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COMPETENCY-BASED WORKFORCE DEVELOPMENT FOR A SUSTAINABLE ECONOMY

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Abstract
The alignment between the Sustainable Development Goals (SDGs) and the professional skills demanded by a sustainable economy constitutes one of the most urgent and undertheorised challenges in contemporary workforce development and higher vocational education. The transition toward net-zero economies, circular production systems, inclusive social services, and digitally mediated value chains all mandated by the 2030 Agenda creates demands for professional competencies that existing vocational training and higher education systems are largely unprepared to supply. This article investigates the intersection of SDG-driven economic transformation and professional skill formation, proposing a comprehensive Sustainable Professional Competency (SPC) framework that identifies the cross-sectoral, sector-specific, and enabling competencies required for SDG-aligned employment.

Keywords: Sustainable Development Goals, professional skills, workforce development, green economy, competency framework, vocational education, sustainable employment, human capital, skills gap, circular economy.

Introduction

The achievement of the Sustainable Development Goals by 2030 will require transformations of production, consumption, energy, land use, urban development, health systems, and social protection of a scope and speed that have no historical precedent [1]. Each of these transformations is ultimately operationalised by human beings — workers, managers, technicians, researchers, designers, educators, health professionals, and community organisers whose professional competencies either enable or constrain the pace and quality of SDG implementation. The skills required to design and operate renewable energy systems, to manage circular supply chains, to deliver inclusive social and health services, to develop climate-resilient agricultural systems, or to implement gender-transformative organisational policies are qualitatively different from the professional competencies produced by twentieth-century vocational and higher education systems optimised for fossil-fuel-based industrial economies [2].

The International Labour Organisation's World Employment and Social Outlook report documented that the green economy transition alone will create 24 million new jobs globally by 2030, while displacing approximately 6 million in carbon-intensive sectors [3]. The 'just transition' dimension of SDG 8 (Decent Work and Economic Growth) ensuring that the

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workforce displacement associated with sustainability transitions does not exacerbate poverty, inequality, or social exclusion — requires that professional skill development systems are simultaneously responsive to emerging SDG-aligned job profiles and inclusive of workers from vulnerable and marginalised groups. This dual requirement places extraordinary demands on vocational education and training (VET) systems, higher education institutions, and enterprise-based training programmes that were designed for very different labour market conditions.

Despite the urgency of this challenge, the scholarly literature reveals a substantial gap between SDG ambition and workforce development system reality. Vocational education curricula in the majority of countries have been slow to incorporate sustainability competencies, green skills standards, or SDG-aligned professional profiles [4]. Higher education programmes that nominally address sustainability tend to confine it to designated elective modules rather than integrating it systematically across professional formation experiences. Employers in SDG-critical sectors consistently report difficulties in recruiting graduates with the combination of technical, interpersonal, and sustainability competencies their SDG-aligned operations require. This skills-demand mismatch constitutes a significant structural bottleneck that, if unaddressed, will substantially constrain the pace of SDG implementation across all 17 goals.

ANALYSIS OF LITERATURE

The theoretical foundations for understanding the relationship between sustainability transitions and professional skill demands draw primarily on transition theory, human capital theory, and competency-based education scholarship. Geels' socio-technical transition framework conceptualises sustainability transformations as multi-level systemic shifts involving changes in technologies, institutions, markets, and user practices, all of which create novel skill demands that existing occupational structures and training systems are initially unable to satisfy [5]. This framework implies that skill development systems must be prospective and adaptive capable of anticipating emerging competency requirements and responding to them before shortages become critical bottlenecks.

The OECD's Skills Outlook series has generated the most comprehensive empirical evidence base for understanding the SDG-aligned evolution of professional skill demands across advanced and emerging economies. The 2019 edition documented that 'green skills' competencies for sustainable energy, resource efficiency, environmental management, and low-carbon technology, are the fastest-growing skill category in online job postings across OECD countries, with demand growth substantially outpacing the supply of trained graduates in most national labour markets [6]. The 2021 edition extended this analysis to the digital-sustainability nexus, finding that roles combining digital and green competencies command significant wage premiums and face the most acute talent shortages.

Competency-based approaches to professional formation have been theorised extensively in the vocational education literature. Wesselink et al.'s integrated competency-based VET model proposed that sustainable professional development requires the simultaneous development of technical competencies (doing), contextual competencies (understanding), normative-evaluative competencies (judging), and learning competencies (growing), forming an integrated professional capability rather than a disaggregated skills inventory [7]. Applied to

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SDG-aligned professional formation, this model implies that sustainability competencies cannot be developed through a dedicated sustainability module appended to otherwise conventional professional training; they must permeate the entire curriculum as an integrative orientation.

Sector-level analysis has revealed significant variation in the nature of SDG-aligned skill demands across different economic domains. In the energy sector, Strietska-Ilina's analysis for the ILO documented that the transition from fossil fuel to renewable energy systems requires not only technical solar, wind, and storage engineering skills but systems integration competencies, community engagement skills, and regulatory navigation capabilities that conventional energy engineering programmes do not develop [8]. In the health sector, SDG 3 implementation demands for universal health coverage require professional profiles combining clinical competency, community health systems knowledge, and equity-focused care delivery skills that challenge the historically hospital-centric orientation of health professional education. In the agri-food sector, SDG 2 (Zero Hunger) and SDG 15 (Life on Land) require agroecological competencies, digital precision agriculture skills, and food system governance knowledge that represent a fundamental reorientation of agricultural professional education.

The CIS dimension of SDG-aligned workforce development has been examined in recent years by several national and regional analyses. Mirzayev's study of green economy skill needs in Uzbekistan identified severe shortages in renewable energy technicians, energy efficiency specialists, and environmental compliance professionals, attributing these gaps to the absence of systematic green skills standards in national VET qualification frameworks and the continued dominance of Soviet-era occupational classification systems that do not recognise emerging sustainability-oriented roles [9]. Abdullayeva's research on professional competency formation in Kazakhstani higher education documented a systematic misalignment between declared sustainability objectives in university strategic plans and actual curriculum content, with sustainability relegated to non-assessed extracurricular activities in the majority of professional programmes [10].

Recognition of prior learning (RPL) and non-formal skill certification have been identified as critical enabling mechanisms for inclusive SDG-aligned workforce development. Werquin's OECD study of RPL systems demonstrated that effective recognition of informally acquired sustainability competencies — particularly prevalent among agricultural workers, community health workers, and informal economy participants — can substantially expand the supply of certified SDG-skilled workers without requiring full formal educational programmes, while simultaneously promoting social inclusion and equity objectives central to the SDG framework [11].

RESEARCH METHODS

This study employed a three-component mixed-methods design. The first component was a systematic literature review conducted in Web of Science, Scopus, ILO LABORDOC, and CEDEFOP documentation databases, retrieving 88 empirical studies meeting inclusion criteria of peer-review, empirical grounding, and direct relevance to SDG-professional skills alignment published between 2015 and 2024.

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The second component was secondary analysis of national labour market skills surveys and occupational demand data from 15 countries across five regions: Western Europe (Germany, Netherlands, Sweden), Eastern Europe (Poland, Ukraine), Central Asia (Uzbekistan, Kazakhstan), East Asia (South Korea, Japan), and Sub-Saharan Africa (Kenya, South Africa, Rwanda). Relevant indicators extracted included green skill demand indices, sustainability competency gap measures, VET curriculum sustainability content scores, and employer satisfaction ratings for sustainability-oriented graduate attributes.

The third component was a three-round Delphi survey involving 46 professional training specialists — VET curriculum developers, sectoral skills council representatives, higher education programme designers, and HR directors from SDG-intensive organisations — from 14 countries. Consensus was defined as 75% or greater agreement across panellists for quantitative Likert items and thematic saturation for qualitative dimensions. The Delphi yielded validated consensus statements on priority SDG-aligned professional competencies, most effective delivery mechanisms, and critical governance reforms for VET system transformation.

RESULTS AND DISCUSSION

Labour market analysis across the 15 sampled countries confirmed significant and growing misalignments between SDG-driven employer skill demands and VET/HE graduate profiles in all five regional groupings, with the largest gaps documented in Central Asia and Sub-Saharan Africa. Three competency domains showed the most acute supply-demand mismatches: green technology operation and maintenance (gap index 0.74 on a 0–1 scale); circular economy supply chain management (gap index 0.71); and inclusive social service delivery (gap index 0.68). Cross-cutting digital-sustainability integration competencies showed the highest rate of demand growth (42% year-on-year in online job postings) but extremely limited VET curriculum coverage (present in only 8% of analysed professional programmes in the CIS region).

Delphi consensus produced the Sustainable Professional Competency (SPC) framework comprising three competency tiers. The Cross-Sectoral Tier encompasses competencies essential across all SDG-aligned professional roles: sustainability systems thinking (the ability to analyse complex socio-ecological systems and identify leverage points for intervention); SDG-oriented ethical judgment (the ability to evaluate professional decisions against sustainability, equity, and intergenerational justice criteria); stakeholder engagement and participatory facilitation; data literacy for sustainability monitoring; and adaptive learning and professional resilience. The Sector-Specific Tier encompasses technical sustainability competencies distinct to major SDG-aligned sectors: renewable energy, sustainable agriculture, circular manufacturing, inclusive health and social care, sustainable urban development, and digital inclusion. The Enabling Tier encompasses competencies that amplify the effectiveness of technical and cross-sectoral skills: multilingual communication, intercultural competency, change leadership, and creative problem-solving under uncertainty.

Implementation analysis identified four structural reform requirements for SDG-aligned workforce development. First, national VET qualification frameworks must be systematically

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revised to incorporate SPC framework competencies into occupational standards, replacing or supplementing outdated Soviet-era occupational classification systems that do not recognise emerging sustainability roles. Second, workplace-based learning components of VET programmes must be substantially expanded and redesigned to provide authentic SDG-aligned skill development contexts that classroom instruction cannot replicate. Third, RPL mechanisms for informally acquired sustainability competencies must be developed and institutionalised within national qualifications frameworks, particularly to recognise the sustainability knowledge of agricultural, health, and environmental workers in informal economies. Fourth, sectoral skills councils and employer associations in SDG-critical industries must be formally engaged in curriculum co-design processes to ensure that professional formation systems remain responsive to rapidly evolving labour market requirements.

CONCLUSIONS

The achievement of the SDGs by 2030 requires a fundamental transformation of professional skill formation systems to produce the workforce competencies that sustainable economic and social transitions demand. The Sustainable Professional Competency framework developed in this study provides an evidence-based tool for diagnosing current skill gaps, designing SDG-aligned VET and HE programmes, and building the sectoral skills governance capacity required for responsive, inclusive, and future-oriented workforce development.

Governments are recommended to integrate the SPC framework into national sustainable development and human capital strategies; to mandate regular SDG-skills gap analysis as a component of national VET planning; to establish financing mechanisms for rapid curriculum upgrading in SDG-critical sectors; and to create legal and institutional frameworks for RPL that recognise informally acquired sustainability competencies. International development partners should support the building of sectoral skills intelligence capacity in lower-income countries to enable evidence-based workforce development planning aligned with national SDG implementation priorities.

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