different financial capacities and reduce overall participation in structured learning programmes. There is also a risk that micro-credentials can result in an unbundling of qualifications and thus increase potential inequalities between learners (Stolte & Spöttl, 2025), and a shift towards many micro-credentials can threaten a solid, general vocational education (Pouliou, 2024)

Ultimately, the balance of advantages and disadvantages depends mainly on the maturity and coherence of micro-credential ecosystems. At the same time, the benefits for employers seem to outweigh the risks (Thi Ngoc Ha et al., 2014). Well-developed systems, characterised by strong quality assurance, shared competency frameworks, digital interoperability, and clear links to national qualification structures, are more likely to support effective integration into WBL. The strength of social partnerships, including employer associations, chambers, unions, and educational institutions, plays a determining role in ensuring relevance, standardisation, and acceptance. Equally important is the existence of clear national and European guidance, which can provide the policy stability and transparency required for SMEs to engage confidently with micro-credential systems.

At the EU level, micro-credentials are positioned as an instrument to increase flexibility, responsiveness, and portability of skills, thereby supporting competitiveness, industrial transformation, and labour-market resilience. When embedded in WBL, micro-credentials can translate these policy objectives into enterprise-level practice by enabling the formal recognition of competences acquired in real-world contexts, including in SMEs. From a policy perspective, this strengthens the link between skills supply and demand, as micro-credentials

can be designed jointly by enterprises and education providers and updated more rapidly than full qualifications. Recently, the European Commission published its “Union of Skills” initiative to increase competitiveness, also among SMEs (Lintzeris & Valassi, 2025). The approach to include micro-credentials in WBL supports this Union of Skills objective of addressing skills shortages through continuous upskilling and reskilling, particularly in sectors affected by digitalisation and the green transition. At the same time, EU policy documents emphasise the need for transparency, quality assurance, and recognition to prevent fragmentation. The Council Recommendation 2022/C 243/02 from June 2022 on micro-credentials (Council of the European Union, 2022) establishes common information elements and quality principles intended to ensure trust and cross-border legibility, which is especially relevant when WBL outcomes are certified outside traditional school settings. The integration of micro-credentials into WBL also has implications for digital governance, as EU initiatives such as European Digital Credentials for Learning are expected to reduce verification costs and support skills portability across firms and countries, an important consideration for SMEs with limited administrative capacity. However, policy analysis must also assess whether EU frameworks sufficiently address SME constraints or risk shifting coordination, digital, and quality assurance burdens to enterprises. In this sense, micro-credentials in WBL serve as both an implementation tool for the Union of Skills and a test case for policy coherence, as their effectiveness depends on alignment among EU guidance, national regulation, intermediary support structures, and enterprise-level capacity.

3. Research methodology

To determine the possibilities for integrating micro-credentials into SMEs based on expert judgement, it is necessary to develop a system of indicators that reflect the current situation.

The micro-credential indicators must be operationalised in a survey questionnaire. The structure of the questionnaire depends on the response scale applied. Two basic approaches are possible. In the first approach, the response scale is uniform across all questions, meaning that each question has the same number of response options. In the second approach, the number of response options differs across questions.

The first approach is methodologically simpler because the relative importance of response options is identical for all indicators. This corresponds to the Likert scale, which is appropriate when the purpose of the survey is to obtain an assessment of the current situation. In the second approach, the aim is to identify the underlying causes of the observed situation. Consequently, the nature of questions and response options differs, as respondents are asked to select the most relevant explanation from a set of alternative causes. Because the number of response options is not uniform, their relative importance is not uniform either.

In Likert-scale surveys, five response options are most commonly used. The most favourable option is assigned a value of 5, whereas the least favourable option is assigned a value of 1 (Table 1).

Table 1. Likert-scale response options and their scores (source: compiled by the authors)

Response options	Strongly agree	Agree	Neither agree or disagree	Disagree	Strongly Disagree
Response scores	5	4	3	2	1

Based on Table 1, the questionnaire administered to respondents to assess the state of micro-credential integration into SMEs is structured as follows (Table 2).

Table 2. Questionnaire for assessing the state of micro-credential integration into SMEs (source: compiled by the authors)

No.	Question	Estimates of responses, %				
		I totally agree	I agree more	I neither agree nor disagree	I disagree more	I totally disagree
1	First					
⋮	⋮					
<i>i</i>	<i>i</i> -th					
⋮	⋮					
<i>n</i>	<i>n</i> -th					

The survey yields information on the distribution of response scores for each question, expressed as percentages across all response options. Based on these data, it is possible to calculate an index that reflects the state of the phenomenon under analysis. First, for each question, an aggregate measure summarising the distribution of scores across all response options is calculated:

$$P_i = \sum_{j=1}^m V_{ij}, \quad (1)$$

where P_i – denotes the aggregate measure summarising the distribution of scores across all response options for the i -th question, and V_{ij} denotes the percentage score of the j -th response option for the i -th question.

The value V_{ij} is determined as follows:

$$V_{ij} = k_{ij} \times q_{ij}, \quad (2)$$

where k_{ij} denotes the score of the importance rank assigned to the j -th response option of the i -th question, and q_{ij} denotes the percentage score of the j -th option of the i -th question.

Given the values P_i , the required index can be determined as follows:

$$P = \frac{\sum_{i=1}^n P_i}{P_{\max}} = \frac{\sum_{i=1}^n \sum_{j=1}^m V_{ij}}{\sum_{i=1}^n V_{i\max}}, \quad (3)$$

where $V_{i\max}$ – i -th question; $P_{\max}$ is the maximum possible value of responses to all questions.

It is straightforward to observe that $V_{i\max} = 500$, and $P_{\max} = nV_{i\max}$.

In the second approach, the number of response options per question is not uniform, meaning that the importance of each option also varies. The QEQS methodology (Ginevičius, 2024) is appropriate for deriving an index reflecting the situation based on this type of data. In the present study, the aim is to assess the state of micro-credential integration into WBL structures; accordingly, the Likert scale is used.

4. Empirical study

The study of the state of micro-credential integration in SMEs draws on assessments by responsible employees of these enterprises, who served as expert respondents. In the first phase of the research, they were tasked with formulating a system of indicators reflecting the phenomenon under examination.

After consolidating the survey results, it was established that the indicator system can comprise ten indicators (Table 3).

Table 3. System of indicators reflecting the state of micro-credential integration into SMEs (source: compiled by the authors)

No.	Title of indicators reflecting the state of micro-credential integration
1	Awareness of micro-credentials
2	Perceived relevance of micro-credentials to SME skills needs
3	Alignment of micro-credentials with work-based learning activities
4	Digital readiness to integrate micro-credentials into enterprise activities
5	Belief in the benefits of training
6	Recognition of and trust in micro-credentials
7	Perception of micro-credential quality
8	Awareness of obstacles to micro-credential implementation
9	Employee willingness to participate in micro-credential programmes
10	Strategic importance for enterprise development

Having established the indicators reflecting the state of micro-credential integration within SMEs, the study proceeded to the next phase: formulating survey questions and assigning scores to response options. The questionnaire was constructed in accordance with the requirements of the Likert scale; the questions and corresponding response scores, developed in the context of Table 3, are presented in Table 4.

The questionnaire was distributed via media channels to 48 enterprises that had agreed to participate in the study. Responses were received from 36 enterprises. After consolidating the responses, the proportional weights of each response option for each question were determined as percentages (Table 4).

Based on Table 4 and Eq. (1), the value of P_i was determined as follows:

$$P_i = 5V_{i1} + 4V_{i2} + 3V_{i3} + 2V_{i4} + 1V_{i5}. \quad (4)$$

The value of P_i calculations based on Eq. (4) are presented in Table 5.

Based on Table 5 and Eq. (3), the index reflecting the state of micro-credential integration into SMEs was calculated:

$$P = \frac{3306}{10 \times 500} = \frac{3306}{5000} = 0.66.$$

The value of P value indicates that the prospects for integrating micro-credentials into the activities of the SMEs examined are reasonably favourable. Notably, employees demonstrate a sound understanding of the importance of micro-credential integration for the further development of their enterprises. At the same time, enterprises should make greater

Table 4. Questionnaire for assessing the state of micro-credential integration into SMEs (source: compiled by the authors)

No.	Question	Estimates of responses, %				
		I totally agree	I agree more	I neither agree nor disagree	I disagree more	I totally disagree
1.	Our company is familiar with the concept of microqualifications (short, competency-based certificates)	12	23	25	25	15
2.	Microskills are important in meeting the current and future skills needs of our company	38	37	15	8	2
3.	Micro-qualifications acquired in our company through on-the-job training can validate skills	30	35	20	8	7
4.	Our company is ready to manage micro-credentials digitally (on platforms, data records)	18	32	15	25	10
5.	Micro-qualifications would improve the efficiency of training processes in our company	28	40	18	9	5
6	Relevant companies and institutions recognise or will recognise micro-qualifications	15	30	25	20	10
7.	The overall quality and reliability of existing microqualifications in our sector is high	12	28	30	20	10
8.	Our company does not face any difficulties in implementing microqualifications in its workplace	10	15	32	28	15
9.	Our company's employees are willing to participate in micro-qualification programs	12	23	25	25	15
10.	Micro-credentials are important for our company's development	30	18	21	23	8

Table 5. Results of calculating P_i (source: compiled by the authors)

Question No.	1	2	3	4	5	6	7	8	9	10
The value of P_i value	292	401	373	323	377	320	312	277	292	339
Index reflecting the score of an individual question	0.58	0.80	0.75	0.65	0.75	0.64	0.62	0.55	0.58	0.68

efforts to familiarise their employees with the concept of micro-credentials (first indicator in Table 3), devote greater attention to reducing obstacles to micro-credential integration (eighth indicator), and more actively motivate their employees to participate in micro-credential programmes (ninth indicator).

5. Conclusions

Micro-credentials represent a relevant but complex innovation for enhancing WBL in European SMEs. Their modular design enables SMEs to address specific skill gaps efficiently, allowing employees to acquire competencies incrementally without committing to lengthy or costly traditional training programs. This adaptability is particularly valuable for SMEs that must respond quickly to evolving market demands and technological advancements. Furthermore, micro-credentials facilitate lifelong learning by providing clear, stackable units of learning that can be accumulated over time, supporting continuous professional development and career progression within the SME context. To pursue systematic improvement in the state of micro-credential integration within SMEs, it is necessary to assess it quantitatively at any given point in time. This task is complex, given that micro-credentials, as a multifaceted phenomenon, manifest in reality across a broad range of dimensions. The state of such phenomena can only be assessed through an adequate system of indicators, whose values can only be obtained by means of a survey. The simplest such approach is the Likert scale. Drawing on this approach, status indices were determined both for individual micro-credential indicators and for the enterprises as a whole. The results indicate that the overall situation is reasonably favourable, with the index value approaching 0.7. Knowledge of the index values for individual indicators enables the formulation of targeted improvement measures.

The proposed methodology is universal and may be applied to the quantitative assessment of the state of complex phenomena of various kinds.

There are several possible limitations of the research. A relatively small proportion of companies still understand the importance of microqualifications for competitiveness. This is evidenced by the fact that out of 48 companies to which the questionnaire was sent, 36 responded. This creates difficulties in obtaining information. The possibilities of future research can be significantly increased by explaining the importance of microqualifications to responsible company employees. It is appropriate to organize seminars of this kind.

Author contributions

Max Hogeferster prepared the first draft of the manuscript and led the research design and literature review. Romualdas Ginevičius developed and conducted the quantitative data analysis. Both authors jointly interpreted the results and contributed to revising and finalising the manuscript.

Disclosure statement

Authors do not have any competing financial, professional, or personal interests from other parties.

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