



Integrated Lifelong Learning Ecosystems for Upskilling and Reskilling in Formal, Non-Formal, and Informal Education

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ABSTRACT

Accelerated digitalization, demographic change, ecological transition, and the continuous reconfiguration of work have intensified the need for lifelong learning systems capable of connecting formal, non-formal, and informal education. This article analyzes how upskilling and reskilling can be organized as an integrated learning ecosystem rather than as isolated training interventions. The study adopts a structured integrative review and documentary content-analysis design based on the theoretical, policy, and empirical literature assembled in the source manuscript. Evidence was organized into seven analytical categories: learning modalities; digital transformation; upskilling and reskilling; equity and access; workplace learning; governance and credentialing; and sustainability and resilience. The results show that the strongest contribution of lifelong learning emerges when institutional certification, workplace experience, community learning, and digitally mediated self-directed learning are connected through recognition mechanisms, flexible pathways, interoperable credentials, and learner-centered support. The synthesis also identifies persistent barriers related to fragmented governance, unequal digital participation, weak recognition of prior and informal learning, limited portability of micro-credentials, time constraints, and psychosocial pressures associated with continuous skill renewal. The discussion proposes an integrated ecosystem model in which public policy, educational institutions, employers, communities, and learners share responsibility for learning continuity and the validation of competences. The article concludes that lifelong learning should be understood simultaneously as a strategy for employability, organizational adaptability, social inclusion, and sustainable human development.

Keywords: lifelong learning, upskilling, reskilling, formal education, informal learning, micro-credentials

INTRODUCTION

Lifelong learning has moved from the margins of educational policy to the center of debates about employability, citizenship, digital transformation, and social resilience. The speed with which occupational knowledge becomes obsolete has weakened the assumption that a single period of initial education can support an entire professional life. At the same time, learning increasingly occurs across multiple settings: universities and technical institutions, corporate academies, community organizations, online platforms, professional networks, and everyday work. This dispersion of learning opportunities creates both possibilities and governance problems. It expands access to knowledge, but it also fragments credentials, quality criteria, financing, and the recognition of what adults already know (Behringer et al., 2021; Desjardins et al., 2021; Walters et al., 2023).

The contemporary relevance of lifelong learning is therefore not limited to increasing the number of courses available to adults. The central challenge is to create continuity between learning experiences that have traditionally been separated by institutional boundaries. Formal education provides structured curricula, recognized qualifications, and disciplinary foundations; non-formal education offers flexible and context-sensitive training; and informal learning captures the knowledge produced through work, social interaction, self-directed practice, and participation in communities of practice. When these modalities remain disconnected, individuals repeatedly invest time in learning that cannot be transferred or formally recognized.



When they are articulated, they can form cumulative pathways in which experience becomes visible and new learning can be built on previous competence (Eraut et al., 2004; Falk et al., 2011; Wenger et al., 2011).

This issue has become especially important because digitalization simultaneously accelerates skill obsolescence and expands the means through which skills can be acquired. Online learning environments, mobile platforms, open educational resources, simulation, artificial intelligence, and digital communities allow learning to occur beyond the conventional classroom. Yet access to technology does not automatically produce educational inclusion. Differences in connectivity, digital self-efficacy, information literacy, time availability, and the capacity to evaluate online information can reproduce or even intensify existing inequalities (Duart et al., 2021; Ferrari et al., 2014; Wei et al., 2011). The problem is thus less about the presence of technology than about the institutional conditions that allow technology to support meaningful and equitable learning.

Upskilling and reskilling provide a practical bridge between lifelong learning and the changing world of work. Upskilling refers to the development of additional or deeper competences within an existing occupational trajectory, whereas reskilling involves the acquisition of capabilities that permit transition toward substantially different tasks or roles. Both processes depend on more than short-term technical training. Sustainable skill development requires reflective learning, feedback, opportunities to apply knowledge, recognition of prior experience, and organizational environments that treat learning as part of work rather than as an interruption to it (Boud et al., 2006; Dohmen et al., 2020; Green et al., 2022).

A further tension concerns the balance between economic and human-development rationales. Lifelong learning is often justified as a mechanism for improving productivity, labor-market mobility, and competitiveness. These outcomes are important, but an exclusively instrumental framing can obscure broader benefits related to health, civic participation, autonomy, social capital, and the capacity to respond to social and ecological uncertainty. Education throughout life can support professional adaptation while also strengthening the ability to participate in democratic life, manage transitions, and sustain community relationships (Schuller et al., 2004; Grotlüschen et al., 2024; Preece et al., 2021).

The literature also reveals a persistent policy-practice gap. International frameworks routinely promote flexible pathways, recognition of prior learning, digital inclusion, and competence-based education, but their implementation varies considerably across systems and population groups. Adults with unstable employment, family-care responsibilities, limited digital literacy, or weak access to institutions often face the greatest need for retraining and the highest barriers to participation. Participation in adult learning is therefore shaped by the interaction between institutional opportunity structures and individual resources rather than by motivation alone (Boeren et al., 2020; Misko et al., 2022; Popović et al., 2022).

Against this background, the present study reframes the broad source manuscript as a focused research article. Rather than treating lifelong learning as a collection of isolated practices, it examines it as an integrated ecosystem in which formal, non-formal, and informal learning interact with digital infrastructure, workplace learning, credential systems, equity mechanisms, and governance arrangements. The research question guiding the article is: How can lifelong learning strategies integrate formal, non-formal, and informal education to support equitable upskilling and reskilling in contexts of technological and organizational change?

The objective is to synthesize the conceptual and empirical patterns contained in the reviewed literature, identify the most recurrent barriers and enabling conditions, and propose an integrated analytical model for lifelong learning ecosystems. The article contributes by organizing a dispersed body of discussion around a limited set of operational dimensions that can guide subsequent empirical research, institutional design, and policy evaluation.

METHODOLOGY

The study follows a qualitative, documentary, and integrative review design. This choice is consistent with the nature of the source manuscript, which compiles theoretical perspectives, comparative policy discussions, organizational examples, and empirical studies on lifelong learning, adult education, workplace learning, digi-



tal learning, and competence development. The revised article does not present a statistical meta-analysis because the source material does not provide a homogeneous set of effect sizes, comparable samples, or standardized outcomes. Instead, the method combines structured literature synthesis with descriptive content analysis in order to identify recurrent categories, relationships, and implementation tensions.

The analytical unit was the substantive evidence statement contained in the source manuscript: a paragraph or set of sentences in which a theoretical proposition, policy mechanism, barrier, practice, or outcome related to lifelong learning was discussed and supported by one or more references. Repetitive passages, rhetorical statements without analytical content, and examples whose evidentiary basis could not be distinguished from general illustration were not treated as independent findings. This decision was intended to reduce overstatement and to align the final article with the evidence actually available in the manuscript.

The coding framework was developed deductively from the central themes of the manuscript and then refined inductively during review. Seven categories were retained: (1) learning modalities and their articulation; (2) digital transformation and digitally mediated learning; (3) upskilling, reskilling, and competence development; (4) equity, access, and participation; (5) workplace and organizational learning; (6) governance, credentialing, and recognition; and (7) sustainability and resilience. These categories were selected because they recur across the problem statement, theoretical framework, implementation challenges, and results sections of the original document and provide a coherent bridge between educational and organizational perspectives.

A second level of analysis focused specifically on implementation barriers. The challenge section of the source manuscript was reviewed for recurrent references to curricular rigidity, the digital divide, credential portability, equity and access, psychosocial well-being, and governance or funding. These categories were not interpreted as prevalence estimates in a population. They are descriptive indicators of thematic salience within the documentary material and serve only to support the comparative discussion.

The synthesis proceeded in four stages. First, the original manuscript was reorganized according to the article structure requested for publication. Second, in-text citations were normalized according to APA 7th edition conventions; therefore, works with three or more authors are cited from the first mention using the first author followed by “et al.” Third, evidence statements were compared across categories to identify convergences and tensions. Fourth, the results were integrated into an ecosystem model that links learning settings, enabling mechanisms, and expected outcomes. No causal claims were inferred from frequency counts, and no primary participants were recruited for the present revision.

Methodological rigor was strengthened through source-boundary control. The article preserves the concepts and claims that are supported by the supplied manuscript and avoids introducing new empirical results. The two figures represent a descriptive scan of thematic occurrences in the source document; they are not inferential tests. Likewise, the tables synthesize concepts and relationships already present in the manuscript rather than reporting new survey or experimental data. This distinction is important because it allows the article to make a structured contribution without presenting documentary synthesis as original field evidence.

Table 1

Analytical framework for the integrative documentary review

Dimension	Operational focus	Illustrative evidence sought
Learning modalities	Relations among formal, non-formal, and informal education	Transfer, complementarity, recognition, continuity of pathways
Digital transformation	Technology-enabled access and personalization	Online learning, digital competence, platform use, digital divide
Upskilling/reskilling	Renewal and conversion of competences	Skill deepening, occupational transition, competence-based learning
Equity and access	Conditions shaping participation	Time, connectivity, socioeconomic barriers, inclusion mechanisms



Workplace learning	Learning embedded in productive activity	Reflection, mentoring, communities of practice, application of learning
Governance/credentials	Institutional coordination and validation	Recognition of prior learning, micro-credentials, portability, quality assurance
Sustainability/resilience	Long-term adaptive and social outcomes	Career adaptability, organizational resilience, social participation

Note. The framework was constructed from the thematic architecture of the supplied manuscript and used as an organizing device for the documentary synthesis.

RESULTS AND DISCUSSION

The Integration of Formal, Non-Formal, and Informal Learning

The first major finding is that lifelong learning becomes strategically meaningful when learning modalities are treated as complementary rather than hierarchical. Formal education remains essential because it provides systematic disciplinary knowledge, recognized standards, and qualifications that are legible to institutions and labor markets. However, its temporal and curricular rigidity can limit responsiveness when technologies and occupational practices change rapidly. Non-formal education compensates for some of this rigidity through short courses, community programs, professional development, and employer-based training, while informal learning supplies the continuous adaptation that occurs through problem solving, observation, peer interaction, and self-directed experimentation (Biesta et al., 2021; Eraut et al., 2004).

The literature reviewed in the source manuscript suggests that the value of these modalities lies in their interaction. Workplace learning, for example, is most powerful when experience is connected to conceptual reflection and when the competences developed through practice can be recognized outside the immediate organization. Similarly, formal curricula become more relevant when they create space for authentic projects, work-based learning, and the analysis of problems emerging from professional contexts. This reciprocal relationship challenges the notion that theory belongs to formal institutions while practice belongs to the workplace. Instead, learning moves across settings and is repeatedly recontextualized (Boud et al., 2006; Falk et al., 2011).

From an equity perspective, the integration of modalities also expands the number of legitimate entry points into education. Adults who cannot return to full-time study may still accumulate competence through community learning, modular courses, professional practice, or digital resources. Yet flexibility only becomes educationally valuable when there are mechanisms to make learning visible and transferable. Recognition of prior learning, credit transfer, competency assessment, and transparent qualification frameworks are therefore not administrative details; they are structural components of an inclusive lifelong learning system (Markowitsch et al., 2020; Salzmann et al., 2024).

The source manuscript repeatedly emphasizes the importance of communities of practice and social learning. Informal learning is not simply an individual process of consuming information. It is frequently relational: people learn how to interpret problems, evaluate solutions, and construct professional identity through participation in social groups. These networks can preserve organizational memory and accelerate the diffusion of new practices, particularly when members have opportunities to question assumptions and compare alternative approaches (Wenger et al., 2011).

A key implication is that policy should move away from binary distinctions between “recognized” and “unrecognized” learning. The relevant question is whether a learning experience produces demonstrable knowledge or competence and whether an appropriate mechanism exists to validate it. This does not imply that all experiences should automatically receive formal credit. Rather, systems require transparent assessment standards that distinguish participation from mastery while still acknowledging that significant learning occurs outside conventional classrooms.



Table 2

Complementary functions of lifelong learning modalities

Learning modality	Primary strength	Typical limitation	Integration mechanism
Formal education	Structured knowledge and recognized qualifications	Long cycles and slower curricular adaptation	Credit transfer, modular curricula, work-integrated learning
Non-formal education	Flexibility and contextual relevance	Variable quality and recognition	Quality assurance, stackable credentials, articulation agreements
Informal learning	Continuous situated learning and tacit knowledge	Low visibility and difficult assessment	Recognition of prior learning, portfolios, competency demonstration
Workplace learning	Immediate application and feedback	May remain organization-specific	External standards, mentoring, reflective practice, portable credentials
Digital self-directed learning	Scalable access and personalization	Digital divide and uneven information quality	Digital literacy, curation, learner support, verified assessment

Note. The table summarizes recurrent functions and tensions identified in the reviewed literature.

Digital Transformation as an Enabler and a Source of Inequality

Digital transformation is the most visible technological force reshaping lifelong learning, but the review indicates that its effects are fundamentally ambivalent. Digital platforms reduce geographical and temporal barriers, support asynchronous participation, and enable modular learning. They also permit rapid updating of content and can connect learners to professional communities beyond their local institutions. These characteristics make digital learning especially relevant for adults balancing employment, family responsibilities, and education (Duart et al., 2021; Bozkurt et al., 2022).

At the same time, the digital divide has evolved from a question of physical access into a multi-level problem involving skills, confidence, critical judgment, and the capacity to use technology for meaningful goals. Learners may technically have internet access while still lacking the digital competence required to evaluate sources, protect personal data, navigate learning platforms, or translate online information into professional practice. The evidence therefore supports a shift from infrastructure-centered digital inclusion toward capability-centered digital inclusion (Ferrari et al., 2014; Wei et al., 2011).

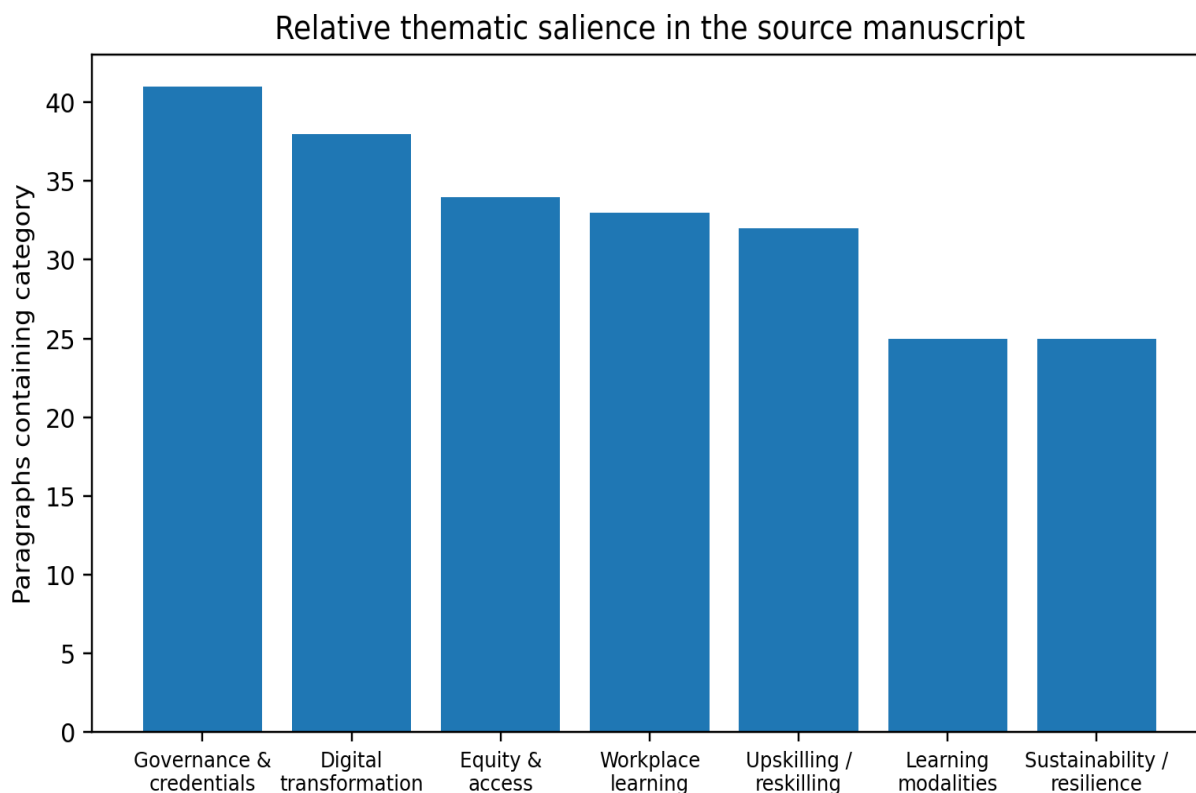
This distinction becomes more important with the growth of algorithmic recommendation systems and generative artificial intelligence. Personalized systems can reduce search costs and tailor learning sequences to individual needs, yet they also introduce questions about transparency, bias, privacy, and the educational consequences of delegating decisions to opaque systems. In an integrated lifelong learning ecosystem, technology should support learner agency rather than replace it. Human guidance, opportunities for reflection, and explicit digital-ethics competencies remain essential.

The review further suggests that digital learning is most effective when embedded in social and institutional support. Self-directed learning should not be interpreted as isolated learning. Adults frequently need mentoring, feedback, peer interaction, and clear signals about the value of a course or credential. Educational institutions and employers therefore have a curatorial role: they can reduce information overload by identifying trustworthy resources, aligning content with competence frameworks, and creating opportunities for learners to demonstrate what they have learned (Cochrane et al., 2020; Romero et al., 2019).

Digitalization also changes the economics of lifelong learning. Short learning units and online delivery can lower marginal delivery costs, but participation still has an opportunity cost. Adults need time, devices, connectivity, and sometimes unpaid hours away from work or care responsibilities. Policies that measure access only by enrollment risk overlooking these hidden costs. A more complete equity framework must examine who can persist, complete, apply, and gain recognition for digital learning.

Figure 1

Relative thematic salience across the supplied manuscript



Note. Values represent the number of substantive paragraphs in the source manuscript containing at least one term from each coding family. Counts are descriptive indicators of documentary emphasis, not population estimates or effect sizes.

Upskilling, Reskilling, and the Organization of Workplace Learning

The third finding concerns the organizational conditions under which upskilling and reskilling become sustainable. The reviewed literature consistently indicates that isolated training events are insufficient when learning is disconnected from work design, feedback, and career pathways. Employees are more likely to transfer new knowledge when they can apply it to authentic tasks, discuss results with colleagues, and receive feedback that helps them refine practice. Productive reflection therefore becomes a central mechanism linking experience with competence development (Boud et al., 2006; Dohmen et al., 2020).

Upskilling and reskilling also differ in organizational complexity. Upskilling can often build on an existing professional identity and familiar work context. Reskilling may require a deeper transition because learners must acquire new conceptual frameworks, routines, and professional languages. This means that reskilling programs need more than content delivery: they benefit from mentoring, staged practice, communities of practice, and clear transition pathways. Organizations that frame reskilling as a collective process rather than an individual deficit can reduce resistance and create stronger conditions for learning.

A strategic learning culture treats competence development as a shared responsibility between the organization



and the learner. If workers are expected to continuously update skills solely in their personal time, lifelong learning can become an additional source of stress. Conversely, when organizations allocate protected learning time, connect training to meaningful career opportunities, and recognize learning contributions, participation becomes more sustainable. This is particularly relevant in environments characterized by continuous technological change, where the demand to remain permanently “up to date” can contribute to fatigue and insecurity.

The literature also points to the importance of intergenerational learning. Experienced workers possess tacit knowledge that is often difficult to codify, while younger workers may enter organizations with greater familiarity with emerging digital tools. Mentoring and reverse-mentoring arrangements can create reciprocal learning rather than one-directional transfer. Such practices can protect organizational memory while accelerating the adoption of new methods. In this sense, lifelong learning is not simply an individual accumulation of skills but a mechanism for renewing collective capability.

For educational institutions, the organizational perspective has two consequences. First, curricula should be designed with greater permeability to workplace and community learning. Second, institutions need stronger partnerships with employers and professional bodies so that competence requirements can be updated without reducing education to narrow task training. A balanced model preserves broad theoretical, ethical, and critical capacities while making learning responsive to changing professional contexts (Green et al., 2022; González-Sanmamed et al., 2021).

Equity, Participation, and the Risk of Unequal Lifelong Learning

The fourth result is that lifelong learning systems can reproduce inequality even when their formal objective is inclusion. Participation depends on the interaction between motivation and opportunity. Time poverty, unstable employment, caregiving, transportation, cost, language, prior educational experiences, and digital confidence can all shape the ability to enter and remain in learning. These barriers are cumulative: the adults with the greatest need for new opportunities may also have the least flexibility to participate (Boeren et al., 2020; Misko et al., 2022).

An equity-oriented system therefore requires differentiated support rather than identical provision. Flexible scheduling, modular pathways, financial assistance, childcare support, accessible technology, guidance services, and recognition of previous experience can reduce the cost of participation for groups who would otherwise be excluded. The principle is not to lower learning standards but to remove barriers that are unrelated to the competence being developed.

Community learning centers and local organizations are especially important in this respect because they can reduce the psychological and cultural distance between learners and formal institutions. Community-based learning can also recognize forms of knowledge that are often ignored by standardized systems. However, these spaces should not become a lower-status alternative for marginalized groups. The strategic goal is to connect community learning to wider qualification and mobility systems so that flexibility does not come at the cost of recognition (Belete et al., 2022; Preece et al., 2021).

Equity also has a temporal dimension. Adult learners do not follow linear educational trajectories. Periods of work, unemployment, migration, illness, caregiving, and occupational transition may interrupt learning. A lifelong system should therefore allow re-entry without forcing learners to restart from the beginning. Accumulation and transfer of recognized learning become critical because they allow education to adapt to life rather than requiring life to adapt completely to institutional calendars.

The broader implication is that lifelong learning must be evaluated with more than enrollment and completion indicators. Equity-oriented evaluation should consider who participates, who persists, whose learning is recognized, who benefits from labor-market or civic outcomes, and who remains excluded. This calls for metrics that combine participation, competence, mobility, well-being, and social inclusion (Valiente et al., 2022; Mattei et al., 2022).



Governance, Micro-Credentials, and Recognition of Prior Learning

Governance and credentialing form the most recurrent thematic category in the source manuscript. This emphasis reflects a central problem: learning opportunities are expanding faster than the institutional mechanisms used to recognize them. Micro-credentials, digital badges, short certificates, employer-based credentials, and competency portfolios create new flexibility, but they also generate uncertainty about quality, equivalence, and portability. Without shared standards, learners may accumulate credentials that have limited value outside the organization or platform that issued them.

Recognition of prior learning addresses a related problem by allowing competences developed through work, community activity, or previous study to be assessed against explicit standards. In principle, this reduces duplication and shortens educational pathways. In practice, recognition procedures can be administratively complex, expensive, or inconsistently applied. Effective systems require transparent criteria, trained assessors, appeal mechanisms, and institutional incentives to recognize learning acquired elsewhere (Salzmann et al., 2024).

Qualification frameworks can provide a common language for comparing levels of competence across institutions and sectors. Their value lies less in classification itself than in the possibility of making transitions more legible. When institutions, employers, and learners can understand how a credential relates to a wider framework, transfer becomes easier and trust increases. However, frameworks must remain sufficiently flexible to accommodate emerging competences and forms of learning (Markowitsch et al., 2020).

The governance challenge is therefore polycentric. No single actor controls lifelong learning. Governments regulate qualifications and fund access; educational institutions provide assessment and structured knowledge; employers identify emerging skill needs and create work-based learning opportunities; professional bodies define standards; communities provide local access and social support; and learners navigate among these systems. Integration depends on coordination mechanisms that distribute responsibility while preserving accountability.

Quality assurance is particularly important because the expansion of short digital credentials can make educational markets difficult to navigate. Transparent information about learning outcomes, assessment methods, workload, issuer identity, and transferability can protect learners from low-value credentials. Interoperability should also be treated as a public-interest issue: when credential systems cannot communicate with one another, the burden of proving learning falls disproportionately on individuals.

Table 3

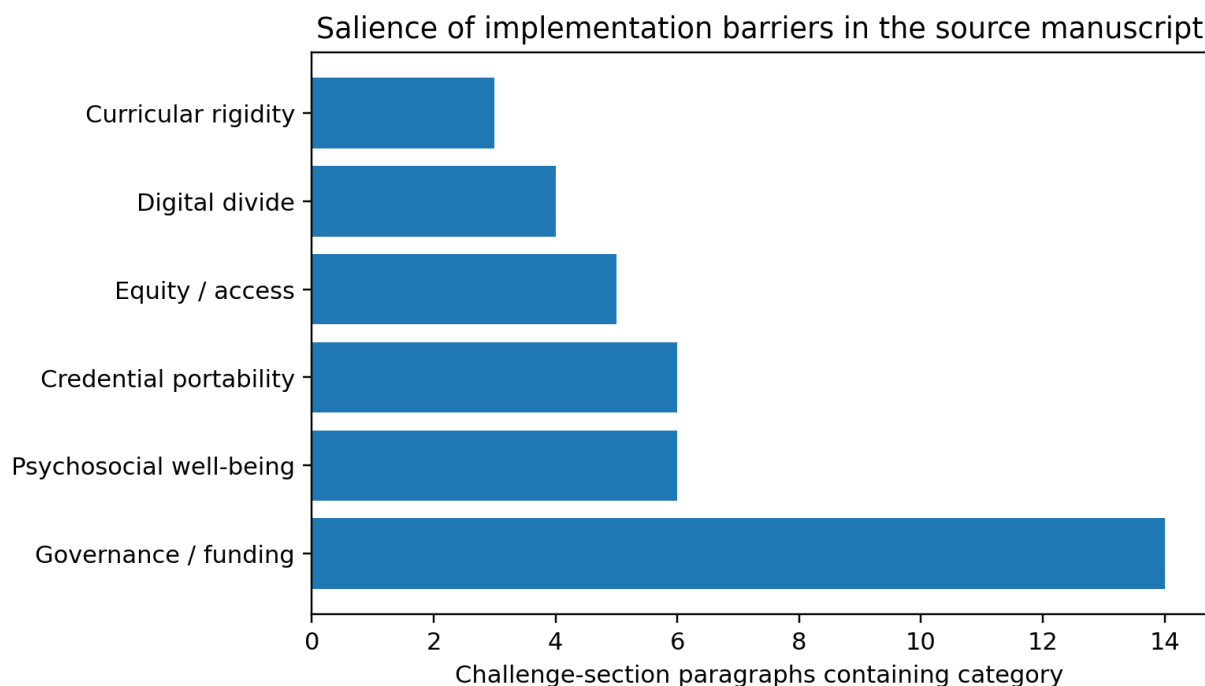
Key implementation barriers and strategic responses

Barrier	Educational consequence	Strategic response
Fragmented governance	Duplicated provision and weak transfer across sectors	Shared frameworks, inter-institutional agreements, coordinated funding
Digital divide	Unequal access, persistence, and quality of participation	Connectivity plus digital competence, mentoring, and device support
Weak recognition of informal learning	Repeated training and invisible competence	Recognition of prior learning, portfolios, performance assessment
Low credential portability	Credentials lose value across institutions or jurisdictions	Interoperable standards and transparent qualification mapping
Time and care constraints	Lower participation among working adults and caregivers	Flexible scheduling, modular delivery, protected learning time
Psychosocial pressure	Fatigue and disengagement from continuous skill renewal	Realistic pacing, career guidance, well-being supports, shared responsibility

Note. Strategic responses synthesize the direction of recommendations contained in the reviewed literature; they should be empirically evaluated in specific institutional contexts.

Figure 2

Relative salience of implementation barriers in the challenge section



Note. Counts indicate the number of challenge-section paragraphs in the supplied manuscript containing at least one term associated with each barrier family. The figure is descriptive and should not be interpreted as a ranking of causal importance.

Sustainability, Resilience, and the Broader Purpose of Lifelong Learning

The final thematic result is that lifelong learning is increasingly linked to resilience and sustainability. Labor markets are being reshaped not only by digitalization but also by demographic change, public-health shocks, geopolitical uncertainty, and ecological transition. These pressures require people and organizations to adapt, yet adaptation should not be reduced to faster skill replacement. Resilience also involves the capacity to interpret change, preserve well-being, collaborate across differences, and make decisions under uncertainty (Sava et al., 2022; Grotlüschen et al., 2024).

This broader perspective helps explain why transversal competences remain central even in highly technical reskilling programs. Communication, critical thinking, self-regulation, collaboration, ethical judgment, and the ability to learn how to learn make it possible to transfer technical knowledge across contexts. Programs that focus only on narrow tools may produce short-term gains but can become obsolete when the tools change. Lifelong learning ecosystems should therefore combine domain-specific competence with meta-learning capacities.

Sustainability also changes the content of learning. Green transitions require new technical knowledge, but they also demand the ability to understand systems, trade-offs, and social consequences. Continuous education can support the diffusion of environmental practices while helping workers navigate occupational transitions associated with decarbonization. From this perspective, upskilling and reskilling become part of a just-transition agenda rather than only a productivity strategy.

The source manuscript's recurrent emphasis on inclusion, governance, and resilience supports a conceptual



shift from courses to ecosystems. A course has a defined beginning and end. An ecosystem creates repeated opportunities to enter, learn, apply, receive recognition, and move to a new stage. The value of the ecosystem lies in its capacity to connect experiences over time. This continuity is what allows lifelong learning to become a practical reality rather than a policy slogan.

Table 4

Integrated lifelong learning ecosystem: mechanisms and expected outcomes

System level	Core mechanism	Expected contribution
Learner	Agency, reflection, digital competence, career guidance	Sustained participation and capacity to navigate transitions
Educational institution	Flexible curricula, assessment, recognition, stackable pathways	Continuity between formal study and external learning
Workplace	Protected learning time, mentoring, application opportunities	Transfer of learning, adaptability, organizational memory
Community	Local access, peer support, culturally relevant knowledge	Inclusion, social capital, participation of underserved groups
Credential infrastructure	Transparent standards, portability, interoperability	Trust, mobility, reduced duplication of learning
Public policy	Financing, quality assurance, equity safeguards, coordination	System coherence and more equitable lifelong learning opportunities

Note. The proposed model is a conceptual synthesis derived from the documentary review and is intended for subsequent empirical testing.

Integrated Interpretation and Research Implications

Taken together, the findings suggest that the central unit of analysis for lifelong learning should be the learning trajectory rather than the individual course or institution. Adult learners move among settings, and the effectiveness of the system depends on whether those transitions are supported. A trajectory-based perspective highlights the importance of cumulative recognition, guidance, and opportunities to re-enter education after interruption. It also makes visible the institutional costs created by fragmentation.

The review further indicates that flexibility and quality should not be treated as opposites. Flexible pathways require stronger, not weaker, transparency about learning outcomes and assessment. Micro-credentials and recognition mechanisms can broaden participation only when learners and employers trust the meaning of the credential. Consequently, quality assurance should focus on demonstrated competence, clear standards, and transferability rather than on duration alone.

A third implication is that digitalization should be evaluated through its effect on capability. Technology is useful when it increases the learner's capacity to access, interpret, apply, and demonstrate knowledge. It is less useful when it simply increases the volume of content or shifts responsibility for training costs onto individuals. Future research should therefore distinguish access to platforms from effective participation and meaningful learning outcomes.

A fourth implication concerns organizational responsibility. The language of lifelong learning can unintentionally individualize structural problems by suggesting that workers must continuously reinvent themselves regardless of working conditions. The evidence reviewed here supports a shared-responsibility model in which employers, institutions, and public policy create time, financing, guidance, and recognition structures. This is particularly important for workers with lower incomes or less stable contracts, who otherwise face a disproportionate burden of reskilling.

Finally, the proposed ecosystem model requires empirical validation. Future studies could operationalize the



six system levels in Table 4 and test their relationship with participation, credential accumulation, occupational mobility, well-being, and organizational adaptability. Comparative research would be especially valuable because governance arrangements that work in one national or sectoral context may not transfer directly to another. Mixed-method designs could combine longitudinal administrative data with learner narratives to capture both measurable outcomes and the lived experience of navigating learning systems.

CONCLUSION

This article reorganized and critically synthesized the supplied manuscript in order to examine lifelong learning as an integrated ecosystem for upskilling and reskilling. The review shows that the strongest models do not treat formal, non-formal, and informal learning as competing alternatives. Instead, they create bridges among them through recognition, flexible progression, workplace application, digital support, and portable evidence of competence.

The analysis also demonstrates that expansion of learning opportunities does not automatically produce equity. Digital platforms, micro-credentials, and short programs may increase flexibility, but they can also reproduce inequality when learners lack connectivity, time, guidance, confidence, or recognized pathways. Effective lifelong learning therefore requires attention to participation conditions as well as to educational supply.

For organizations, upskilling and reskilling should be embedded in work design and career development rather than treated as occasional training events. Protected learning time, mentoring, reflective practice, intergenerational knowledge exchange, and opportunities to apply new competence can strengthen transfer and reduce the risk that continuous learning becomes an individualized burden. For educational institutions, the central task is to combine disciplinary rigor with permeability to external learning and emerging professional needs.

At the system level, governance and credentialing are decisive. Recognition of prior learning, interoperable micro-credentials, qualification frameworks, and transparent quality assurance can reduce duplication and make learning trajectories more portable. These mechanisms require coordination among governments, institutions, employers, professional bodies, communities, and learners. No single actor can construct a lifelong learning ecosystem independently.

The principal conceptual contribution of the study is therefore the proposition that lifelong learning should be evaluated as a connected trajectory of learning, application, validation, and transition. Its success should be assessed not only through course completion or immediate employability, but also through equitable participation, competence transfer, career adaptability, well-being, social inclusion, and resilience. This integrated perspective provides a foundation for future empirical research and for the design of educational systems capable of responding to technological change without losing sight of human development and social justice.

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