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Advancing Qualification Recognition at CIMEA

Digital Transformation and AI Integration for Fair and Equitable Credential Evaluation

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Sommario

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Preface

Enzo Maria Le Fevre Cervini

The recognition of academic qualifications has quietly become one of the most consequential public-service functions of our time. Behind every decision to recognise a degree earned abroad lies a person's right to study, to work, and to build a life across borders. As global enrolment in higher education has risen from roughly 100 million students at the turn of the century to some 264 million today, and as the number of internationally mobile students has more than tripled, the institutions that evaluate foreign credentials have found themselves at the centre of a transformation they did not choose, but can no longer postpone. This volume is, above all, an honest and rigorous account of what that transformation actually looks like when an institution decides to take it seriously.

The literature on digital transformation and artificial intelligence is vast; the literature that follows a single recognition centre, step by step, from manual files to AI-assisted workflows – documenting both the promise and the friction – is far scarcer. That is what makes this study distinctive, and what gives it real value for the world of credential evaluation. It does not treat technology as an abstraction or a forecast. It examines, concretely, how CIMEA, the Italian ENIC-NARIC centre, re-engineered its evaluation processes, built and matured its DiploMe platform, and then asked the harder question of where – and whether – artificial intelligence belongs in the assessment of academic credentials. For colleagues across the ENIC-NARIC networks, and for recognition bodies well beyond Europe, the contribution here is not a set of conclusions to be copied, but a method to be adapted: a worked example of disciplined, accountable change.

Several threads run through the chapters that follow. The first is conceptual clarity – the insistence that digitisation, digitalisation and digital transformation are not synonyms, and that only the last, when embedded in structured change management and supported by sound knowledge management, creates the conditions for adopting AI responsibly. The second is regulatory seriousness: the analysis is anchored in the EU Artificial Intelligence Act, the Council of Europe Framework Convention on Artificial Intelligence, the General Data Protection Regulation and UNESCO's normative frameworks, treating compliance not as an afterthought but as a design constraint. The third, and to my mind the most important, is the human-centred commitment that recurs on almost every page. Whether described as *human-rights-by-design, ethics-by-design*, or simply human oversight, the principle is constant: artificial intelligence is examined here as a way to augment the judgement of credential evaluators, never to replace it.

This matters because the stakes in credential evaluation are unusually concrete. Recognition decisions touch fraud detection and document authentication, the integrity of academic mobility, and ultimately the trust that allows qualifications to travel at all. An automated decision that goes wrong in this domain is not a technical inconvenience; it is a barrier placed in front of a real person. The volume's careful treatment of these questions – mapping where automation genuinely adds value and where human evaluators must remain firmly in the loop – is precisely what the field needs as AI tools become more capable and more available.

I have had the privilege of observing the research behind this book closely, and its story deserves to be told. The work grew out of a collaboration between CIMEA and UBA-IALAB, the Laboratory on Innovation and Artificial of the Faculty of Law of the University of Buenos Aires – a partnership between an Italian recognition centre and one of the top Latin American University laboratories for artificial intelligence that says something hopeful about how knowledge now travels. It began with a collaborative academic study carried out between November 2023 and May 2024. The first phase was deliberately cautious: a feasibility assessment built on the review of nineteen case studies of AI and blockchain in credential assessment, drawn from Europe, Latin America, Japan and the United States. From there the work became participatory. Credential evaluators, CIMEA's technical staff and IALAB researchers sat down together to map the recognition workflow task by task, identifying where automation could add genuine value and where it could not – an exercise that produced six concrete opportunities for AI integration rather than a wish list.

What might have remained a diagnostic exercise did not stop there. At the end of 2024, IALAB presented CIMEA with a proof of concept: a generative-AI-based agent able to receive a credential, process it, check it against CIMEA's own rules, and return an explainable report. On that basis the two institutions opened a new phase, running through 2025, dedicated to designing, developing and piloting a GENAI-based agent connected directly to DiploMe and intended to assist – not supplant – the staff who validate academic credentials. That work is still under way as this volume goes to print, which is itself fitting: the book documents a journey honest enough to admit that it is not finished.

There is a wider significance to all of this. As recognition centres everywhere confront the same pressures – rising application volumes, more sophisticated fraud, and the arrival of powerful but still imperfect AI tools – the question is no longer whether to engage with these technologies, but how to do so without eroding fairness, transparency and due process. A documented, self-critical account of one centre's path is, in this sense, a contribution to a shared endeavour: it offers the ENIC-NARIC networks and comparable institutions a common reference point, a vocabulary, and a set of tested practices on which future standards can be built. That this account has emerged from a dialogue spanning two continents only strengthens its claim to general relevance.

It is rare for a publication to be at once a scholarly contribution, a practitioner's handbook and a candid institutional self-portrait. The Quaderni Universitas series has produced exactly such a volume, and the credit belongs to its editors – Chiara Finocchietti, Luca Lantero and Serena Spitalieri – and to the teams at CIMEA and IALAB whose patient, interdisciplinary work it records. Readers working in credential evaluation will find here both reassurance and challenge: reassurance that digital transformation and artificial intelligence can be approached without abandoning the values that make recognition trustworthy, and a challenge to do so with the same rigour. I commend this volume to them, and I am grateful to have been part of the conversation from which it emerged.

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* The views expressed in this preface are those of the author and do not necessarily reflect the position of the European Commission.

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CHAPTER 1

Introduction

Luca Lantero

Higher education systems worldwide are undergoing profound transformations driven by globalisation, digitalisation and evolving socio-economic dynamics. Within this rapidly changing context, the recognition of foreign qualifications has assumed an increasingly strategic role in facilitating international academic and professional mobility, ensuring fair and transparent evaluation procedures, and promoting equitable access to education, training and employment opportunities. As higher education systems become progressively interconnected, recognition practices are required not only to guarantee comparability and reliability, but also to respond effectively to the growing complexity of transnational educational pathways.

According to recent data published by the UNESCO Institute for Statistics[1], global enrolment in higher education increased from approximately 100 million students in 2000 to 264 million in 2025. During the same period, the number of internationally mobile students more than tripled, rising from nearly 2 million to over 6.9 million worldwide. This significant expansion of international mobility has intensified the need for recognition systems that are efficient, secure, transparent and capable of operating across increasingly diversified educational contexts. In this regard, digital transformation has emerged as a crucial factor in strengthening the quality, interoperability and scalability of credential evaluation and recognition processes[2].

[1] UNESCO Institute for Statistics (UIS), *Global Flow of Tertiary-Level Students and Worldwide Higher Education Enrolment Data*, Montreal: UNESCO Institute for Statistics, 2025.
[2] UNESCO, *Digital Transformation and the Recognition of Qualifications in Higher Education*, Paris: UNESCO, 2025.

At the same time, the growing volume and complexity of applications for the recognition of foreign qualifications have generated new operational and institutional challenges for recognition authorities, higher education institutions and quality assurance bodies. Traditional administrative procedures are often no longer sufficient to manage large-scale requests while simultaneously ensuring accuracy, consistency and timely decision-making. Consequently, institutions are increasingly required to adopt innovative approaches capable of enhancing organisational efficiency, improving analytical precision and ensuring the long-term sustainability of recognition systems.

Within this evolving framework, digital technologies and artificial intelligence (AI) have emerged as key drivers of transformation, progressively reshaping both credential recognition practices and the organisational structures involved in these processes. Over the past decades, recognition systems have evolved in response to international regulatory developments, technological innovation and broader policy agendas related to digitalisation and internationalisation. The progressive integration of digital tools, automated verification systems and AI-supported analytical processes has contributed to strengthening transparency, security and operational effectiveness, while also opening new debates concerning governance, ethics, human oversight and institutional accountability in the field of qualification recognition.

This publication adopts both a scholarly and practice-oriented perspective, combining the operational experience of CIMEA (Centro Informazioni sulla Mobilità e le Equivalenze Accademiche) with an analytical framework potentially transferable to other credential recognition institutions and centres. The study is situated within the broader European regulatory and policy context – particularly that of the European Union and the Council of Europe – while also engaging with UNESCO's normative approaches and international policy frameworks. Within this perspective, the recognition of qualifications is conceptualised not merely as an administrative procedure, but as a fundamental public-service function intrinsically connected to the right to education, academic mobility and equitable access to opportunities. Simultaneously, processes of innovation and technological advancement are critically examined through a human-centric and rights-based lens, avoiding deterministic interpretations of technology and emphasising the continued centrality of human oversight and institutional accountability.

The research underpinning this volume originates from a collaborative academic study conducted between November 2023 and May 2024 by CIMEA and the Laboratory on Innovation and Artificial Intelligence (IALAB) of the University of Buenos Aires. The project aimed to analyse the implications of digital transformation within credential recognition systems, with particular attention devoted to the integration of artificial intelligence and emerging technological solutions in evaluation and verification processes.

From a methodological perspective, as discussed in the following chapter, the study combines participatory co-design approaches involving credential evaluators and institutional stakeholders with organisational change management, knowledge management perspectives, and legal-ethical

compliance analysis. This interdisciplinary methodological framework enables technological solutions to be assessed within real operational environments, ensuring that innovation remains aligned with institutional procedures, human oversight mechanisms (human-in-the-loop), and due-process safeguards, including transparency requirements and the right to appeal. Building upon this research framework, the volume provides a comprehensive analysis of the evolution of digital transformation in credential recognition, examining its organisational implications and the strategic integration of artificial intelligence within CIMEA's operational ecosystem. Drawing on international case studies, regulatory frameworks, comparative experiences and recent technological developments, the study advances evidence-based reflections and recommendations aimed at strengthening evaluation procedures, improving operational efficiency and reinforcing institutional reliability. Although grounded primarily in the Italian context, the analytical models and operational approaches discussed throughout the volume are conceived as potentially transferable to ENIC-NARIC centres (European Network of Information Centres and National Academic Recognition Information Centres in the European Union) as well as to analogous institutions seeking to align digital transformation processes with trustworthy, transparent and human-centric AI systems. Particular attention is devoted to the development of CIMEA's DiploMe platform, which represents a significant case study of digital innovation in qualification recognition and provides an important framework for the progressive integration of AI-supported functionalities.

Ultimately, the study offers strategic insights into how digital transformation and artificial intelligence may be effectively integrated to enhance operational capacity, ensure compliance with international standards and respond to the increasing demand for transparent, secure and reliable recognition systems. In particular, the volume highlights the analytical distinction between digitisation, digitalisation and digital transformation, arguing that only the latter – when embedded within structured processes of organisational change management and supported by robust knowledge management practices – can create the institutional and operational conditions necessary for the sustainable, ethical and responsible adoption of artificial intelligence in credential recognition.

1.1. Aims and Objective

The primary objective of this research is to evaluate and enhance the digital transformation of credential recognition processes at CIMEA, with a particular focus on the potential applications of AI in qualification assessment. The study aimed to identify technological solutions that could improve the efficiency, accuracy, and security of academic credential evaluation while ensuring compliance with international regulatory frameworks.

To achieve these objectives, the research focuses on:

- Analysing the impact of digital transformation on credential recognition processes, identifying key phases and best practices for digital innovation.
- Assessing the effectiveness of AI-driven solutions in automating decision-making, supporting the detection of fraudulent documentation.
- Examining the regulatory landscape governing AI in education, with particular emphasis on the EU Artificial Intelligence Act (EU AI Act), the Council of Europe Framework Convention on Artificial Intelligence and Human Rights, Democracy and the Rule of Law and UNESCO Six pillars for the digital transformation of education.
- Documenting the evolution of DiploMe, CIMEA's digital credential evaluation management platform, and its role in streamlining academic evaluation workflows.

- Evaluating AI applications in the credential evaluation workflow, identifying six key opportunities for AI integration,
- including automated case assignment, AI-supported fraud detection and predictive analytics for workflow management.
- Providing strategic recommendations for AI integration in CIMEA as ENIC-NARIC centre, emphasising organisational change, technical readiness, and the establishment of multidisciplinary teams to oversee AI deployment.

The research is conducted through a combination of case study analysis, stakeholder interviews, and a systematic review of regulatory frameworks, ensuring that the proposed AI applications are aligned with ethical standards and institutional requirements. By bridging digital transformation with AI-driven innovation, the study provides a structured roadmap for the sustainable and responsible adoption of artificial intelligence in credential recognition systems.

1.2. Structures of the Study

The volume is structured into a series of chapters, each addressing a critical dimension of digital transformation in credential recognition. Chapter 2 establishes the theoretical foundations and methodological framework of the study. It defines the key research questions and outlines the analytical approach adopted throughout the volume.

Chapter 3, *Conceptual Foundations: Change Management and Digital Transformation*, provides the conceptual basis for understanding organizational change in the context of digitalization. It examines the principles, methodologies and challenges associated with transformation processes, with particular attention to their implications for higher education and the recognition of foreign qualifications. Digital transformation is framed not merely as a technological shift, but as a structural reconfiguration of organizational processes, strategies and cultures aimed at enhancing efficiency, sustainability and internationalization. The chapter is organized into three sections. The first introduces change management, focusing on leadership roles, preparatory phases and strategies to address resistance. The second section traces the evolution of digital transformation – from early digitalization to contemporary data-driven ecosystems – and highlights key enabling factors such as knowledge management, organizational agility and human-centred approaches. The third section applies these dynamics to qualification recognition, analysing digital credentials, data governance, interoperability and the stages of digital transformation in evaluation processes. The chapter concludes by outlining six guiding principles for digital innovation, including user-centricity, inclusivity, data protection and compliance with international standards.

Chapter 4, *Regulatory and Systemic Frameworks: Digitalization and AI in Qualification Recognition*, examines the legal and policy dimensions of digital transformation. It analyses the evolving regulatory landscape at global and regional levels, with particular attention to the implications of artificial intelligence for education and credential evaluation. Key instruments include the UNESCO Global Convention on the Recognition of Qualifications, the Council of Europe Framework Convention on AI, and the European Union's AI Act and GDPR. The chapter highlights both the opportunities and risks associated with digitalization and AI. While digital tools enhance efficiency, transparency and interoperability, they also raise concerns related to data protection, algorithmic bias, explainability and the need for human oversight. Particular attention is devoted to AI applications such as automated decision-making, fraud detection and cross-border recognition support, as well as to the ethical and governance challenges they entail.

Chapter 5, *Case Study: Digital Transformation at CIMEA*, presents an empirical case study of institutional transformation. It analyses the development and implementation of digital solutions for credential evaluation, focusing on the DiploMe platform. The chapter traces the transition from manual processes to integrated digital systems, highlighting the role of change management, stakeholder engagement and user-centred design. It also incorporates qualitative insights from credential evaluators, offering a grounded perspective on the organizational and human impact of digitalization.

Chapter 6, *Implementing AI in CIMEA's Qualification Recognition Processes*, explores the strategic integration of artificial intelligence within credential evaluation workflows. Drawing on research conducted in collaboration with IALAB at the University of Buenos Aires, it identifies key use cases, including fraud detection, automated classification, workflow optimization and user communication. The chapter emphasizes the importance of a gradual and ethically grounded approach to AI adoption, supported by interdisciplinary collaboration, robust data governance and continuous monitoring.

Overall, the volume demonstrates that digital transformation, regulatory adaptation and artificial intelligence are deeply interconnected dimensions of contemporary higher education systems. By combining theoretical analysis, regulatory perspectives and empirical evidence, it provides a comprehensive framework for understanding the future of qualification recognition in an increasingly digital and globalized context.

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CHAPTER 2

Theoretical and Methodological Framework

Serena Spitalieri

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The research reflects a rigorous and systematic examination of the digital transformation process undertaken by CIMEA from 2018 to the present, tracing its fundamental stages to provide an in-depth analysis of the defining characteristics and structural complexities inherent in innovation and digitalization within a governmental organization. As a key institution responsible for fostering and guiding the internationalization of the Italian higher education system, CIMEA plays a fundamental role in credential recognition and evaluation, making its digital transition particularly significant in the broader discourse on the modernization of educational frameworks.

Drawing on methodological approaches, institutional frameworks, and organizational paradigms that have guided CIMEA's digital evolution, the study analyses the mechanisms through which change management and digital transformation can be systematically implemented in institutional settings, particularly within the higher education sector. In doing so, it identifies the structural, procedural, and strategic factors that enable the effective modernization of evaluation processes, as well as the conditions that facilitate their integration and adoption by credential evaluators.

The transition towards digitalized systems for the recognition and evaluation of qualifications necessitates a comprehensive and critical assessment of the integration of emerging technologies, particularly in relation to automated recognition processes and fraud prevention within the educational sector. Ensuring the reliability, transparency and ethical integrity of these systems requires adherence to a regulatory framework that incorporates principles of fairness, accountability and human rights from the earliest stages of conceptualization and implementation. Consequently, this research situated CIMEA's digital transformation within the broader national, European and international regulatory landscape, delineating the normative and operational parameters that govern the interaction between digitalization and education. Particular attention was given to the implications of artificial intelligence as a transformative force within credential evaluation, emphasizing both the opportunities it presents and the challenges it poses in the context of higher education policy and governance. Within this framework, the primacy of the *human-rights-by-design* paradigm[3] in conjunction with UNESCO's human-centered approach[4], is emphasized as a foundational principle for the development of digital systems in sensitive domains such as education, the assessment of learning outcomes, the recognition and evaluation of qualifications, and equitable access to higher education. These principles serve as foundational pillars to ensure that digital transformation processes not only enhance efficiency and scalability but also uphold ethical standards, fairness and inclusivity. These principles serve as foundational pillars to ensure that digital transformation processes not only enhance efficiency and scalability but also uphold ethical standards, fairness and inclusivity.

Furthermore, the findings of this research seek to stimulate a critical reflection on CIMEA's role as an agent of transformation at both the national and international levels. In addition to fostering dialogue on the implications of emerging technologies in qualification recognition, CIMEA provides a concrete model of technological innovation. This model was grounded in a *quality-by-design, ethics-by-design*[5] and *human-centric approach*[6], aimed at promoting sustainable and resilient frameworks that align with broader social, economic and environmental objectives. The re-engineering of evaluation workflows and the development of a structured knowledge architecture within CIMEA illustrate how digital transformation is not merely a procedural shift but a catalyst for substantial improvements in the quality and consistency of credential evaluation. The evolution of digital recognition mechanisms has led to enhanced policy coherence, greater reliability of collected data and an overall reinforcement of trust in the validation and certification of academic qualifications.

[3] Council of Europe, Work in progress: Artificial Intelligence, s.a https://www.coe.int/en/web/artificial-intelligence/work-in-progress [last accessed 6 May 2026].
[4] UNESCO, Artificial Intelligence in Education, s.a., https://www.unesco.org/en/digital-education/artificial-intelligence [last accessed 6 May 2026].
[5] European Commission, Ethics by design and ethics of use approaches for Artificial Intelligence, 2021. https://ec.europa.eu/info/funding-tenders/opportunities/docs/2021-2027/horizon/guidance/ethics-by-design-and-ethics-of-use-approaches-for-artificial-intelligence_he_en.pdf [last accessed 6 May 2026].
[6] European Commission, Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions - Building Trust in Human-Centric Artificial Intelligence, 2019. https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX%3A52019DC0168 [last accessed 6 May 2026].

2.1. Research Questions

In pursuit of research objectives, this study seeks to address the following research questions:

1. How has digital transformation reshaped the recognition processes of academic qualifications within CIMEA?
    - What structural and organizational changes were required to implement these transformations?
    - What technologies were integrated into the evaluation framework and how have they influenced operational workflows?
2. What are the principal challenges associated with implementing artificial intelligence in the recognition of academic qualifications?
    - What legal, forensic and ethical risks arise from the deployment of AI in this domain?
    - How can these risks be mitigated while safeguarding the transparency, reliability and integrity of recognition procedures?

3. How can the ethics-by-design paradigm be operationalized to ensure a human-rights-centered approach in credential recognition?

   - In what ways can a rights-based framework safeguard personal data and mitigate risks of bias, discrimination, or procedural inaccuracies?
   - What oversight mechanisms are necessary to uphold the rights and interests of individuals within digital systems?

4. What is the role of forensic methodologies in the digital recognition of academic qualifications?

   - How can forensic techniques contribute to fraud prevention and reinforce the credibility of digitally authenticated credentials?
   - What best practices can be adopted to ensure the robustness and security of digital recognition procedures?

5. What insights can be drawn from CIMEA's experience in managing change and implementing digital transformation in academic credential recognition?

   - How can other higher education institutions and credential evaluation bodies benefit from CIMEA's model?
   - What operational strategies and frameworks can be adapted or optimized to facilitate digitalization in similar institutional contexts?

By addressing these questions, the research provides a comprehensive and theoretically grounded analysis of the intersection between digital transformation, credential evaluation and regulatory compliance. The findings contribute to the ongoing discourse on the evolution of qualification recognition in an era increasingly defined by artificial intelligence and digital governance, while offering strategic insights for policy development and institutional capacity-buildin.

2.2. Methodological Approach

This research adopts a qualitative, interdisciplinary and practice-oriented methodological framework, integrating academic literature, institutional case-study analysis and forensic approaches applied to the evaluation and recognition of foreign qualifications. The core of the empirical analysis is structured around the case study of CIMEA, examined as a significant institutional model for understanding both the challenges and opportunities associated with the modernization of credential evaluation systems. To this end, the study followed a rigorous methodological framework based on:

- the observation and comparative analysis of internal recognition procedures before and after the implementation of digital systems, assessing their impact on efficiency, accuracy, institutional workflows and compliance with regulatory frameworks;
- the examination of official documentation and credential recognition protocols, with particular attention devoted to data protection policies, legal frameworks and procedural safeguards;
- the evaluation of CIMEA's technological infrastructure, focusing on the integration of artificial intelligence, digital verification mechanisms and the organisational strategies adopted to manage institutional transformation processes.

A central component of the methodological approach consists of the collection of primary qualitative data through semi-structured interviews. These interviews were conducted with CIMEA staff directly involved in the digital transformation process, as well as with legal and forensic experts specialising in credential evaluation and fraud prevention. The interview framework was designed to provide insights into:

- institutional perspectives regarding the implementation of digital transformation and the challenges encountered throughout the process.
- assessment of risks and benefits associated with the integration of artificial intelligence into academic recognition procedures.
- expert legal perspectives on the implications of AI-driven credential evaluation, particularly concerning personal data protection, regulatory compliance and forensic methodologies for fraud prevention.

The data collected through interviews, institutional analysis and forensic evaluations underwent a methodological triangulation process integrating multiple sources of evidence in order to strengthen the validity and robustness of the findings. Systematic cross-referencing of qualitative insights with forensic assessments and institutional documentation provided a more nuanced and comprehensive understanding of the phenomenon, enhancing the reliability of the conclusions, mitigating potential biases and deepening the interpretative scope of the study.

Furthermore, the research adheres strictly to established ethical and legal standards, ensuring compliance with fundamental principles of research ethics, particularly with regard to:

- informed consent: all interview participants provided explicit consent, ensuring their voluntary participation and understanding of the research objectives.
- data protection and confidentiality: personal data collected during interviews and case study analyses have been handled with strict confidentiality protocols, safeguarding the privacy and rights of participants.
- regulatory compliance: the research fully aligns with applicable legal frameworks for data protection, including adherence to the General Data Protection Regulation (GDPR) and other relevant regulatory instruments governing the processing, storage and security of sensitive information.

Finally, the study also examines the integration of artificial intelligence within CIMEA's evaluation

processes for foreign qualifications. This component of the research was conducted in collaboration with the Laboratory on Innovation and Artificial Intelligence (IALAB) at the University of Buenos Aires, further enriching the study through an applied exploration of AI-driven methodologies in credential recognition and institutional governance.

a. Problem Areas

The COVID-19 pandemic acted as a catalyst that accelerated pre-existing structural vulnerabilities within higher education systems, generating profound consequences at both national and international levels. Beyond the immediate health emergency, the crisis intensified the need for systemic transformation, particularly in relation to digital infrastructures, educational accessibility and the recognition of academic qualifications. Preliminary studies conducted within the higher education sector identified several cross-cutting dynamics that emerged during the pandemic period:

(i) a pronounced escalation of social inequalities, further exacerbating disparities in access to education and highlighting the limitations of existing frameworks in ensuring equitable participation.

(ii) the abrupt and complete suspension of all forms of physical mobility, disrupting international student flows and academic exchange programs.

(iii) the widespread adoption of emergency online teaching modalities, which fundamentally challenged traditional conceptualizations of the university experience and necessitated adjustments to national regulatory frameworks governing quality assurance and credential recognition.

(iv) an unprecedented acceleration of digital transformation processes across both academic and administrative sectors.

From the perspective of social inequality, the availability of digital infrastructures played a critical role in determining the extent to which educational institutions and national systems could adapt to the crisis. Countries with advanced digital capabilities were better positioned to mitigate disruptions, whereas those lacking robust technological frameworks faced significant barriers, leading to the exclusion of large segments of the population from educational opportunities. Furthermore, the pandemic exposed the vulnerabilities of administrative, school and university procedures that had not yet undergone digital transformation, underscoring the urgent need for a fundamental reconfiguration of administrative and procedural mechanisms.

Within this broader context, international students encountered particularly acute challenges. Beyond the complexities associated with the evaluation and recognition of their academic qualifications,

they were also subject to additional bureaucratic constraints, including entry visa requirements and residency permit obligations. These factors compounded the difficulties of accessing and continuing higher education, further reinforcing the necessity of streamlined and digitally integrated solutions.

At present, the absence of comprehensive digital frameworks for credential issuance and verification continues to pose significant risks, notably in terms of fraud prevention and the authentication of academic qualifications. The lack of efficient digital mechanisms not only increases the susceptibility of the education sector to fraudulent practices but also obstructs and, in some cases, entirely prevents the recognition of qualifications by third-party institutions. Addressing these challenges requires a concerted effort to modernize recognition procedures, enhance digital infrastructures, and establish globally interoperable systems that facilitate the secure and transparent validation of academic credentials.

b. Context of Reference

The commitment to advancing the automatic recognition of academic qualifications and study periods within the European Higher Education Area (EHEA)[7] has been explicitly reaffirmed by the Ministers for Higher Education of the 49 EHEA member states. In the *Rome Communiqué* adopted during the 2020 Ministerial Conference, Ministers explicitly committed themselves to ensuring automatic recognition in order to facilitate the free movement of students, teachers and graduates for study, teaching and research purposes. The *communiqué* also emphasized the importance of developing secure and interoperable digital systems for credential exchange and verification, including the exploration of blockchain-based technologies[8]. These developments reflect the progressive institutionalization of digital credential ecosystems within the European Higher Education Area, where technological infrastructures are increasingly considered essential components of mobility governance, transparency and trust-building mechanisms.

The Committee of Ministers reaffirmed its commitment to an inclusive, innovative and connected EHEA by 2030 in Tirana in May 2024. Ministers also addressed contemporary challenges such as the ethical use of artificial intelligence (AI) in education. They committed to promoting digital literacy among students and staff, while supporting AI practices that prioritize transparency, fairness and human-centered approaches. They highlighted the importance of micro-credentials and lifelong learning as tools to adapt to the rapidly changing demands of the labor market and society[9].

A similar endorsement of digital solutions had already been articulated in the *Recommendation of the Council of the European Union of 26 November 2018 on promoting the mutual and automatic*

[7] European Higher Education Area (EHEA), *European Higher Education Area*. Available at: https://ehea.info/ [last accessed 7 May 2026].
[8] EHEA, Rome Communiqué, 19 November 2020, https://ehea.info/Upload/Rome_Ministerial_Communique.pdf [last accessed: 6 May 2026].
[9] EHEA, *Tirana Ministerial Communiqué*, 29-30 May 2024, https://ehea.info/page-Ministerial-Conference-Tirana-2024 [last accessed: 6 May 2026].

recognition of higher education and upper secondary education and training qualifications and of the outcomes of study periods abroad. In this document, the Council welcomed the European Commission's commitment to "explore the potential of new technologies, such as blockchain technology, to facilitate automatic recognition"[10].This reflects an increasing recognition at the policy level of the transformative role that digital tools can play in streamlining and securing qualification recognition processes.

Beyond the European context, international policy frameworks have similarly emphasized the imperative of technological integration in higher education. The *UNESCO Global Convention on the Recognition of Qualifications in the Field of Higher Education* explicitly acknowledges the need for signatory countries to "adopt all measures to eradicate all forms of fraudulent practices concerning qualifications in the field of higher education," advocating for the use of advanced technologies and the establishment of collaborative networks between participating states[11]. The recognition of digitalization as a key tool in credential evaluation aligns with broader global educational strategies, such as those outlined in the *United Nations 2030 Agenda*, which identifies digital infrastructure as a fundamental enabler of equitable access to quality education[12] The absence – or insufficient deployment – of digital solutions in large regions of the world has, in practice, hindered, restricted, and, in some cases, entirely precluded the realization of the right to education. What was once perceived as a merely instrumental mechanism for process simplification is increasingly recognized as an essential and multifaceted solution addressing a wide spectrum of challenges, including the facilitation of academic and professional mobility, the verifiability and immutability of credentials, the assurance of fair and transparent recognition processes, and the removal of barriers to educational access.

At the national level, Italy has responded to these international imperatives by incorporating digitalization strategies into its higher education policies. The *Strategy for the Internationalization of the Italian Higher Education system*[13] (2024-2026), jointly adopted by the *Ministry for Universities and Research and the Ministry of Foreign Affairs, and the Procedures for Entry, Residence and Enrollment of International Students and the Related Recognition of Qualifications for Higher Education Courses in Italy (Academic Year 2024-2025)*, have been designed to meet international commitments while also serving the national objective of attracting highly qualified international students[14]. Developed through a coordinated effort involving the Ministry for Universities and Research (MUR), the Ministry of the Interior (MINT) and the Ministry of Foreign Affairs and International Cooperation (MAECI), the

[10] Council of the European Union, *Council Recommendation of 26 November 2018 on promoting automatic mutual recognition of higher education and upper secondary education and training qualifications and the outcomes of study periods abroad,* 2018. Available at: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=oj:JOC_2018_444_R_0001 [last accessed 6 May 2026].
[11] UNESCO, *Global Convention on the Recognition of Qualifications concerning Higher Education*, Paris, 2019. Available at: https://www.unesco.org/en/legal-affairs/global-convention-recognition-qualifications-concerning-higher-education?hub=70286 [last accessed 6 May 2026].
[12] UNESCO, *Education 2030: Incheon Declaration and Framework for Action. Towards inclusive and equitable quality education and lifelong learning for all*, 2015. Available at: https://unesdoc.unesco.org/ark:/48223/pf0000245656 [last accessed 6 May 2026].
[13] Ministry of University and Research, *Strategy for the Internationalisation of Higher Education, Research and Innovation 2024-2026*, 2024, https://www.mur.gov.it/sites/default/files/2024-10/Strategia%20internazionalizzazione%20MUR%202024-2026%20%5BENG%5D.pdf [last accessed 6 May 2026].
[14] Ibid.

Procedures have introduced a preliminary digital platform aimed at streamlining access to Italian higher education institutions for international students requiring study visas. Within this framework, the *Universitaly* portal represents one of the first fully digitalized national systems for managing visa applications and university enrolment procedures, contributing to the standardization and integration of processes related to international student mobility.

Moreover, Italian national policies increasingly encourage the adoption of blockchain technologies for the verification and comparability of foreign qualifications. In this context, CIMEA – as the Italian ENIC-NARIC centre – pioneered the implementation of blockchain-based credential verification systems through the development of the DiploMe ecosystem in 2019. DiploMe may therefore be interpreted not merely as a technological platform, but as an institutional governance model aimed at restructuring recognition workflows through secure, interoperable and user-centred digital infrastructures. By leveraging blockchain technologies and digitally verifiable credentials, the platform contributes to enhancing transparency, portability, authenticity and fraud prevention within qualification recognition procedures. The integration of digital technologies in the recognition of academic credentials reflects a paradigm shift in higher education governance, reinforcing the imperative for institutions and regulatory bodies to adapt to evolving technological landscapes. The convergence of international policy directives, national implementation frameworks and technological advances underscores the growing consensus on the necessity of digital transformation in credential evaluation – both as a means of facilitating mobility and as a safeguard against fraudulent practices.

This research was also guided by the broader objective of developing an organizational and governance framework capable of standardizing, restructuring and innovating administrative procedures related to the attraction, admission and retention of international students. The proposed model seeks to reconcile the needs and strategic priorities of key governmental stakeholders – namely, the Ministry for Universities and Research (MUR), the Ministry of Foreign Affairs and International Cooperation (MAECI) and the Ministry of the Interior (MINT) – with national policies concerning migration, security and the internationalization of higher education. Simultaneously, it aimed to generate a tangible impact on the primary actors within the educational system – students and researchers – by addressing the broader social, economic and environmental dimensions of international student mobility.

One of the critical challenges faced by national education systems in the context of internationalization policies is striking a balance between increasing the influx of international students and ensuring that those admitted are genuinely committed to completing their academic programs. The phenomenon of *university dropout* among international students represents a significant failure of the system, leading to inefficiencies, missed opportunities for long-term academic and professional contributions and considerable socio-economic repercussions. To enhance the capacity to attract and retain international students, it is imperative to simplify and optimize administrative and procedural frameworks, particularly in relation to the evaluation methodologies for academic qualifications, the

documentation requirements for enrollment and the regulatory frameworks governing student entry and mobility policies.

The increasing complexity and scale of international student mobility necessitate the adoption of new organizational models, underpinned by digital transformation strategies. According to UNESCO data, the global population of mobile students expanded from 1.8 million in 2000 to over 7.0 million in 2020, with projections indicating that this figure will reach approximately 14.0 million by 2025[15]. Despite the temporary disruptions caused by the COVID-19 pandemic, demand for international education has remained robust, with mobility patterns increasingly extending beyond European borders. The ability of higher education institutions to remain competitive in this evolving landscape will largely depend on their capacity to develop effective policies for attracting and integrating international students, particularly from non-European regions.

At the systemic level, the European Union's strategic initiatives for the establishment of the *European Education Area (EEA) by 2025*[16] play a crucial role in shaping the future of higher education and credential recognition. Key developments within this framework include the introduction of *micro-credentials* and their formal recognition[17], the further implementation of the *European Qualifications Framework*[18] and the expansion of the *European University Initiative*[19], all of which are designed to create an integrated educational space capable of fostering academic excellence and serving as a catalyst for economic growth at the national and regional levels.

Following these broader frameworks and policy developments, the present study provides an in-depth analysis of the digital transformation process undertaken by CIMEA, examining the conceptualization, development and implementation of the DiploMe infrastructure. Particular attention is devoted to organizational architecture, service design, data protection and the holistic user-centred approach that guided the re-engineering of workflows and institutional interactions. The analysis also considers the perspectives and roles of the various stakeholders involved in recognition procedures, including international students, credential evaluators, Italian higher education institutions and national and international institutional actors engaged in qualification recognition processes.

[15] UNESCO Institute for Statistics (UIS), *UIS.Stat Database*, 2025. Available at: https://uis.unesco.org/ [last accessed 6 May 2026].
[16] European Commission, *The European Education Area explained*, s.a., https://education.ec.europa.eu/about-eea/the-eea-explained [last accessed 6 May 2026].
[17] Council of the European Union, *Council Recommendation of 16 June 2022 on a European approach to micro-credentials for lifelong learning and employability*, 2022, https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32022H0627%2802%29 [last accessed 6 May 2026].
[18] European Commission, *European Qualifications Framework (EQF)*, s.a., https://europass.europa.eu/en/europass-digital-tools/european-qualifications-framework [last accessed 6 May 2026].
[19] European Commission, *European Universities initiative*, s.a., https://education.ec.europa.eu/education-levels/higher-education/european-universities-initiative [last accessed 6 May 2026].

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CHAPTER 3

Conceptual Foundations: Change Management and Digital Transformation

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3.1. Digital Transformation in Modern Organizations

Digital transformation[20] a profound organisational and strategic shift affecting institutions and enterprises worldwide, driven by the convergence of advanced technologies such as Cloud Computing, Big Data, the Internet of Things (IoT) and Artificial Intelligence (AI). Far beyond the mere adoption of new technological tools or the modernisation of IT infrastructures, digital transformation entails the systemic integration of digital technologies into organisational structures, operational processes and decision-making mechanisms, fundamentally reshaping how institutions create value, deliver services and interact with stakeholders[21]. As digital technologies increasingly permeate economic, administrative and social systems, digital transformation has evolved from a predominantly technical objective into a strategic and governance-related imperative capable of redefining organisational models, institutional cultures and patterns of interaction. In this context, technological innovation not only enhances operational efficiency and organisational agility, but also contributes to the reconfiguration of institutional ecosystems, enabling new forms of connectivity, data management and service provision[22].

[20] Although digitization, digitalization, and digital transformation are closely related concepts, it is important to distinguish between them for the purposes of this chapter: Digital transformation in turn can be defined as the integration of digital technology into all aspects and operations of an organization, which in turn leads to infrastructural changes in how the organization is operated and delivers value to its customers. Vial, G., "Understanding digital transformation: a review and a research agenda", The Journal of Strategic Information Systems, 28, n. 2, 2019, pp. 118-144. McGrath, R., and McManus, R., "Digital transformation: learning your way to a new business model", Harvard Business Review, 98(3), 2020, pp. 125-133. Digitalization refers to the changes that business operations, business functions, and business models undergo by leveraging digital technologies. Digitalization thus implies a broader use and context of digitized data, which are contextualized in the specific organization. Through digitalization, digitized data can be turned into intelligence and actionable knowledge. Brennen, J. S., Kreiss, D., "Digitalization", in Jensen, K. B. et al. (a cura di), The International Encyclopedia of Communication Theory and Philosophy, Wiley, 2016. Digitization means creating digital (bits and bytes) versions of analog/physical things such as paper documents, microfilm images, photographs, sounds, and more. It often becomes a synonym of automation: use digital data, extracted from physical carriers, to automate business processes and workflows. It is impossible to digitize a whole process, but it is advantageous to automate the process by digitizing information. Digitization and digitalization are strongly correlated, yet they are very different things and the one does not necessarily imply the other. This is even more true concerning digital transformation. Through digital transformation, entire business models can be reshaped or replaced. Giving this overarching scope, it is essential that DT strategies are aligned with other strategies, both at the company and the business levels.

[21] McKinsey Global Institute, *Jobs lost, jobs gained: What the future of work will mean for jobs, skills, and wages*, 2017. Available at: https://www.mckinsey.com/featured-insights/future-of-work/jobs-lost-jobs-gained-what-the-future-of-work-will-mean-for-jobs-skills-and-wages [last accessed 6 May 2026].

[22] Siebel, T. M., *Digital transformation: survive and thrive in an era of mass extinction*, Rosetta Books, 2019.

Digital transformation offers organisations significant opportunities, including the development of more efficient and user-centred services, the acceleration of innovation processes and the strengthening of organisational adaptability within rapidly changing environments. Moreover, digitally enabled infrastructures facilitate the creation of interconnected ecosystems capable of fostering collaboration across sectors and institutions, while simultaneously expanding possibilities for value creation, data interoperability and knowledge exchange[23].

3.1.1 Digital Transformation in Credential Evaluation

The digital transformation of credential evaluation processes has become essential in a globalized world where the need for efficient, secure, and accurate recognition of foreign qualifications continues to grow[24]. Over the past few years, fully digitalized workflows have seen significant growth and adoption, driven in part by the urgent need for remote solutions during the COVID-19 pandemic[25]. This transformation in the way academic qualifications are evaluated has helped improve the speed and quality of recognition decisions while reducing the administrative burdens traditionally associated with paper-based workflows. Moreover, it has allowed for the secure and verifiable exchange of academic qualifications across borders, contributing to more harmonized and standardized recognition practices globally[26]. Digitalization has enabled the creation of a one-stop shop for recognition services, where applicants can submit their qualifications, track the progress of their applications, and receive recognition decisions, all within a single digital platform. This integration of services has greatly enhanced the user experience, making the recognition process more accessible and efficient. However, the process of digital transformation in education is complex, involving multiple stakeholders and systems that must progress in a coordinated manner. Ensuring that these components develop in harmony is a challenge, as discrepancies in progress or misaligned incentives among stakeholders can undermine overall efforts. In addition, the rapid pace of technological innovation often exceeds the capacity of education policymakers and experts to effectively integrate these developments[27].

[23] Correani, A., De Massis, A., Frattini, F., Messeni Petruzzelli, A., and Natalicchio, A., "Implementing a digital strategy: learning from the experience of three digital transformation projects", *California Management Review*, 62(4), 2020, pp. 37–56. Available at: https://doi.org/10.1177/0008125620934864 [last accessed 6 May 2026].

[24] The number of students enrolled in higher education worldwide doubled between 2000 and 2019, rising from 100 million to 235 million by 2020, according to recent UNESCO statistics. Student mobility is also growing at its highest rate, with the number of internationally mobile students tripling in the same period, increasing from 2 million to 6 million. Over half of these 6 million students are studying outside their home regions. UNESCO, *Global Convention on the Recognition of Qualifications concerning Higher Education*, UNESCO, 2019. UNESCO, *Higher Education Global Data Report: Working document*, UNESCO, May 2022. Available at: https://d7.right-to-education.org/sites/right-to-education.org/files/resource-attachments/UNESCO_Higher%20Education%20Global%20Data%20Report_Working%20document_May2022_EN_0.pdf [last accessed 6 May 2026].

[25] European Commission / EACEA / Eurydice, *The European Higher Education Area in 2024: Bologna Process Implementation Report*, Publications Office of the European Union, Luxembourg, 2024. Available at: https://eurydice.eacea.ec.europa.eu/sites/default/files/2024-05/Chapter_2_Key_commitments_Degree_structures_recognition_and_quality_assurance.pdf [last accessed 6 May 2026].

[26] Nuffic, Digitalisation of credential evaluation workflows: practical guidelines for the ENIC-NARIC Networks, 2023. Available at: https://www.nuffic.nl/sites/default/files/2023-09/digitalisation-of-credential-evaluation-workflows.pdf [last accessed 6 May 2026].

[27] UNESCO, *Six pillars for the digital transformation of education: a common framework*, edited by J. Normén-Smith, F. van Cappelle, E. Atis, and D. Ghobashy, ED-2024/WS/23, 2024. Available at: https://unesdoc.unesco.org/ark:/48223/pf0000391299 [last accessed 25 September 2024].

To address these complexities, specific standards and frameworks have been established within the European Higher Education Area (EHEA) to ensure consistency, equity, and quality in the recognition of academic qualifications. Implementing transparency tools across the European Union supports mutual recognition and prevents duplication of efforts, aligning practices with the shared quality assurance standards and criteria[28] To fully leverage the potential of new technologies, a shift is needed from fragmented, technology-first approaches to a comprehensive, human-centered framework that views digital transformation as part of a systemic evolution. As outlined in the UNESCO Framework, digital transformation requires collaboration across government departments, civil society, and private stakeholders. This collaborative effort, driven by education leaders, professionals, and relevant actors, should be guided by a shared vision for designing and implementing a sustainable and effective strategy, that includes digital infrastructure, regulation, social development, and finance. The transformation process should prioritize transparency, inclusiveness, and accountability, ensuring that all participants contribute to maintaining education as a common good, with clear roles and responsibilities in advancing educational transformation through the use of technology[29].

While the Lisbon Recognition Convention does not directly address "digitalization" or the implementation of electronic solutions, the Second Monitoring Report on the Implementation of the Lisbon Recognition Convention (LRC) acknowledges the growing significance of these technologies, which has enabled individuals and institutions to enhance the portability, transparency, and reliability of information, as well as the verification of authenticity[30]. These advancements have helped streamline the recognition process, making it faster and more efficient, while maintaining the fair, transparent, and accessible evaluation of qualifications in line with the principles and criteria of the LRC.

Furthermore, the Monitoring Report calls for the drafting of a new subsidiary text within the LRC framework to specifically address the integration of digital solutions. It recommends that the adoption of such solutions ensure the secure, reliable, and straightforward exchange of information and student data. To this end, systems should facilitate the trustworthy verification of both the authenticity of credentials and the identity of the holder, adhering to international standards such as self-sovereign identity. The integration of digital solutions in qualification recognition processes still faces significant challenges, particularly in building IT infrastructures that are adaptable and resilient to the evolving demands of the field. Organizations are at different stages of digital maturity: some rely predominantly on paper-based processes, while others employ hybrid models, blending digital and analogue elements,

[28] Council of the European Union, *Council Recommendation of 22 May 2017 on the European Qualifications Framework for lifelong learning and repealing the Recommendation of the European Parliament and of the Council of 23 April 2008 on the establishment of the European Qualifications Framework for lifelong learning*, 2017. Available at: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32017H0615(01) [last accessed 7 May 2026].
[29] UNESCO, *Six pillars for the digital transformation of education: a common framework*, edited by J. Normén-Smith, F. van Cappelle, E. Atis, and D. Ghobashy, ED-2024/WS/23, 2024. Available at: https://unesdoc.unesco.org/ark:/48223/pf0000391299 [last accessed 25 September 2024].
[30] UNESCO and Council of Europe, *Monitoring the implementation of the Lisbon Recognition Convention: monitoring report*, Paris/Strasbourg, 2022. Available at: https://unesdoc.unesco.org/ark:/48223/pf0000383465 [last accessed 9 December 2024].

such as paper submissions with digital case management systems. A smaller number of organizations have fully digitized the recognition lifecycle, though the degree of standardization, automation, and use of structured data varies. At the same time, many institutions are now investing heavily in advancing their digital transformation, aiming to enhance operational efficiency and improve service delivery[31].

Even with these advancements, digital transformation has only partially modernized many recognition processes, and its full potential is yet to be realized. To bridge this gap, institutions should foster a culture of continuous improvement, ensuring that digital solutions are effectively integrated with existing workflows and adaptable to future advancements. In order to achieve this, efforts should focus on extending these technologies to more remote regions and less developed areas, where infrastructure and connectivity limitations pose significant challenges. A more holistic and student-centered approach to recognition can enhance these efforts by considering the diverse educational backgrounds and experiences of applicants, while ensuring reliable verification processes that build trust and transparency.

3.1.2 Digitalisation and the Emergence of Digital Credentials

According to Gartner's conceptual distinction, digitisation concerns the conversion of analogue information into digital formats, while digitalisation refers to the broader integration of digital technologies into organisational and operational processes in order to optimise activities, generate value and support the transition toward digitally enabled institutional models[32]. In the context of credential recognition, digitalisation extends far beyond the simple conversion of paper-based documentation into electronic formats; rather, it entails the comprehensive reconfiguration of administrative workflows in order to enhance efficiency, reduce redundancies and strengthen institutional coordination. Through the implementation of digitally enabled verification systems, credential recognition centres have progressively transitioned from the management of physical documentation to integrated digital infrastructures capable of supporting automated records management, data interoperability and streamlined evaluation procedures. This transformation contributes not only to the reduction of administrative burdens and processing times, but also to the minimisation of human error and the improvement of procedural consistency and transparency.

Simultaneously, the emergence of digital credentials[33] – including electronic diplomas, transcripts

[31] Nuffic, *Digitalisation of credential evaluation workflows: practical guidelines for the ENIC-NARIC Networks*, 2023. Available at: https://www.nuffic.nl/sites/default/files/2023-09/digitalisation-of-credential-evaluation-workflows.pdf [last accessed 6 May 2026].
[32] Gartner, *Digitalization*. Available at: https://www.gartner.com/en/information-technology/glossary/digitalization [last accessed 7 May 2026].
[33] European Commission, *European Digital Credentials for Learning*, Commissione europea, s.d., Available at: https://europass.europa.eu/en/european-digital-credentials [last accessed 2 May 2026]. European Digital Credentials describe a learning achievement. They can describe activities, assessments, and professional entitlements as well as qualifications. As a digital file, credentials can include a wide range of valuable information that can help the recognition and understanding of the credential by employers and other institutions.

and certificates – has introduced new technological solutions capable of enhancing security, authenticity verification and international portability. Digital credentials may incorporate metadata, encrypted identifiers and verifiable authentication mechanisms that significantly reduce the risk of forgery while reinforcing trust within international recognition systems. Furthermore, the adoption of interoperable and standardised digital formats facilitates more transparent and efficient verification procedures across institutions and national systems. At the same time, it is essential to distinguish between automatic recognition[34] and automatized recognition processes. Automatic recognition refers primarily to policy and regulatory frameworks enabling qualifications to be recognised without requiring extensive individual assessment procedures, whereas automatized recognition concerns the use of technological tools and digitally enabled workflows to support or partially automate evaluation processes. Consequently, automatic recognition may exist independently of digitalisation and automation processes. Nevertheless, the digitalisation of recognition systems can significantly facilitate the implementation of automatic recognition by improving interoperability, enhancing security mechanisms and enabling the development of personalised and verifiable digital recognition statements linked directly to qualification holders[35].

[34] European Commission, *Proposal for a Council Recommendation on promoting automatic mutual recognition of higher education and upper secondary education and training qualifications,* European Commission, 2018. The Council Recommendation on Automatic Mutual Recognition defines automatic recognition of qualifications as the right for holders of a qualification of a certain level issued by a Member State and giving access to higher education in the home country to be considered eligible for access to a higher education program or entry to the next level in any other Member State without having to go through any separate recognition procedure (e.g., general access to higher education = general access to higher education; Bachelor = Bachelor; Master = Master), and without the intervention of a credential evaluator because the level, quality, and workload of a qualification are automatically accepted.
[35] The Ad Hoc Group on Digitalisation in Recognition, *Digitalisation in recognition*, Nordic Council of Ministers, 2020. Available at: https://norric.org/wp-content/uploads/NCM-Report-on-Digitalization-in-Recognition.pdf [last accessed 4 December 2020].

3.2. Change Management in the Context of Digital Transformation

Digital transformation in credential recognition should not be understood merely as a technological upgrade, but rather as a comprehensive process of organisational, procedural and cultural reconfiguration. Institutions operating in the field of qualification recognition – such as CIMEA – face the dual challenge of introducing innovative digital systems while simultaneously ensuring that credential evaluators, administrative personnel and institutional stakeholders are capable of effectively adapting to, integrating and sustaining these transformations over time. Addressing this challenge requires situating digital innovation within two closely interconnected dimensions: change management and knowledge management.

In contemporary organisational environments characterised by technological acceleration, regulatory evolution and increasingly complex operational demands, change management has emerged as a critical institutional capability. Organisations are continuously required to adapt to technological innovation, evolving stakeholder expectations, market transformations and new models of governance and service provision. Within this framework, organisational change refers to the intentional transformation of core institutional components, including organisational culture, technological infrastructures, governance structures and internal operational processes[36].

[36] Stobierski, T., "Organizational change management: what it is and why it is important", *Harvard Business School Online*, 21 January 2020. Available at: https://online.hbs.edu/blog/post/organizational-change-management [last accessed 7 May 2026].

Within the academic literature, change management is frequently conceptualised as the methodological and analytical lens through which digital transformation processes may be interpreted, implemented and evaluated. From this perspective, change management may be understood as a structured and systemic approach aimed at guiding organisational transformation toward successful implementation and long-term sustainability. Such processes generally involve three interrelated phases: preparation, implementation, and follow-through[37]. Simultaneously, change management concerns the broader renewal of organisational direction, institutional structures and operational capabilities in response to evolving internal and external pressures. It therefore encompasses not only organisational procedures and managerial strategies, but also the mechanisms and tools necessary to support individuals throughout periods of institutional transition and adaptation[38]. Change management aims to ensure that people, processes, and systems are well-prepared and aligned with the objectives of the change initiative, whether it involves technological advancements, process improvements, organizational restructuring, or any other transformational efforts. Effective change management is paramount for any organization that wishes to stay competitive in a constantly shifting environment. Without a structured approach, changes can lead to disruption, lowered employee morale, and increased resistance, resulting in significant financial and time losses[39].

A successful change management initiative requires the integration of individual and organizational change management, since it depends on how successfully people implement the change. Following the ADKAR model – where the acronym represents Awareness of the need for change, Desire to support the change, Knowledge of how to change, Ability to implement the required skills and behaviours, and Reinforcement to sustain the change – success is achieved only when every impacted employee is fully aware of the necessity and urgency of the change, motivated to adopt it, and equipped with the skills and practical knowledge needed to perform effectively in the post-change environment[40]. Furthermore, higher levels of employee participation and organisational engagement are generally associated with more effective outcomes, since active involvement contributes to fostering stronger senses of ownership, accountability and long-term commitment toward both the transformation process and its institutional objectives[41].

[37] Ibid.
[38] Bellantuono, N., Nuzzi, A., Pontrandolfo, P., and Scozzi, B., "Digital transformation models for the I4.0 transition: lessons from the change management literature", Sustainability, 13(23), 2021, 12941. Available at: https://doi.org/10.3390/su132312941 [last accessed 7 May 2026].
[39] Ibid.
[40] Ibid.
[41] Kotter, J. P., "Leading change: why transformation efforts fail", *Harvard Business Review*, March–April 1995, pp. 59–67.

3.2.1 Developing a Structured Change Management Model

a. The Role of Leadership and Team Empowerment

Effective change management requires a blend of top-down and bottom-up approaches, with leaders playing a critical role in fostering an environment where change is not only introduced but embraced throughout the organization. Leaders must empower their teams to actively participate in change initiatives: this involves generating awareness of the need for change and creating a sense of urgency around it. The needed empowerment of employees goes beyond delegation; it involves entrusting teams with responsibilities such as project storytelling, tracking accountability, and, crucially, overcoming obstacles.

b. Overcoming Skepticism and Resistance to Change.

One of the greatest challenges in organizational change is overcoming skepticism and resistance to change, which can undermine the process before it even begins[42].

Organizations should carry out activities to consolidate the change, namely, to make the digital change an integral part of the organization's culture; the definition of a new digital business model, as well as the digitalization of existing business processes and the definition of new digital processes, are activities suggested in implementing the digital change[43].

c. Participatory Design and User Involvement.

The change management process typically consists of three main phases: planning, implementation, follow-through. It is important to underline that change management does not end with implementation; follow-through is critical to ensuring that the changes become ingrained in the organizational culture. This phase includes training employees on new processes, continuously monitoring performance, and celebrating milestones. Consistent reinforcement of the change helps prevent regression and ensures that the organization reaps long-term benefits.

In addition to specific change initiatives, fostering a change-ready culture is essential for long-term adaptability. Organizations that are agile and resilient in the face of change have a competitive advantage in today's fast-paced business environment[44]. Building such a culture involves fostering an environment of continuous learning and development, where employees are encouraged to prioritize ongoing skill acquisition and improvement. By providing access to training, resources, and growth opportunities, organizations empower their workforce to adapt more seamlessly to new roles,

[42] Bellantuono, N., Nuzzi, A., Pontrandolfo, P., and Scozzi, B., "Digital transformation models for the I4.0 transition: lessons from the change management literature", *Sustainability*, 13(23), 2021, 12941. Available at: https://doi.org/10.3390/su132312941 [last accessed 7 May 2026].
[43] Ibid.
[44] Aghina, W., Handscomb, C., Salo, O., and Thaker, S., "The impact of agility: how to shape your organization to compete", *McKinsey & Company*, 25 May 2021. Available at: https://www.mckinsey.com/capabilities/people-and-organizational-performance/our-insights/the-impact-of-agility-how-to-shape-your-organization-to-compete [last accessed 7 May 2026].

technologies, or processes[45]. Such a culture of transparency reduces resistance to change and fosters a stronger sense of ownership over organizational transformation, thereby enhancing collective buy-in and commitment.

d. Building Capacity for Future Change: Human-Centric Transformation

Change management should not rely solely on external consultants or isolated initiatives. Instead, organizations must develop internal capabilities to manage future changes independently. This can be achieved by creating centers of excellence, communities of practice, and continuous learning and training opportunities for employees.

Effective change management necessitates the adoption of innovative mindsets and approaches that transcend traditional strategies, transforming change from a challenging obligation into a sustainable organizational strength[46]. Among the most impactful methodologies is the principle of co-creation[47]. By actively involving teams in the design and implementation of change initiatives – rather than positioning leaders as sole decision-makers – organizations can harness the creativity, commitment, and diverse perspectives of their employees. When individuals contribute to shaping the changes they will experience, their motivation and engagement increase significantly[48], while resilience to the feelings of loss and uncertainty that often accompany change is strengthened. Leaders who adopt a coaching role, rather than a directive approach, empower teams to overcome challenges and obstacles autonomously, fostering a more effective and self-sustaining change process.

e. Knowledge and Agility in Digital Transformation

When strategically managed, digital transformation can significantly enhance an organization's capacity for continuous knowledge creation and institutional learning. In the Digital Age, the concepts of learning organizations and organizational learning have become increasingly critical to navigating change and fostering innovation[49]. In modern organizations, a key challenge lies in how individual knowledge is shared and managed at an organizational level. Organizational learning has been defined as «a change in the organization that occurs as the organization acquires experience»[50]. Organizational knowledge develops through the dynamic interplay between tacit knowledge, which is personal and context-bound, and explicit knowledge, which is codified and easily shared: this interaction fosters the

[45] Durth, S., Hancock, B., Macon, L., and van der Boor, P., *The State of Organizations 2023: ten shifts transforming organizations*, McKinsey & Company, 2023. Available at: https://www.mckinsey.com/capabilities/people-and-organizational-performance/our-insights/the-state-of-organizations-2023 [last accessed 7 May 2026].
[46] Rinne, A., "Change management requires a change mindset", *Harvard Business Review*, 22 May 2023. Available at: https://hbr.org/2023/05/change-management-requires-a-change-mindset [last accessed 7 May 2026].
[47] Tams, C., "The co-creation imperative: how to make organizational change collaborative", *Forbes*, 11 February 2018. Available at: https://www.forbes.com/sites/carstentams/2018/02/11/the-co-creation-imperative-how-to-make-organizational-change-collaborative/ [last accessed 7 May 2026].
[48] Carucci, R., "Design your organization to match your strategy", *Harvard Business Review*, 6 June 2022. Available at: https://hbr.org/2022/06/design-your-organization-to-match-your-strategy [last accessed 7 May 2026].
[49] Marchegiani, L., *Digital Transformation and Knowledge Management*, Routledge, 2021, p. 112.
[50] IBID. Argote, L., and Miron-Spektor, E., "Organizational learning: from experience to knowledge", *Organization Science*, 22/5

continuous creation, sharing, and application of insights. By effectively managing these processes, organizations can build adaptive systems that drive innovation and resilience in the complexities of the Digital Age[51].

By creating environments where teams can collaboratively experiment with new approaches, organizations enable natural, experiential learning, which strengthens both commitment and confidence in the new direction. Furthermore, fostering an organizational learning culture has been shown to significantly enhance the relationship between team building and employee empowerment, ultimately improving employee competencies. This interplay underscores the importance of embedding learning opportunities within change management frameworks in order to ensure that both individual and organizational capabilities evolve in tandem to support sustained success.

In credential recognition, evaluators hold significant tacit knowledge – context-specific expertise accumulated over years of practice – that needs to be systematically captured and codified. Instruments such as Wikis, structured repositories, and databases facilitate this process, ensuring organizational learning and consistency across evaluators. Consequently, structured change management in credential recognition should not be understood merely as a technological transition, but as a long-term organizational learning process requiring leadership, participation, knowledge-sharing, and institutional adaptability.

3.2.2 Human-Centric Approach to Digital Transformation

A human-centric approach to digital transformation emphasizes the need to place people, rather than technology, at the center of the process. In this context, adopting a participatory approach to digital transformation is critical as it enables all actors affected by or involved in the transition to actively contribute to both the definition and implementation of change. Within this participatory framework, stakeholders are actively involved throughout all phases of digital transformation, from the development of a digital vision and strategy to the redesign of organizational and business processes.

Education and training play a central role in this participatory framework. Successful digital transformation requires equipping individuals not only with technical skills – such as digital literacy, artificial intelligence, data analytics, and cybersecurity – but also with transversal competencies. These include creative problem-solving, entrepreneurial capabilities, teamwork, effective communication, and the ability to manage complexity. Such skills are essential for fostering adaptability and resilience

[51] Marchegiani, L., *Digital Transformation and Knowledge Management*, Routledge, 2021, p. 112.
[52] European Commission, *Digital Education Action Plan 2021–2027: resetting education and training for the digital age*, 2021. Available at: https://education.ec.europa.eu/focus-topics/digital-education/action-plan [last accessed 7 May 2026].

in navigating the multifaceted challenges of digital transformation[53]. A human-centric approach therefore ensures that digital transformation is not limited to technological modernization, but evolves into a sustainable organizational process grounded in participation, inclusion, and continuous capacity-building.

THE ROLE OF LEADERSHIP	HUMAN-CENTRICITY AND CO-CREATION	ORGANIZATIONAL LEARNING	DIGITAL MATURITY
• Leadership is defined by its capacity to model adaptability and create enabling environments. • Resistance is not an indication of failure, but rather a natural response to an environment that is not concucive to change. • Effective communication and early success are key factors in fostering trust. • Emplowered teams have the capacity to become co-creators of change. • Institutional culture exerts a significant influence on the sustainability of transformation.	• Successful change is guided by a clear vision supported by cross-functional teams, and refined through interative feedback. • Agile and participatory methodologies enhance responsiveness and inclusiveness in transformation processes. • Sustainability is achieved by strengthening internal capacity and fostering digital literacy across the organization. • Actively involving teams in the design and implementation of change initiatives unlocks creativity, commitment, and diverse perspectives. • When people helps shape the changes they will experience, their motivation and engagement increase significantly.	• Creating the Capacity to Learn and Adaptt in a Changing Lanscape. • Building institutional culture of continuous learning that empowers people and strengthens trust. Educations and training play a central role in this participatory framework. Successful digital transformation requires equipping individuals not only with technical skills-such as digital literacy, artificial intelligence, data analytics, and cybersecurity, but also with transversal competencies. These include creative problem-solving, entrepreneurial capabilities, teamwork, effective communication, and the ability to manage complexity. Such skills are essential for rostering adaptability and resilience in navigating the multifaceted challenges of digital trasnformation.	• Effective transformation begins with a clear assessment of organizational readliness. • Digital maturity encompasses not only infrastructure and skills, but also governance and organizational culture. Digital maturity-assessment models and tools can be adopted to understand the areas and processes in which the organization presents an advanced level of digital maturity, as wellas those presenting room for improvement. This assessment makes the organization aware of its own digital gaps and reveals needs and priorities of its digital transformations.

[53] Bellantuono, N., Nuzzi, A., Pontrandolfo, P., and Scozzi, B., "Digital transformation models for the I4.0 transition: lessons from the change management literature", Sustainability, 13(23), 2021, 12941. Available at: https://doi.org/10.3390/su132312941 [last accessed 7 May 2026].

Knowledge Management and Digital Transformation

Knowledge Management (refers to the sysetematic process of identifying, developing, and leveraging what an organization knows-or could know-in order to adapt, innovate, and remain competitive in a context of continuos change.

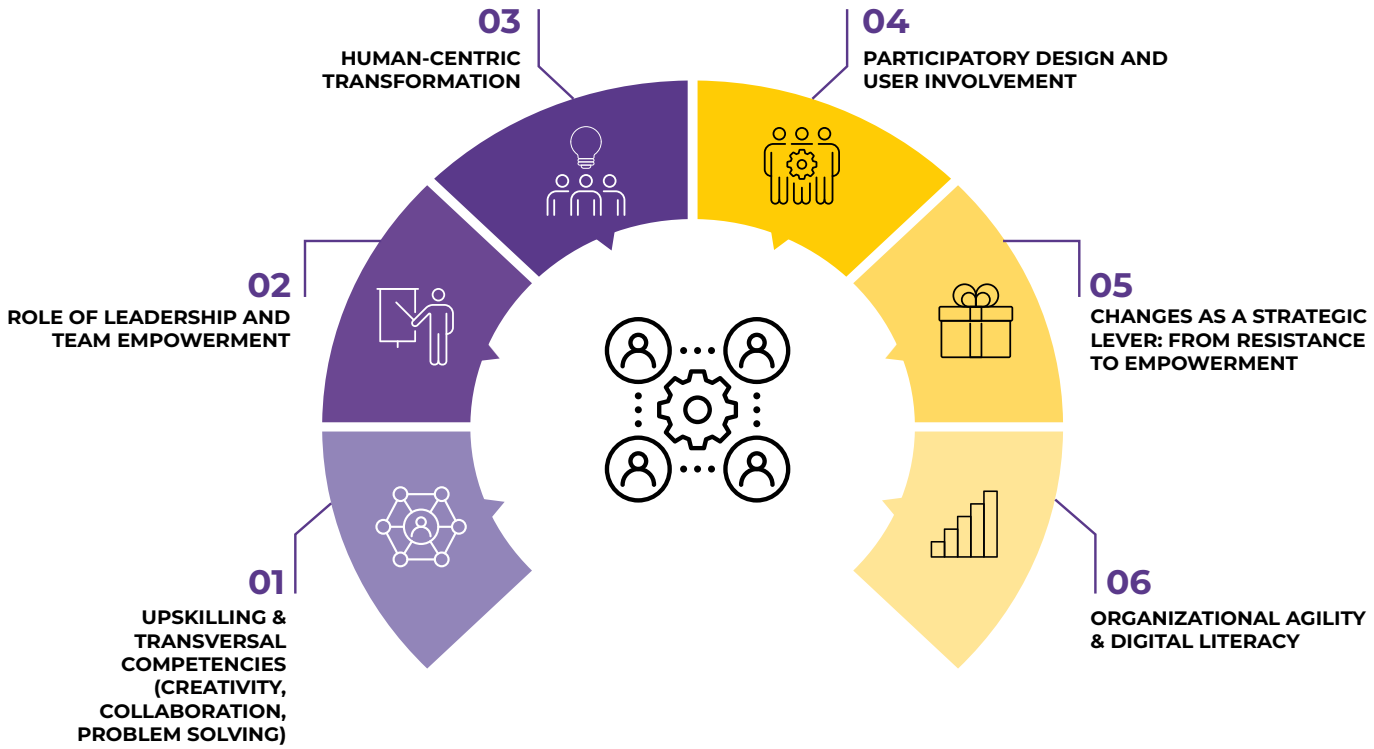
It integrates both **technological infrastructure and human creativity**, seeking a balance between information processing and the cognitive andrelational dynamics of people.

Knowledge Management concerns the critical issues of organizational adaption, survival, and competence in the face of growing and discontinuosus environmental change.

KM can be defined ad an element of coordination of the resources necessary **for the creation of added value**.

KM has highlighted **the importance of learning as a fundamental resource for the survival of organizations**.

Analytical Framework for a New Digital Culture: People, Processes and Purpose



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CHAPTER 4

Regulatory and Systemic Frameworks: Digitalization and AI in Qualification Recognition

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The rapid digital transformation of higher education and qualification recognition processes has brought about new regulatory challenges and opportunities, necessitating a structured legal and ethical framework to guide institutions, policymakers and credential evaluators. As digital solutions become integral to the assessment of foreign qualifications, the importance of a clear, internationally recognised regulatory framework has become increasingly critical.

4.1. Regulatory Frameworks Governing AI and Digitalisation

AI-powered technologies have been recognized for their potential to support a wide range of learners, including children, lifelong learners, and individuals with special needs. The use of data analytics can provide valuable insights into learning patterns, while adaptive tutoring systems and voice assistants may contribute to enhancing inclusivity in education[54]. Within the higher education sector, AI shows promise in streamlining qualification recognition, helping institutions assess credentials with improved efficiency and consistency. Additionally, AI-driven systems could enhance the verification of academic records, thereby facilitating global student mobility while preventing education fraud. Nevertheless, these technological advancements come with significant risks, necessitating careful regulatory oversight.

A primary concern is that AI could deepen existing inequalities and reinforce biases in education. Students from marginalized groups, including individuals with disabilities, minorities, and those from disadvantaged socioeconomic backgrounds, face a higher risk of being disproportionately affected. Without a well-defined regulatory framework, AI may perpetuate discriminatory practices or reinforce ineffective pedagogical approaches[55]. Moreover, using AI in qualification recognition raises questions

[54] Council of Europe, *Standing Conference of Ministers of Education: regulating artificial intelligence in education*, November 2023. Available at: https://rm.coe.int/regulating-artificial-intelligence-in-education-26th-session-council-o/1680ac9b7c [last accessed 6 May 2026].
[55] Council of Europe, *For a quality education free of fraud and corruption: a new recommendation of the Committee of Ministers*, 13 July 2022. Available at: https://www.coe.int/en/web/portal/-/for-a-quality-education-free-of-fraud-and-corruption-a-new-recommendation-adopted-by-the-committee-of-ministers [last accessed 6 May 2026].

regarding the accuracy and fairness of automated decision-making processes. Another critical issue is that AI systems could shift educational priorities away from essential humanistic values such as ethics, collaboration, and critical thinking, instead prioritizing easily quantifiable skills that machines are better equipped to assess. This transition might diminish educational quality, reduce the role of educators, and ultimately erode public confidence in AI-driven solutions[56].

Recognizing these risks, international organizations, including UNESCO, the Council of Europe, and the European Commission, have emphasized the need for a regulatory approach that safeguards human rights in AI applications for education. Recent legislative efforts in countries such as Australia, the United States, and various European nations stress the necessity of ensuring that AI in education remains transparent, accountable, and human-centered. UNESCO's Recommendation on the Ethics of Artificial Intelligence[57] and the European Commission's Ethics Guidelines for Trustworthy AI[58] provide structured frameworks for guiding the responsible implementation of AI in education. These policies are designed to uphold ethical standards, protect fundamental rights and ensure accountability. In the context of higher education, this includes guaranteeing that AI-based credential recognition remains transparent and does not replace the human oversight essential for evaluating complex cases.

Aligned with these regulatory initiatives, the *Tirana Communiqué*, signed in May 2024 by the ministers responsible for higher education in the European Higher Education Area[59], reinforces the commitment to ethical, trustworthy, and human-rights-centred AI implementation. The Communiqué underscores the necessity of assessing the broader and long-term impact of digital transformation, particularly AI, on key aspects such as Qualification Frameworks, the European Credit Transfer and Accumulation System (ECTS), and Quality Assurance. Building on the ethical groundwork established in the 2020 by the Rome Communiqué, where AI was first introduced in this context, the Tirana Communiqué further strengthens efforts to uphold ethical standards and human rights in the digital era[60].

Despite these advancements, a recent Council of Europe report on AI and education[61] identifies critical gaps in existing legal frameworks and underscores the need for dedicated legislation that could be able to agrees the unique and specific needs connected to Education, «*to fostering a nuanced and inclusive understanding of the multifaceted relationship between Artificial Intelligence (AI) and*

[56] Ibid.
[57] UNESCO, *Recommendation on the Ethics of Artificial Intelligence*, adopted on 23 November 2021. Available at: https://unesdoc.unesco.org/ark:/48223/pf0000380455.locale=en [last accessed 7 May 2026].
[58] European Commission, *Ethics Guidelines for Trustworthy AI, High-Level Expert Group on Artificial Intelligence*, 2019. Available at: https://ec.europa.eu/digital-strategy/en/ethics-guidelines-trustworthy-ai [last accessed 6 May 2026].
[59] EHEA, Tirana Ministerial Communiqué, 29-30 maggio 2024, https://ehea.info/page-Ministerial-Conference-Tirana-2024 [last accessed 6 May 2026].
[60] Ibid.
[61] *Artificial Intelligence and education - A critical view through the lens of human rights, democracy and the rule of law* (https://www.coe.int/en/web/education/all-resources?p_p_id=com_liferay_portal_search_web_search_results_portlet_SearchResultsPortlet_INSTANCE_RS8r1mqLF9Ht&p_p_lifecycle=0&p_p_state=maximized&p_p_mode=view&_com_liferay_portal_search_web_search_results_port) [last accessed 6 May 2026].

education, guided by the principles of human rights, democracy, and inclusivity»[62]. This concern is further validated by findings from a Council of Europe survey on AI and education across Europe, which highlights the urgent need for regulation in this domain[63].

As the debate on AI regulation in Education continues, in the Europan Union a major step was taken by approving the *EU Artificial Intelligence Act* (EU AI Act) in March 2024. This legislation establishes a comprehensive framework to ensure that AI technologies used across the European Union are transparent, secure, and respectful of fundamental rights[64]. In addition, in May 2024, the Council of Europe introduced the *Framework Convention on Artificial Intelligence*, the first legally binding international treaty aimed at ensuring AI systems comply with human rights, democratic principles, and the rule of law[65]. Open to non-European countries as well, this treaty establishes a legal structure that governs AI throughout its entire lifecycle, balancing the mitigation of risks with the encouragement of responsible innovation.

Beyond these regional European initiatives, the conversation surrounding AI's potential role in advancing societal objectives has gained significant momentum on a global scale. In March 2024, the United Nations General Assembly passed a resolution[66] acknowledging AI's ability to accelerate progress toward the Sustainable Development Goals (SDGs). This resolution highlights AI's role in promoting digital skills, capacity-building efforts, technological innovation, and equitable access to AI's benefits. It also stresses the importance of developing secure and reliable AI systems that drive digital transformation while ensuring fair access to technological advancements, an essential component of achieving all 17 SDGs across economic, social, and environmental dimensions. This marks the first time the General Assembly has addressed AI governance at such a scale, demonstrating the growing global recognition of the need for robust regulatory structures. The resolution calls on Member States and encourages collaboration among various stakeholders, including the private sector, civil society, academic institutions, research organizations, international agencies, and technical communities, to establish and promote governance frameworks that guarantee AI systems are safe, secure, and trustworthy.

As AI technologies, particularly generative AI tools like ChatGPT, become more widely adopted, the urgency for regulatory oversight intensifies. These innovations raise ethical concerns regarding their role

[62] Council of Europe, *Artificial Intelligence and Education*, disponibile sul sito ufficiale del Consiglio d'Europa: https://www.coe.int/en/web/education/artificial-intelligence [Last accessed: May 6, 2026].
[63] Council of Europe, *The state of artificial intelligence and education across Europe – Results of a survey of Council of Europe member states*, 2024. https://rm.coe.int/the-state-of-artificial-intelligence-and-education-accross-europe-the-/1680b29929 [Last accessed: May 6, 2026].
[64] European Commission, *Artificial Intelligence in Education*, 2024, https://rm.coe.int/the-state-of-artificial-intelligence-and-education-accross-europe-the-/1680b29929 [Last accessed: May 6, 2026].
[65] Council of Europe, *Framework Convention on Artificial Intelligence and Human Rights, Democracy and the Rule of Law*, Council of Europe Treaty Series, n. 225, 5 Settembre 2024. https://rm.coe.int/1680afae3c [Last accessed: May 6, 2026]
[66] United Nations, Integrated and coordinated implementation of and follow-up to the outcomes of the major United Nations conferences and summits..., 11 march 2024. https://documents.un.org/doc/undoc/ltd/n24/065/92/pdf/n2406592.pdf [Last accessed: May 6, 2026].

in education, highlighting the need for clear governance measures and for well-defined guidelines[67]. Additionally, generative AI systems have the potential to spread misinformation and disinformation, exacerbating challenges to maintaining public trust in education and society at large.

4.1.1 The AI Act and its Implication for Education

In response to the broader societal implications of AI technologies, the European Union has proposed the EU Artificial Intelligence Act, which came into force last August 2024. As is well established, the EU AI Act adopts a risk-based approach to ensure that AI systems used within the European Union are safe, transparent, traceable, non-discriminatory, and environmentally sustainable. AI systems are classified into four categories according to their potential societal impact: unacceptable risk, high risk, limited risk, and minimal risk. This tiered classification enables a nuanced regulatory framework, whereby stricter obligations are imposed on systems that pose greater risks. Much like the European Union's General Data Protection Regulation (GDPR), adopted in 2018, the EU AI Act may emerge as a global regulatory benchmark, shaping the extent to which AI generates positive rather than negative impacts across different contexts[68].

(i) Unacceptable risk

Under Article 5 of the EU AI Act, certain AI practices are explicitly prohibited, particularly those that intrude upon individuals' rights and freedoms. Specifically, the EU AI Act forbids the use of AI systems that infer emotional states from biometric data in sensitive contexts such as education, due to their intrusive nature and potential to lead to discriminatory outcomes. This prohibition is based on the idea that the power imbalance in educational and workplace settings could lead to the misuse of such systems, resulting in the adverse or discriminatory treatment of individuals or groups.

(ii) High-risk

High-risk AI systems in education, as defined by Article 6.2 and specifically established in Annex III, Section 3, are those that significantly affect individuals' fundamental rights, including the right to education and non-discrimination. These includes:

> **(a)** AI systems intended to be used to determine access or admission or to assign individuals to educational and vocational training institutions at all levels;
>
> **(b)** AI systems intended to evaluate learning outcomes, especially when those outcomes are used to guide the learning process of individuals in educational and vocational institutions at all levels;

[67] Eaton, S. E., *Artificial intelligence and academic integrity, post-plagiarism*, «University World News», 4 march 2023, https://www.universityworldnews.com/post.php?story=20230228133041549 [Last accessed: May 6, 2026].
[68] European Commission, *The EU Artificial Intelligence* Act, 2024. https://artificialintelligenceact.eu/ [Last accessed: May 6, 2026]

(c) AI systems intended to assess the appropriate level of education that an individual will receive or be able to access, within the context of education and vocational training institutions at all levels;

(d) AI systems intended to monitor and detect prohibited behaviours of students during exams within educational and vocational training institutions at all levels.

These systems are considered high-risk due to their capacity to shape individuals' educational and professional futures. Improper design or use of these systems can be highly intrusive and may perpetuate historical patterns of discrimination based on gender, age, disability or racial and ethnic origins, potentially violating the right to education and equal treatment.

(iii) Fundamental rights impact assessment (Article 27).

To mitigate the previously mentioned risks, the EU AI Act mandates that deployers of high-risk AI systems conduct a fundamental rights impact assessment before putting them into use. The aim of this assessment is for the deployer to identify the specific risks to the rights of individuals or groups of individuals likely to be affected, and to identify measures to be taken in the case of a materialization of those risks. The impact assessment should be performed prior to deploying the high-risk AI system and should be updated when the deployer considers that any of the relevant factors have changed.

(iv) AI Literacy (Article 4).

Furthermore, providers and deployers of AI systems shall take measures to ensure, to their best extent, a sufficient level of AI literacy of their staff and other persons dealing with the operation and use of AI systems on their behalf, taking into account their technical knowledge, experience, education, training and the context the AI systems are to be used in. Requirements (Articles 8-15). For high-risk AI systems, the EU AI Act imposes a series of mandatory requirements. These include the implementation of risk management systems, the use of high-quality training data, detailed documentation and record-keeping, transparency and provision of information to users, human oversight and ensuring robustness, accuracy, and cybersecurity.

Obligations. The AI Act introduces specific obligations for providers and users of high-risk AI systems. Providers must conduct conformity assessments, register systems in an EU database, keep documentation, cooperate with competent authorities and monitor post-market

4.1.2 Trustworthy and Human-Centered AI in Qualification Recognition

When implementing AI technologies in the educational sector, and particularly in processes related to qualification recognition and access to education, it is crucial to reconsider how these systems are designed, deployed, and monitored. CIMEA is actively investigating AI-based solutions to streamline internal workflows, enhance quality, transparency, ethics, efficiency and improve service delivery to further enhance the automatic recognition of qualification at national, international and global level. These technologies focus on key aspects such as case initiation, data-driven recommendations, fraud detection, and classification of academic qualifications, aiming to support rather than replace human judgment and human-decision making.

As previously discussed, the EU AI Act's fundamental objective is to promote trustworthy, human-centric AI while ensuring the protection of health, safety, and fundamental rights (Article 1)[69]. CIMEA's AI-driven solutions uphold these principles by optimizing administrative processes, increasing decision-making accuracy, and reducing bias and errors. This contributes to the safeguarding of fundamental rights, particularly the right to education, while also improving operational efficiency in qualification recognition.

Article 1: Subject Matter

> The purpose of this Regulation is to improve the functioning of the internal market and promote the uptake of human-centric and trustworthy artificial intelligence (AI), while ensuring a high level of protection of health, safety, fundamental rights enshrined in the Charter, including democracy, the rule of law and environmental protection, against the harmful effects of AI systems in the Union and supporting innovation.

As previously mentioned, CIMEA has consistently adopted a participatory approach – combining both bottom-up and top-down strategies – to the digital transformation process implemented from 2019 to the present day. This approach reflects an awareness of the importance of involving stakeholders from the earliest design phases and entrusting the leadership of the transformation process to those who possess the expertise that AI systems are intended to enhance, namely Credential Evaluators.

In line with Article 4 of the EU AI Act, CIMEA has also considered it essential to provide its staff with training in Digital and AI Literacy in order to address the growing need for upskilling and reskilling associated with digital transformation.

[69] European Parliament and Council of the European Union, *Regulation (EU) 2024/1689 of 13 June 2024 laying down harmonised rules on artificial intelligence and amending Regulations (Artificial Intelligence Act), Official Journal of the European Union*, L 2024/1689, 12 July 2024. Available at: https://eur-lex.europa.eu/eli/reg/2024/1689/oj/eng [last accessed 7 May 2026].

Article 4: AI literacy[70]

> Providers and deployers of AI systems shall take measures to ensure, to their best extent, a sufficient level of AI literacy of their staff and other persons dealing with the operation and use of AI systems on their behalf, taking into account their technical knowledge, experience, education and training and the context the AI systems are to be used in, and considering the persons or groups of persons on whom the AI systems are to be used.

CIMEA's AI initiatives are designed to exclude any prohibited applications[71] (Article 5: Prohibited AI Practices) and prioritize transparency and traceability throughout their lifecycle. For instance, AI-powered case allocation systems distribute workloads fairly, while fraud detection mechanisms enhance the credibility of the process without automating decisions that directly impact individuals. Human oversight remains integral to all AI-generated outputs, ensuring that technology supports, rather than dictates, decision-making. Despite their application in the education sector, CIMEA's AI tools do not fall under the high-risk classification stablished by the AI Act (Article 6). These systems assist in credential validation but do not determine admission or regulate access to educational institutions. As supportive tools for human evaluators, they do not directly affect individuals' rights, further reinforcing their compliance with the Act's regulatory framework.[72]

In terms of risk management, the EU AI ACT[73] explicitly states in Article 9 ("Risk Management System") that «the risk management system shall be understood as a continuous iterative process planned and run throughout the entire lifecycle of a high-risk AI system, requiring regular systematic review and updating». Consequently, strategic oversight, continuous monitoring and long-term planning remain fundamental priorities in the governance of AI systems. Similarly, data governance[74] as outlined in Article 10 ("Data and Data Governance"), constitutes a central requirement. Training, validation and testing datasets must comply with high standards of quality, accuracy and representativeness in order to minimise biases and ensure reliable and trustworthy outcomes, including in contexts involving non-high-risk AI applications. The EU AI Act also sets forth specific regulations regarding technical documentation[75] (Article 11), transparency in user information[76] (Article 13), and the requirement for human oversight[77] (Article 14). While CIMEA's AI tools do not undergo the rigorous scrutiny applied to high-risk systems, maintaining detailed documentation and ensuring that human operators can interpret AI-generated outputs remain critical for regulatory compliance and ethical accountability.

[70] European Parliament and Council of the European Union, *Regulation (EU) 2024/1689*, cit., Article 4.
[71] European Parliament and Council of the European Union, *Regulation (EU) 2024/1689*, cit., Article 5.
[72] Art. 9, 4, letter c): (c) provision of information required pursuant to Article 13 and, where appropriate, training to deployers. With a view to eliminating or reducing risks related to the use of the high-risk AI system, due consideration shall be given to the technical knowledge, experience, education, the training to be expected by the deployer, and the presumable context in which the system is intended to be used.
[73] European Parliament and Council of the European Union, *Regulation (EU) 2024/1689*, cit., Article 9.
[74] Ivi, Article 10.
[75] Ivi, 11.
[76] Ivi, Article 13.
[77] Ivi, Article 14.

Focus on Article 14: Human Oversight

Given the centrality of human oversight within AI governance frameworks, Article 14 of the EU AI Act provides detailed provisions regarding the role of human supervision in the deployment and operation of high-risk AI systems. The Article explicitly emphasizes the necessity of ensuring that AI systems remain subject to meaningful human control, interpretation, and intervention throughout their lifecycle. These principles are particularly relevant in the context of qualification recognition, where evaluative decisions require contextual interpretation, professional expertise, and the ability to critically assess AI-generated outputs.

Article 14: Human Oversight

1. High-risk AI systems shall be designed and developed in such a way, including with appropriate human-machine interface tools, that they can be effectively overseen by natural persons during the period in which they are in use.

2. Human oversight shall aim to prevent or minimise the risks to health, safety or fundamental rights that may emerge when a high-risk AI system is used in accordance with its intended purpose or under conditions of reasonably foreseeable misuse, in particular where such risks persist despite the application of other requirements set out in this Section.

3. The oversight measures shall be commensurate with the risks, level of autonomy and context of use of the high-risk AI system, and shall be ensured through either one or both of the following types of measures:

   (a) measures identified and built, when technically feasible, into the high-risk AI system by the provider before it is placed on the market or put into service;

   (b) measures identified by the provider before placing the high-risk AI system on the market or putting it into service and that are appropriate to be implemented by the deployer.

4. For the purpose of implementing paragraphs 1, 2 and 3, the high-risk AI system shall be provided to the deployer in such a way that natural persons to whom human oversight is assigned are enabled, as appropriate and proportionate:

   (a) to properly understand the relevant capacities and limitations of the high-risk AI system and be able to duly monitor its operation, including in view of detecting and addressing anomalies, dysfunctions and unexpected performance;

(b) to remain aware of the possible tendency of automatically relying or over-relying on the output produced by a high-risk AI system (automation bias), in particular for high-risk AI systems used to provide information or recommendations for decisions to be taken by natural persons;

(c) to correctly interpret the high-risk AI system's output, taking into account, for example, the interpretation tools and methods available;

(d) to decide, in any particular situation, not to use the high-risk AI system or to otherwise disregard, override or reverse the output of the high-risk AI system;

(e) to intervene in the operation of the high-risk AI system or interrupt the system through a 'stop' button or a similar procedure that allows the system to come to a halt in a safe state.

5. For high-risk AI systems referred to in point 1(a) of Annex III, the measures referred to in paragraph 3 of this Article shall be such as to ensure that, in addition, no action or decision is taken by the deployer on the basis of the identification resulting from the system unless that identification has been separately verified and confirmed by at least two natural persons with the necessary competence, training and authority. The requirement for a separate verification by at least two natural persons shall not apply to high-risk AI systems used for the purposes of law enforcement, migration, border control or asylum, where Union or national law considers the application of this requirement to be disproportionate.

These provisions are particularly significant for qualification recognition processes, where human evaluators must retain the ability to interpret AI-generated outputs critically, supervise automated processes, and intervene whenever necessary. In this regard, CIMEA's approach aligns with the principles established by the EU AI Act, emphasizing that AI systems should function as support mechanisms that enhance, rather than replace, human expertise and professional judgment.

Finally, ensuring robustness, accuracy, and cybersecurity constitutes a fundamental requirement of the AI Act[78] (Article 15). Accordingly, CIMEA promotes continuous monitoring and assessment mechanisms aimed at ensuring the secure, reliable, and transparent functioning of AI-supported processes, particularly with regard to data protection and system integrity.

[78] Ivi, Article 15.

4.1.3 The Council of Europe Framework Convention on Artificial Intelligence, Human Rights, Democracy and the Rule of Law

The Council of Europe's Committee on Artificial Intelligence (CAI) has developed a new Framework Convention focused on the development, design, and use of AI systems based on the Council's standards of human rights, democracy, and the rule of law[79]. This convention aims to complement existing international standards and address legal gaps resulting from rapid technological advances. It was drafted by the 46 member states of the Council of Europe, with participation from observer states such as Canada, Japan, Mexico, the Holy See, and the United States, as well as non-member states including Australia, Argentina, Costa Rica, Israel, Peru, and Uruguay. While both the AI Act[80] and the AI Treaty outline general obligations and principles, they are not specifically designed to address the unique needs and risks present in each public policy sector, especially when it comes to the risks involved in educational settings. This gap highlights the need for sector-specific considerations in the application of these frameworks to education.

The Treaty emphasizes that AI systems must uphold human rights, ensuring that they do not discriminate or undermine individuals' dignity. In educational settings, this means that AI technologies should be designed and implemented in ways that promote inclusive, equitable, and high-quality education. A key element of the Treaty is its focus on the ethical use of AI. It aims to address legal gaps left by existing national or regional legislation by establishing comprehensive international standards. The Treaty mandates that AI systems must be transparent, accountable, and aligned with broader democratic and human rights objectives. This includes ensuring that AI does not perpetuate inequality in access to education or compromise the integrity of educational institutions.

Covering the use of AI systems in both the public and private sectors – including companies acting on behalf of the public sector – the convention offers parties two ways of complying with its principles when regulating the private sector. Parties may opt to be directly obliged by the relevant convention provisions or adopt alternative measures to comply with the treaty's provisions while fully respecting their international obligations regarding human rights, democracy, and the rule of law.

The convention establishes transparency and oversight requirements tailored to specific contexts and risks, including identifying content generated by AI systems. Parties are required to adopt measures to identify, assess, prevent, and mitigate possible risks, and to assess the need for bans or other appropriate actions concerning uses of AI systems where their risks may be incompatible with human rights standards.

[79] Council of Europe, Framework Convention on *Artificial Intelligence, Human Rights, Democracy and the Rule of Law*, Consiglio d'Europa, 2024.
[80] European Union, *Regulation (EU) 2024/1689 laying down harmonised rules on artificial intelligence (Artificial Intelligence Act)*, Unione europea, 2024.

Oversight refers to various mechanisms designed to monitor, evaluate, and guide activities within the AI lifecycle. In the context of credential evaluation, such oversight mechanisms are essential to ensure that AI systems used in the evaluation process do not introduce errors, bias, or unjust outcomes that could negatively influence an individual's educational or career trajectory. Ensuring transparency depends on factors such as the type of AI system, its context of use, its role, and the background of relevant actors or affected stakeholders. Measures may include documenting data sources, training methodologies, validation processes, risk mitigation efforts, and decisions made during development. Transparency may also involve communicating essential information about the AI system – such as its purpose, limitations, underlying algorithms, training methods, and quality assurance practices – to help understand how outputs are generated and their impact on human rights, democracy, and the rule of law. This openness is often referred to as "algorithmic transparency".

The treaty highlights the critical importance of promoting digital literacy and skills across all segments of the population. Such programs are particularly beneficial for individuals from diverse backgrounds and those who may be underrepresented or in vulnerable situations, including women, girls, indigenous peoples, the elderly, and children. Training is also vital for those responsible for identifying, assessing, preventing, and mitigating risks posed by AI systems, such as judiciary members, national supervisory authorities, data protection agencies, equality and human rights bodies, consumer protection agencies, and AI providers and users. Given the protected interest in limiting access to an individual's life experiences and engagements, it is crucial that AI developers – including those with a public interest mission – ensure their innovations do not have harmful implications and incorporate appropriate safeguards to mitigate risks in a controlled environment.

Developers must ensure accountability and responsibility for adverse impacts, and that AI systems respect equality – including gender equality – the prohibition of discrimination, and privacy rights. Parties to the treaty must ensure the availability of legal remedies for victims of human rights violations related to the use of AI systems and procedural safeguards, including notifying individuals when they are interacting with AI systems.

Finally, the convention mandates that each party establish an independent oversight mechanism to oversee compliance with the treaty, raise awareness, stimulate informed public debate, and conduct multistakeholder consultations on how AI technology should be used.

4.1.4 AI and Qualification Recognition in Relation to the UNESCO Sustainable Development Goals (SDGs)

The Sustainable Development Goals (SDGs) established by the United Nations represent a comprehensive framework aimed at fostering a sustainable and equitable future for all. These goals are interconnected, addressing a wide range of global challenges, including poverty, inequality, climate change, environmental degradation, economic prosperity, peace, and justice[81]. In this context, the integration of innovative technological solutions presents a significant opportunity to enhance the processes involved in the recognition of academic qualifications. Beyond improving efficiency and optimizing resource management within organizations, such advancements directly contribute to the achievement of the SDGs.

The adoption of artificial intelligence (AI) and automation within qualification recognition procedures offers numerous advantages, particularly in increasing operational efficiency and reallocating human resources towards higher-value tasks. This strategic shift aligns closely with SDG 8, which advocates for sustained, inclusive, and sustainable economic growth, as well as the promotion of full and productive employment and decent work for all. By leveraging AI-driven solutions, CIMEA can reduce manual workloads, enhance the accuracy of recognition processes, and optimize resource allocation, thus improving overall institutional performance.

Current manual procedures necessitate the submission of certified copies or original documents, a time-intensive and resource-demanding requirement. The integration of AI technologies, particularly in document verification, holds the potential to expedite these processes significantly. By automating verification mechanisms, AI can minimize errors, improve accuracy, and streamline the evaluation of foreign qualifications, ultimately contributing to greater efficiency and accessibility.

A concrete example of AI's transformative potential within qualification recognition is the deployment of conversational agents to address frequently asked questions. At present, a significant portion of staff time – up to four hours daily – is allocated to handling routine inquiries. The implementation of AI-driven chatbots could reduce this burden to just one hour per day, thereby allowing personnel to focus on complex and strategic tasks. Such efficiency gains not only enhance organizational productivity but also contribute to improved working conditions by reducing stress and increasing job satisfaction. These improvements are directly aligned with SDG 8, which underscores the importance of fostering productive employment and decent working environments[82].

[81] United Nations, *Take Action for the Sustainable Development Goals*. Available at: https://www.un.org/sustainabledevelopment/sustainable-development-goals/ [last accessed 7 May 2026].
[82] Parisotto, A., *Decent work for all: parsing Goal 8 of the SDGs*, International Labour Organization, 2015. Available at: https://www.un.org/en/chronicle/article/goal-8-parsing-goal-8-decent-work-all [last accessed 7 May 2026].

Beyond efficiency gains, the digitalization of qualification recognition processes carries significant environmental benefits. The transition from paper-based documentation to digital solutions drastically reduces the need for physical storage and paper consumption. Consequently, organizations can repurpose spaces previously dedicated to archiving paper documents for more sustainable and efficient uses. This transition aligns with SDG 12, which promotes responsible consumption and production patterns by encouraging the efficient use of resources and waste reduction[83].

Furthermore, AI-driven anomaly detection and document authentication significantly enhance the accuracy and reliability of academic qualification assessments. These technological improvements contribute directly to SDG 4, which seeks to ensure inclusive, equitable, and quality education while promoting lifelong learning opportunities for all. By improving verification mechanisms, AI fosters greater transparency and fairness in the recognition of qualifications, ultimately supporting educational mobility and social inclusion. Additionally, continuous training programs for credential evaluators at CIMEA ensure that staff members are equipped with the necessary skills to adapt to emerging technological advancements, further reinforcing professional development within the organization.

Another key advantage of AI integration in qualification recognition is its ability to facilitate data-driven decision-making. By analyzing historical trends and identifying peak request periods, AI enables organizations to allocate resources more effectively, prioritize tasks, and anticipate demand fluctuations. This proactive approach minimizes resource wastage and enhances operational resilience, aligning with SDG 9, which emphasizes the role of information and communication technologies in sustainable development[84].

The automation of administrative tasks not only enhances efficiency but also contributes to a more sustainable work environment by reducing redundant workloads. This shift fosters improved job satisfaction and employee engagement, reinforcing a more balanced and sustainable organizational model. Moreover, by optimizing operational processes and reducing resource consumption, AI contributes to lowering an organization's carbon footprint, further aligning with SDG 12 and the broader sustainability objectives outlined in the United Nations 2030 Agenda[85]. To ensure that technological advancements align with sustainability objectives, organizations must implement robust monitoring and evaluation mechanisms. Establishing key performance indicators related to resource efficiency, waste reduction, and user satisfaction can provide valuable insights into the impact of digital transformation initiatives. Additionally, integrating user feedback mechanisms allows organizations to refine their processes continually and adapt to evolving needs. Such measures contribute to the

[83] United Nations, *Take Action for the Sustainable Development Goals*. Available at: https://www.un.org/sustainabledevelopment/sustainable-development-goals/ [last accessed 7 May 2026].
[84] Ibid.
[85] United Nations General Assembly, *Transforming our world: the 2030 Agenda for Sustainable Development*, Resolution adopted by the General Assembly on 25 September 2015, A/RES/70/1, 2015. Available at: https://sdgs.un.org/2030agenda [last accessed 7 May 2026].

ongoing improvement of recognition procedures while reinforcing sustainable development practices. While digital transformation represents a significant step toward sustainability, it is imperative to acknowledge and address potential ethical and environmental concerns associated with technological advancements. The implementation of AI in qualification recognition processes must be guided by principles of ethical responsibility, sustainability, and inclusivity. Despite AI's potential to enhance efficiency and promote responsible consumption, it also introduces new dependencies and challenges that require careful consideration. Consequently, organizations must adopt a balanced approach that prioritizes ethical considerations while leveraging AI's capabilities to support the broader objectives of the Sustainable Development Goals.

In conclusion, the integration of AI and digital solutions within qualification recognition processes offers a multifaceted opportunity to enhance efficiency, sustainability and inclusivity. By aligning technological innovations with the principles of the SDGs, organizations can contribute to economic, social and environmental sustainability while fostering a more equitable and accessible education system. Through ongoing evaluation and adaptation, institutions like CIMEA can continue to refine their practices, ensuring that digital transformation efforts remain aligned with the evolving landscape of global education and sustainable development.

4.2. Systemic Impacts of Digitalization and AI in Qualification Recognition

The digital transformation of credential recognition has established the technological and organizational foundations required for more efficient, transparent and user-centered processes. While digital systems enable workflow automation and secure data management, the integration of Artificial Intelligence (AI) introduces a qualitatively new set of possibilities.

Digital transformation provides the structural basis upon which AI can be meaningfully deployed. In the absence of redesigned processes, interoperable data, and effective change management the use of AI in qualification recognition cannot be sustainable or ethically sound. In this regard, AI does not substitute digitalization but rather extends its scope. Whereas digital transformation ensures efficiency and reliability in process and data management, AI contributes advanced capabilities for analysis, prediction and decision support, thereby enhancing the quality, agility and scalability of recognition services. By enabling automation, enhancing decision-making, and optimizing the overall efficiency of credential evaluation, AI complements digital systems, making it possible to handle complex recognition cases more effectively and at a larger scale.

Artificial Intelligence could support the LRC's principles by providing rapid, consistent initial assessments and maintaining comprehensive databases of qualifications and education systems, making information more accessible to applicants and evaluators[86]. AI can also contribute to ensuring that recognition is granted unless substantial differences are demonstrated,[87] helping to reduce biases and ensuring a standardized approach across different institutions and countries. Following the LRC's principles, AI should be developed and implemented following a human-centered approach, ensuring that both students and credential evaluators are at the core of its design and functionality, thus promoting a comprehensive and trustworthy assessment of qualifications.

4.2.1 Automation and Efficiency in Decision-Making Processes

The qualification recognition process is labor-intensive and involves multiple stages of document analysis, manual cross-checking, and validation. AI can address these challenges by streamlining the process, starting with the automation of document extraction and the initial analysis of key elements such as the awarding institution, program length, and qualification level[88]. Furthermore, AI can be programmed to compare qualifications against predefined criteria, identify inconsistencies, and enable credential evaluators to process a higher volume of requests without compromising quality. This allows human evaluators to dedicate their attention to more complex, high-value tasks[89].

AI systems can also be trained to recognize qualification elements and map them against standardized frameworks like the European Qualifications Framework[90] facilitating a more consistent comparison across different education systems. This enables AI to assess whether a qualification meets specific standards and flag anomalies for further human review, thereby reducing evaluators' workload and minimizing the risk of human error in repetitive tasks[91]. Equally important, leveraging emerging technologies such as blockchain for secure and transparent digital certification could strengthen the credibility and reliability of the qualification recognition process[92].

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[86] Council of Europe and UNESCO, *Convention on the Recognition of Qualifications concerning Higher Education in the European Region*, Lisbon, 11 April 1997, Articles III.3. Available at: https://rm.coe.int/168007f2c7 [last accessed May 6, 2026].
[87] Council of Europe and UNESCO, *Convention on the Recognition of Qualifications concerning Higher Education in the European Region*, Lisbon, 11 April 1997, Articles VI.1. Available at: https://rm.coe.int/168007f2c7 [last accessed May 6, 2026].
[88] Council of Europe, *Artificial intelligence and Education*, 12 December 2022.Retrieved from https://www.coe.int/en/web/education/-/new-isbn-publication-artificial-intelligence-and-education [last accessed May 6, 2026].
[89] Wang, T., Lund, B. D., Marengo, A., Pagano, A., Mannuru, N. R., Teel, Z. A., and Pange, J., "Exploring the potential impact of artificial intelligence (AI) on international students in higher education: generative AI, chatbots, analytics, and international student success", *Applied Sciences*, 13(11), 2023, 6716. Available at: https://doi.org/10.3390/app13116716 [last accessed 7 May 2026].
[90] Council of the European Union, Council Recommendation of 22 May 2017 on the European Qualifications Framework for lifelong learning and repealing the Recommendation of the European Parliament and of the Council of 23 April 2008 on the establishment of the European Qualifications Framework for lifelong learning, 2017. Available at: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32017H0615(01) [last accessed 7 May 2026].
[91] CIMEA, *Substantial differences: a glimpse of theory, practice and guidelines,* 2021. Available at: https://www.cimea.it/Upload/Documenti/7590_Brochure_substantial_differences.pdf [last accessed 6 May 2026].
[92] UNESCO and Council of Europe, *Monitoring the implementation of the Lisbon Recognition Convention: monitoring report*, Paris/Strasbourg, 2022. Available at: https://unesdoc.unesco.org/ark:/48223/pf0000383465 [last accessed 9 December 2024].

Building on these capabilities, the Lisbon Recognition Convention (LRC) emphasizes the need for timely processing of recognition requests,[93] an area where AI could significantly reduce processing times, helping institutions meet these standards and expectations. However, compliance with the LRC principles requires maintaining human oversight to preserve the right to appeal,[94] which AI systems could facilitate by flagging complex cases for human review.

The assessment of qualification comparability typically involves several stages[95] beginning with the identification of elements within submitted documents. AI tools can summarize these elements using pre-established models, allowing credential evaluators to detect problematic aspects that may require further examination. This is particularly effective for qualifications within the European Higher Education Area (EHEA), where transparency tools and common frameworks have been adopted[96]. However, applying AI to evaluate qualifications from non-EHEA countries, especially regarding elements like learning outcomes or academic rights, presents new challenges that warrant further exploration. The next stage involves checking for substantial differences between the qualification and its equivalent in the receiving education system. While some differences are well-documented with clear identification criteria, more complex cases may require a case-by-case methodology based on national or institutional policies[97]. AI's role in supporting these nuanced evaluations remains an area for further research to determine its effectiveness.

Finally, establishing and expressing the comparability of the qualification is another stage where AI can assist by pre-filling data related to personal details and qualification information, reducing human errors and streamlining the drafting of comparability statements. In this case, AI could help identify the elements of the qualification and compare them to a standard evaluation model.

4.2.2 AI-Supported Fraud Detection and Document Verification

The integration of artificial intelligence into the verification process of qualification authenticity could provide valuable support for credential evaluators, both through direct use of digital verification methods - this could help overcome language barriers and reduce the time needed for verifications, particularly in contexts where the database is only accessible in the local language - and by offering indirect assistance as an early-warning mechanism for detecting possible fraudulent documents based

[93] Council of Europe and UNESCO, *Convention on the Recognition of Qualifications concerning Higher Education in the European Region*, Lisbon, 11 April 1997, Articles III.5. Available at: https://rm.coe.int/168007f2c7 [last accessed 7 May 2026].
[94] Ibid.
[95] CIMEA, *Metodologia valutativa*. Available at: https://www.cimea.it/pagina-metodologia-valutativa [last accessed 7 May 2026].
[96] CIMEA, *Substantial differences: a glimpse of theory, practice and guidelines,* 2021. Available at: https://www.cimea.it/Upload/Documenti/7590_Brochure_substantial_differences.pdf [last accessed 6 May 2026].
[97] Ibid.

on a standardized checklist[98]. AI can detect fraudulent diplomas more effectively by cross-referencing relevant document features with existing structured data. By analyzing elements like logos, stamps, and formatting, AI can identify inconsistencies that suggest forgery and reduce the risk of accepting fraudulent qualifications, a persistent challenge in international recognition[99]. Beyond these advantages, digital tools can strengthen fraud prevention by confirming the identity of qualification holders in accordance with global standards like self-sovereign identity. This ensures authentication processes that are both secure and adaptable to the continuously evolving landscape of digital credentials[100]. However, it remains to be seen in which scenarios AI would be most reliable and where it might be prone to errors or limitations. In this context, the Council of Europe suggests continuing research on technological innovation aimed at eradicating all forms of educational fraud[101].

4.2.3 AI and the Enhancement of International Academic Mobility

Another key area where AI can provide substantial benefits is in supporting international mobility. As students and professionals increasingly seek opportunities abroad, the recognition of qualifications obtained in different languages and educational contexts becomes a complex process.

In this context, AI can support international students in overcoming barriers such as language differences and unfamiliarity with local education systems. Many academic documents, including transcripts, diplomas, and course descriptions, are issued in the language of the country where the qualifications were obtained, making it difficult for credential evaluators to accurately assess them. AI-driven translation tools can facilitate the recognition process by automatically translating these documents into the language of the receiving institution, allowing evaluators to work with documents issued in multiple languages[102].

This capability is particularly relevant in the context of the European Higher Education Area, where automatic recognition across member states is a key objective to enhance academic mobility. By analyzing learning outcomes and determining equivalencies between different education systems, AI can help standardize the evaluation of qualifications, thus contributing to fair and transparent

[98] CIMEA, *Guide on diploma mills and other dubious institutions*, 2018. Available at: https://www.cimea.it/Upload/Documenti/Guidelines-on-Diploma-Mills.pdf [last accessed 27 September 2024].
[99] Ibid.
[100] UNESCO and Council of Europe, *Monitoring the implementation of the Lisbon Recognition Convention: monitoring report*, Paris/Strasbourg, 2022. Available at: https://unesdoc.unesco.org/ark:/48223/pf0000383465 [last accessed 9 December 2024].
[101] Draper, M., Farrington, D., Finocchietti, C., Hesselbäck, A., Lantero, L., Johansson, E., and Newton, P., *Means to counter education fraud: legislation, practices and instruments*, Vol. 7, Council of Europe Platform on Ethics, Transparency and Integrity in Education (ETINED), 2023. Available at: https://rm.coe.int/prems-023823-gbr-2512-etined-vol-7-16x24-web-4-/1680addf63 [last accessed 2 October 2024].
[102] Wang, T., Lund, B. D., Marengo, A., Pagano, A., Mannuru, N. R., Teel, Z. A., and Pange, J., "Exploring the potential impact of artificial intelligence (AI) on international students in higher education: generative AI, chatbots, analytics, and international student success", *Applied Sciences*, 13(11), 2023, 6716. Available at: https://doi.org/10.3390/app13116716 [last accessed 7 May 2026].

recognition practices aligned with the Lisbon Recognition Convention.[103] Additionally, the European Area of Recognition Manual[104] (EAR Manual) provides practical guidelines on assessing substantial differences between qualifications. AI could be trained to follow these guidelines, offering initial assessments and suggesting potential alternatives, such as partial recognition, based on comprehensive analyses of qualifications and their alignment with the recipient country's education system. In addition to language support, AI can assist international students in overcoming cultural and procedural unfamiliarity. Personalized learning tools, such as chatbots, can provide real-time guidance on local regulations, application processes, academic expectations, and even social and cultural practices within the host country[105]. To support these efforts, national authorities should consider developing inclusive digital strategies that ensure interoperability and synergy between different systems, enabling the creation of comprehensive recognition frameworks that can adapt to the growth of mobility facilitated by technological advancements[106].

4.2.4 Ethical, Data Governance and Transparency Challenges

The increasing use of Artificial Intelligence (AI) in qualification recognition processes introduces not only a transformative potential to streamline global educational exchanges but also significant ethical, legal, and governance challenges. While AI enhances efficiency and scalability in credential evaluation, concerns regarding its trustworthiness, transparency and accountability remain central. As these systems increasingly shape decisions about individuals' educational and professional opportunities, ensuring that their implementation adheres to ethical and regulatory frameworks is essential to maintaining fairness, equity, and public trust. The EU AI Act classifies AI applications in qualification recognition[107] as high-risk due to their potential to impact fundamental rights, necessitating compliance with strict obligations related to risk management, data quality, transparency, human oversight and bias mitigation. These requirements reflect the broader need to address the ethical implications of delegating decision-making authority to AI systems and ensuring that such technologies enhance, rather than undermine, trust in the recognition process.

One of the primary concerns in AI-driven qualification recognition is the potential for bias in decision-making processes. AI models rely on extensive datasets to evaluate credentials, and their accuracy is contingent on the quality, representativeness and diversity of the data used for training. If the underlying

[103] Council of Europe and UNESCO, *Convention on the Recognition of Qualifications concerning Higher Education in the European Region*, Lisbon, 11 April 1997, Articles III.1 and III.2. Available at: https://rm.coe.int/168007f2c7 [last accessed 7 May 2026].
[104] ENIC-NARIC Networks, *EAR Manual. Available* at: http://ear.enic-naric.net/emmanual/ [last accessed 26 September 2024].
[105] UNESCO, *Beijing Consensus on Artificial Intelligence in Education*, 2019. Available at: https://unesdoc.unesco.org/ark:/48223/pf0000368303 [last accessed 26 September 2024].
[106] UNESCO and Council of Europe, *Monitoring the implementation of the Lisbon Recognition Convention: monitoring report*, Paris/Strasbourg, 2022. Available at: https://unesdoc.unesco.org/ark:/48223/pf0000383465 [last accessed 9 December 2024].
[107] The EU Artificial Intelligence ACT: High-risk AI systems are subject to specific requirements, including risk management (Art. 9), data and data governance (Art. 10), transparency (Art. 13), and human oversight (Art. 14). https://artificialintelligenceact.eu/section/3-2/ [last accessed 7 May 2026].

data disproportionately reflects qualifications from certain regions or educational systems, AI-driven decisions may systematically disadvantage qualifications from underrepresented institutions or non-traditional learning pathways. This issue is particularly critical given the global disparities in higher education infrastructure, where institutions with well-documented, digitized qualification records benefit from AI's pattern recognition capabilities, while those lacking structured data may face systemic barriers to recognition. Addressing these risks requires AI systems to be trained on diverse, inclusive datasets that reflect the full spectrum of global educational qualifications, preventing the reinforcement of historical inequalities and ensuring that recognition decisions remain fair and unbiased[108].

Transparency is fundamental to the ethical deployment of AI in qualification recognition, as it ensures that AI-driven decisions are explainable, traceable and subject to scrutiny. Given that these decisions can influence access to education, employment and professional mobility, AI systems must be designed to provide clear justifications for their outputs. This includes making information available on how algorithms are trained, the datasets used and the rationale behind specific recognition outcomes. Without transparency, the risk of arbitrary or opaque decision-making increases, potentially undermining trust in qualification recognition processes[109]. The European Union's AI Act emphasizes the need for high-risk AI applications to incorporate explainability measures, allowing individuals to contest decisions and seek redress where necessary. Ensuring that AI-generated recognition decisions are auditable is particularly crucial in cross-border academic mobility, where applicants must understand how their credentials have been assessed and why specific determinations were made.

However, transparency alone is insufficient. Human oversight remains a critical safeguard in AI-driven qualification recognition, ensuring that automated decisions align with ethical principles and institutional standards. While AI can effectively automate routine tasks such as document verification and fraud detection, it lacks the contextual understanding required for nuanced evaluations, particularly in cases involving non-standard credentials, experiential learning, or qualifications from regions with complex education systems. The EU AI Act mandates human oversight in high-risk AI applications, reinforcing the necessity of human evaluators in reviewing and interpreting AI-assisted recognition decisions. Human involvement is essential not only in verifying the accuracy of AI-generated outputs but also in ensuring that decisions are fair, especially when applicants' educational or professional futures are at stake[110]. Without human oversight, AI systems risk perpetuating biases embedded in historical data or algorithmic models, potentially disadvantaging marginalized communities or individuals from less-documented educational backgrounds.

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[108] European Commission / EACEA / Eurydice, *The European Higher Education Area in 2024: Bologna Process Implementation Report*, Publications Office of the European Union, Luxembourg, 2024. Available at: https://eurydice.eacea.ec.europa.eu/sites/default/files/2024-05/Chapter_2_Key_commitments_Degree_structures_recognition_and_quality_assurance.pdf [last accessed 6 May 2026].

[109] UNESCO, *Recommendation on the Ethics of Artificial Intelligence*, adopted on 23 November 2021. Available at: https://unesdoc.unesco.org/ark:/48223/pf0000380455.locale=en [last accessed 7 May 2026].

[110] Council of Europe, *Framework Convention on Artificial Intelligence and Human Rights, Democracy and the Rule of Law*, Council of Europe Treaty Series No. 225, 2024. Available at: https://rm.coe.int/1680afae3c [last accessed 6 May 2026].

Closely linked to transparency and oversight is the issue of data governance, which is central to ensuring that AI systems operate within an ethical and legally compliant framework. The Data Governance Act (DGA) of the European Commission introduces critical measures for managing, sharing, and securing data within the EU, emphasizing the need for robust governance practices to prevent misuse or exploitation of personal information. Given that AI-driven qualification recognition systems process vast amounts of personal and institutional data, stringent safeguards must be in place to ensure compliance with privacy and security regulations, such as the General Data Protection Regulation (GDPR)[111]. Ethical data governance requires that AI models be trained on high-quality, representative and unbiased datasets, with safeguards to prevent discriminatory patterns from influencing decision-making processes. Additionally, AI systems should integrate mechanisms for bias detection and mitigation, including regular audits and impact assessments to identify potential disparities in recognition outcomes[112].

Since the use of AI in qualification recognition is classified as high-risk, training, validation, and testing datasets must adhere to strict data governance and management practices appropriate for this classification. This includes careful consideration of design choices, the provenance and intended purpose of collected data and the necessary preprocessing steps such as annotation, labelling, cleaning, and aggregation. AI providers must also assess the availability, quantity, and suitability of datasets to ensure that recognition models do not generate misleading or discriminatory outcomes. Regular assessments are necessary to detect and correct biases that could disproportionately affect applicants from specific backgrounds, ensuring that AI-driven processes do not replicate systemic inequities in access to education and employment opportunities[113]. The identification of data gaps is also a key challenge, particularly in cases where structured qualification records are limited or inconsistent. To address these issues, qualification recognition frameworks must incorporate mechanisms to enhance data completeness, ensuring that AI models are capable of evaluating diverse educational qualifications with accuracy and fairness.

In exceptional cases where bias detection and correction require the processing of special categories of personal data, strict safeguards must be applied, including pseudonymization, access controls and data retention limitations. Such data should only be processed when strictly necessary and must be deleted once the bias has been addressed. Additionally, all instances of special data processing must be clearly documented, justifying why alternative methods – such as the use of synthetic or anonymized data – were insufficient[114]. The AI Act also mandates that AI providers ensure that high-risk systems operate within a legally compliant framework, requiring comprehensive documentation, security protections, and human oversight throughout the AI lifecycle.

[111] European Parliament and Council of the European Union, Regulation (EU) *2022/868 of 30 May 2022 on European data governance and amending Regulation (EU) 2018/1724 (Data Governance Act), Official Journal of the European Union*, L 152, 3 June 2022. Available at: https://eur-lex.europa.eu/eli/reg/2022/868/oj/eng [last accessed 7 May 2026].
[112] UNESCO, *Recommendation on the Ethics of Artificial Intelligence*, adopted on 23 November 2021. Available at: https://unesdoc.unesco.org/ark:/48223/pf0000380455.locale=en [last accessed 7 May 2026].
[113] European Parliament and Council of the European Union, *Regulation (EU) 2024/1689*, cit., Article 10.
[114] European Parliament and Council of the European Union, *Regulation (EU) 2024/1689*, cit., Article 10.

Beyond technical and regulatory considerations, the ethical use of AI in qualification recognition must be guided by broader principles of fairness, proportionality, and non-discrimination. AI should only be applied when its benefits outweigh the risks, and its implementation must not compromise fundamental values such as human rights, privacy, and accessibility. The Do No Harm principle emphasizes that AI systems should be deployed in ways that do not unfairly exclude or disadvantage specific groups, particularly those from regions with underrepresented education systems. Ethical AI governance must also address the broader societal impact of digital transformation in qualification recognition, ensuring that automation does not exacerbate inequalities or limit educational mobility[115].

Ultimately, the integration of AI in qualification recognition requires a holistic approach that balances technological innovation with ethical safeguards and regulatory compliance. While AI presents significant opportunities to enhance efficiency and streamline cross-border recognition, its implementation must be guided by principles of transparency, accountability, and human-centered governance. Adhering to international regulatory frameworks such as the AI Act and Data Governance Act, alongside ethical guidelines from UNESCO and the Council of Europe, will ensure that AI contributes positively to educational fairness, institutional trust, and global mobility. By embedding governance, oversight, and bias mitigation strategies within AI-driven recognition frameworks, institutions can create a more inclusive and equitable system that reflects the core values of transparency, integrity, and educational justice.

4.2.5 Future Perspectives on AI Adoption in Qualification Recognition: Governance, Regulation, and Emerging AI Paradigms

The rapid evolution of Artificial Intelligence is reshaping qualification recognition processes on a global scale, introducing unprecedented opportunities while also posing significant regulatory and ethical challenges. As AI systems continue to develop, particularly with advancements in AI agents and agentic workflows, their application in credential evaluation must be assessed not only from a technological standpoint but also in alignment with existing regulatory frameworks, ensuring compliance with international standards on transparency, accountability and human rights protection. As it was previously addressed, current regulatory instruments, such as the AI Act of the European Union and the Council of Europe's Framework Convention on Artificial Intelligence, Human Rights, Democracy, and the Rule of Law, provide overarching guidelines to govern AI adoption in public and private sectors. However, the application of these frameworks in education and qualification recognition remains an evolving subject, requiring sector-specific adaptations that ensure AI implementation upholds principles of fairness, explainability and human oversight.

[115] UNESCO, *Recommendation on the Ethics of Artificial Intelligence*, adopted on 23 November 2021. Available at: https://unesdoc.unesco.org/ark:/48223/pf0000380455.locale=en [last accessed 7 May 2026].

The EU AI Act establishes a risk-based framework that classifies AI systems according to their potential impact on fundamental rights. AI applications involved in qualification recognition, university admissions, and credential evaluation are considered high-risk, requiring strict adherence to data governance, transparency, and human oversight provisions[116]. In practical terms, this means that any AI-driven system supporting qualification assessment, fraud detection, or academic equivalency determination must ensure that AI models are trained on high-quality, representative datasets to prevent bias and discrimination in recognition decisions, decision-making processes remain explainable and auditable, allowing affected individuals to contest AI-driven outcomes and human oversight mechanisms remain central, preventing AI from making fully autonomous determinations regarding qualification recognition or access to education.

The AI Treaty complements the EU AI Act by reinforcing obligations related to human rights protection, non-discrimination, and algorithmic transparency[117]. However, as AI adoption in qualification recognition expands, existing regulatory frameworks may need to be further refined to address sector-specific challenges. Neither the EU AI Act nor the AI Treaty explicitly outlines how AI should be implemented in cross-border qualification recognition systems, an issue that becomes increasingly relevant as education systems digitize credentialing processes through blockchain-based solutions, decentralized identity frameworks and AI-assisted verification models.

The next phase of AI-driven transformation in credential evaluation is expected to be shaped by AI agents and workflow automation, which extend beyond traditional machine learning models by enabling autonomous, adaptive, and iterative decision-making processes. Unlike conventional AI systems that rely on predefined rules and supervised learning models, AI agents are capable of orchestrating complex workflows, autonomously handling data ingestion, document validation, qualification comparison and compliance checks. The emergence of workflow automation tools powered by AI agents, akin to agentic systems in software orchestration, raises several key considerations for qualification recognition. Automated case handling enables AI agents to autonomously manage qualification recognition requests, retrieving necessary information from academic databases, regulatory bodies and digital credential repositories, reducing administrative burdens on human evaluators. Dynamic fraud detection allows AI models to continuously learn from new fraud patterns, adapting their validation processes based on evolving credential forgery techniques. Interoperability with global standards can facilitate cross-border credential recognition by automating comparative analysis of qualifications, aligning regional education frameworks and mapping degree equivalencies based on real-time policy updates. While these advancements hold transformative potential, they also intensify concerns about accountability, oversight and regulatory compliance. The integration of AI agents in qualification recognition demands a governance framework that balances automation with ethical and legal

[116] European Parliament and Council of the European Union, *Regulation (EU) 2024/1689*, cit., Article 6 and Annex III.
[117] Council of Europe, *Framework Convention on Artificial Intelligence and Human Rights, Democracy and the Rule of Law*, Council of Europe Treaty Series No. 225, 2024. Available at: https://rm.coe.int/1680afae3c [last accessed 6 May 2026].

safeguards, ensuring that AI-enhanced workflows do not override human judgment or introduce systemic biases in academic mobility decisions. The rise of generative AI further expands the landscape of AI-driven transformation in education. These capabilities raise both opportunities and challenges, as generative AI can streamline document summarization, multilingual credential interpretation and equivalency analysis, improving efficiency and accuracy in qualification assessments. However, given that generative AI models operate probabilistically, there is an inherent risk of fabricated outputs or incorrect interpretations of qualification frameworks, requiring rigorous validation protocols. Generative AI systems rely on large-scale data processing, necessitating strict compliance with GDPR and the Data Governance Act to prevent unauthorized use of personal academic records[118].

As AI continues to shape the future of qualification recognition, international regulatory bodies, education institutions and AI developers must work towards a responsible governance model that ensures algorithmic transparency, preserves human oversight, strengthens data governance and ethical AI principles, develops AI literacy among credential evaluators and facilitates cross-border collaboration in AI regulation.

[118] European Parliament and Council of the European Union, Regulation (EU) 2022/868 of 30 May 2022 on European data governance and amending Regulation (EU) 2018/1724 (Data Governance Act), Official Journal of the European Union, L 152, 3 June 2022. Available at: https://eur-lex.europa.eu/eli/reg/2022/868/oj/eng [last accessed 7 May 2026].

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CHAPTER 5

Case Study: Digital Transformation at CIMEA

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5.1. Key Phases of Digital Transformation in Credential Recognition

The digital transformation of credential recognition should not be conceived as a one-off IT project but as a continuous organizational trajectory. International initiatives have underscored the relevance of holistic frameworks in avoiding fragmented or siloed systems. Drawing on these insights and informed by the empirical case of CIMEA, a flexible orientation model is proposed for ENIC-NARIC centers and analogous institutions. The proposed orientation model is informed not only by international literature and policy frameworks, but also by the operational experience developed through CIMEA's digital transformation trajectory. This model delineates four interdependent domains that collectively support institutions in navigating the evolving phases of digital transformation. These domains do not constitute sequential stages but rather mutually reinforcing areas of innovation and institutional capacity building. Although analytically distinguishable, these domains overlap in practice and should therefore be understood as interconnected dimensions of institutional transformation.

a. Process Reengineering

Digital transformation requires a fundamental reconsideration of existing workflows. Recognition procedures frequently contain bottlenecks, redundancies, or legacy steps that reduce efficiency. A digital-first approach enables organizations to streamline the intake of applications (input), support evaluators through decision-support tools during assessments (throughput), and optimize the issuance of decisions and secure digital credentials (output). Iterative redesign, grounded in pilot testing and user feedback, ensures adaptability while safeguarding service continuity.

b. Data Readiness and Interoperability

The foundation of any sustainable transformation lies in the availability of high-quality, structured, and interoperable data. Digital maturity assessment is a key activity in any digital transformation initiative, as it consists of determining the current level of digitalization of the organization and its readiness to introduce changes. In this phase, digital maturity-assessment models and tools can be adopted to understand the areas and processes in which the organization presents an advanced level of digital maturity, as well as those presenting room for improvement. This assessment makes the organization aware of its own digital gaps and reveals needs and priorities of its digital transformation. Workshops should be arranged to make the stakeholders aware of the need for digital change, share with them the digital maturity assessment results and depict the benefits stemming from the digital transformation[119].

Recognition centers must implement common data models and metadata schemas consistent with international standards (e.g., the European Learning Model, the European Digital Credentials for Learning). Data validation mechanisms at the intake stage contribute to authenticity and error reduction, while interoperability with verification databases and cross-border frameworks strengthens trust and comparability.

c. Intelligent Automation

Once processes and data infrastructures have been consolidated, AI-driven and automation-based tools can significantly enhance operational efficiency and scalability. Fraud detection algorithms, predictive models for workload distribution, and document classification systems enable institutions to manage increasing volumes of requests without compromising quality and consistency. Such tools, however, must be embedded within human-in-the-loop frameworks that ensure compliance with ethical principles and regulatory requirements, including the EU AI Act and the Lisbon Recognition Convention. In this context, transparency, proportionality and meaningful human oversight remain indispensable safeguards for ensuring accountability, reliability and trustworthiness in AI-assisted decision-making processes.

[119] Bellantuono, N., Nuzzi, A., Pontrandolfo, P., and Scozzi, B., "Digital transformation models for the I4.0 transition: lessons from the change management literature", Sustainability, 13(23), 2021, 12941. Available at: https://doi.org/10.3390/su132312941 [last accessed 7 May 2026].

d. Trust Infrastructure

Recognition processes ultimately rely on trust. Applicants, higher education institutions and international partners must have confidence in the legitimacy, reliability and consistency of recognition outcomes. Such trust depends on the existence of robust digital identity systems, tamper-resistant and verifiable digital credentials, including blockchain-based solutions, as well as strict compliance with data protection frameworks such as the GDPR. Equally important are governance structures encompassing clear data stewardship responsibilities, transparent reporting mechanisms and ethical oversight procedures. A reliable trust infrastructure ensures that recognition decisions are not only efficient and secure, but also internationally portable, transparent and institutionally accountable.

5.2. Best practices and Guidelines for Digital Innovation

Digital transformation in qualification recognition addresses the increasing demand for secure, efficient, and user-centered evaluation methods that can handle higher volumes of requests and meet complex cross-border recognition requirements. By embracing digital innovation, organizations can streamline operations, enhance data security, improve user accessibility, and ensure compliance with international standards (Lisbon Recognition Convention[120], UNESCO Global Convention[121], EU transparency tools[122]), thus establishing a consistent global approach. Beyond technological implementation, digital transformation also requires the adoption of normative and operational principles capable of ensuring long-term sustainability, institutional legitimacy and user trust. These best practices complement the four domains outlined above (Process Reengineering, Data Readiness, Intelligent Automation, Trust Infrastructure), providing operational principles that guide their implementation. To achieve these goals, digital innovation relies on core principles such as user-centricity, accessibility, data privacy, interoperability, data sharing, and adherence to established frameworks.

[120] Council of Europe and UNESCO, *Convention on the Recognition of Qualifications concerning Higher Education in the European Region*, Lisbon, 11 April 1997, European Treaty Series No. 165. Available at: https://rm.coe.int/168007f2c7 [last accessed 7 May 2026]
[121] UNESCO, *Global Convention on the Recognition of Qualifications concerning Higher Education*, Paris, 2019. Available at: https://www.unesco.org/en/legal-affairs/global-convention-recognition-qualifications-concerning-higher-education?hub=70286 [last accessed 6 May 2026]
[122] European Commission, *Bologna Process and European Higher Education Area*, European Education Area. Available at: https://education.ec.europa.eu/es/education-levels/higher-education/inclusive-and-connected-higher-education/bologna-process [last accessed 6 May 2026].

a. User-Centricity

User-centricity is a crucial principle for any successful digital credential evaluation system. It ensures that digital services are designed to meet the real needs and expectations of end-users – whether students, educational institutions, employers, or governments – rather than focusing only on technical aspects. This approach improves usability, ensures accessibility, and enhances user satisfaction while reducing errors and miscommunication.

Achieving user-centricity requires understanding the motivations, challenges, and preferences of different user groups through research methods like surveys and interviews. Journey mapping can then help visualize the evaluation process from the user's perspective, identifying pain points and streamlining interactions. Additionally, continuous feedback, both during and after the development phase, allows for adjustments based on user experiences, ensuring the system remains responsive and effective.

This aligns with the Lisbon Recognition Convention's principle that recognition procedures should be transparent, fair and applicant-oriented.

b. Accessibility and Inclusivity

Ensuring accessibility and inclusivity is essential for providing fair credential evaluation services. Accessibility involves designing systems that are usable by all, including those relying on assistive technologies like screen readers or voice control (W3C, 2023). Inclusivity goes beyond this, ensuring services are effective for users with varying digital literacy levels and language skills. Adhering to accessibility standards ensures that digital content is perceivable, operable, and understandable by a diverse audience. Accessibility should be embedded early in the design and maintained throughout the system's lifecycle. Additionally, multilingual support and various submission options enhance accessibility, giving users flexibility in interacting with evaluation systems.

c. Data Privacy and Security

Credential evaluation involves handling sensitive personal data, which requires strong privacy and security measures to prevent unauthorized access and misuse. Many regions, including the EU, enforce strict regulations such as GDPR to safeguard personal data[123]. Privace-by-design[124] should be integrated into the system lifecycle, including data minimization and encryption. This ensures that only necessary data is collected and securely handled. Organizations must also establish clear data access policies and conduct regular audits and training to reinforce security and maintain user trust. These principles are

[123] European Parliament and Council of the European Union, Regulation (EU) 2016/679 on the protection of natural persons with regard to the processing of personal data (General Data Protection Regulation), Official Journal of the European Union, 27 April 2016. Available at: https://eur-lex.europa.eu/eli/reg/2016/679/oj/eng [last accessed 6 May 2026].

[124] "Privacy by Design" means nothing more than "data protection through technology design." Behind this is the thought that data protection in data processing procedures is best adhered to when it is already integrated in the technology when created. See https://gdpr-info.eu/issues/privacy-by-design/

also consistent with the requirements of the EU AI Act when automation tools are deployed, ensuring trustworthy and proportionate use of AI in credential recognition.

d. Sustainable Interoperability

Sustainable interoperability[125] is a key element for modern digital credential evaluation systems. It allows for seamless communication and data exchange between systems, trusted sources, and external databases, facilitating efficient data sharing and reducing manual intervention across the evaluation process. Achieving interoperability requires the adoption of standardized data models that align with globally recognized frameworks, such as the European Learning Model (ELM) and European Digital Credentials for Learning (EDC). This ensures consistent data exchange and reduces discrepancies when transferring data between systems. The use of standardized identifiers, like ISO country codes or institutional IDs from databases like the World Higher Education Database, further enhances data reliability and ensures consistency across platforms. Interoperability must also support future adaptability, enabling systems to integrate new technologies and standards without significant reconfiguration. In the context of international mobility, interoperability is also critical to supporting the automatic recognition agenda of the European Higher Education Area.

e. Data Sharing and Reuse

Effective data sharing and reuse practices are essential for optimizing resources, improving operational efficiency, and supporting informed decision-making in credential evaluation. By creating centralized, standardized databases of recognized qualifications, institutions, and related data, organizations can minimize redundant data entry, streamline case handling, and reuse previous evaluations to support new assessments.

This approach enables credential evaluators to access relevant data quickly, ensuring consistent and high-quality evaluations. To further enhance data sharing, tools like chatbots and centralized repositories of common queries can improve communication with users while freeing up valuable staff time. Additionally, leveraging data mining and machine learning on historical datasets allows for identifying trends, recognizing patterns, and predicting outcomes, which significantly enhances the accuracy and efficiency of the credential evaluation process. These practices also contribute to stronger data governance and sustainability, reinforcing the role of recognition systems as data-informed policy instruments.

[125] The IEEE defines interoperability as the "*ability of a system or a product to work with other systems or products without special effort on the part of the customer*".
The new concept of sustainable interoperability is introduced as a new dimension of research and application in the domain of enterprise systems interoperability, and indeed in systems interoperability more generally. The simplest way to describe the term "sustainability" in this context is that it is related to the aim of improving the quality of service by contributing to a more robust interoperability, avoiding excessive consumption of resources.

f. Compliance with International Standards

Credential evaluation organizations operate within frameworks established by international standards, such as the Convention on the Recognition of Qualifications concerning Higher Education in the European Region (hereinafter referred to as "Lisbon Recognition Convention" or "LRC)[126], and the UNESCO Global Convention on the Recognition of Qualifications concerning Higher Education (hereinafter referred to as "Global Convention") (UNESCO, 2019), which provides guidelines for transparent and consistent recognition of qualifications. Adherence to these standards ensures that credential evaluation practices align with global expectations, promoting fair and reliable recognition processes across borders.

A key component of compliance is the ability to document and standardize procedures, ensuring that digital workflows support efficient and transparent evaluation processes. Systems should be designed to accommodate appeals, revisions, and secure data storage in multiple formats, enabling the organization to handle both traditional analogue and modern digital documents.

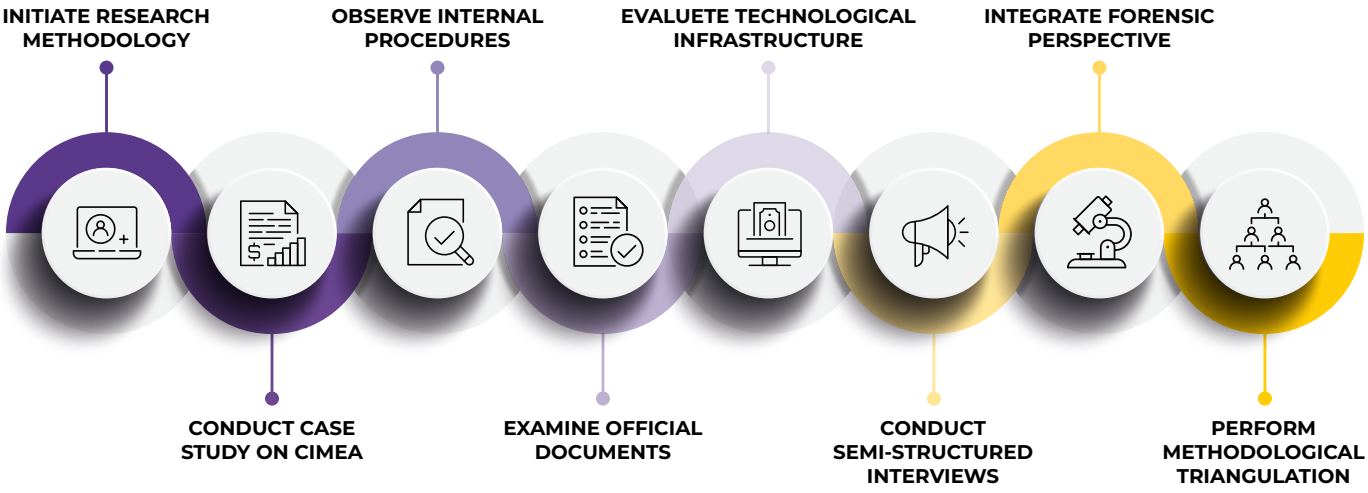
[126] Council of Europe and UNESCO, *Convention on the Recognition of Qualifications concerning Higher Education in the European Region*, Lisbon, 11 April 1997, European Treaty Series No. 165. Available at: https://rm.coe.int/168007f2c7 [last accessed 7 May 2026]

5.3. Digital Transformation and Change Management in the Adoption of DiploMe

With the rise of academic mobility and the growing interconnection between global education systems, the demand for efficient, secure and transparent credential recognition processes has become increasingly evident. Digitalization has emerged as the most effective means to address these challenges, initially by converting analogue process into digital workflows and later by integrating advanced technologies to enhance security and authenticity. For CIMEA, this transition required a reassessment of traditional credential evaluation processes, which had previously relied on manual processing and paper-based documentation. Transitioning from traditional processes to a digital platform like DiploMe required a well-structured change management approach within CIMEA. Institutional leaders understood that such a transformation would affect not only operational workflows but also the organizational culture and the daily activities of employees. To navigate this shift effectively, CIMEA implemented a multi-phase strategy, emphasizing preparation, communication and employee engagement to ensure a seamless transition.

The initial phase involved comprehensive consultations with internal and external stakeholders to anticipate potential obstacles and identify areas of resistance. Management prioritized transparent communication, clearly outlining the necessity of digital transformation and the specific advantages the new DiploMe would bring. By aligning the platform's goals with CIMEA's overarching mission of advancing academic mobility, the organization was able to foster a positive narrative around the transition, which helped facilitate broader acceptance. A key component of this transition was staff training and capacity-building, ensuring that employees developed the digital competencies and AI literacy needed to effectively navigate the DiploMe ecosystem. By integrating blockchain technology, the platform has not only modernized CIMEA's credential evaluation processes but has also enhanced accessibility and reliability for both Italian and international institutions, addressing the evolving demands of the digital age.

CIMEA's Digital Transformation in Credential Evaluation



5.4. Development of Digital Solutions at CIMEA

Digitalization is broadly understood as the use of digital technologies to change a business model and provide new revenue and value-producing opportunities and the process of moving to a digital business[127]. However, beyond the mere transition from analog to digital, digitalization entails a strategic transformation that redefines how organizations operate, integrating technology at scale to enhance user experience and optimize costs. This shift goes beyond the adoption of new tools, requiring a fundamental restructuring of institutional workflows, decision-making processes, and service delivery models. It demands a continuous process of adaptation, encouraging organizations to challenge the status quo, embrace experimentation, and foster a cultural shift that prioritizes agility and innovation[128].

[127] Gartner, Digitalization. Available at: https://www.gartner.com/en/information-technology/glossary/digitalization [last accessed 7 May 2026].
[128] McKinsey & Company, *What is digital transformation*?, 2024. Available at: https://www.mckinsey.com/featured-insights/mckinsey-explainers/what-is-digital-transformation [last accessed 7 May 2026].

As such, organizations undertaking digitalization initiatives must conduct a critical assessment not only of which data should be digitized but also of the underlying rationale and implementation strategy. This process requires the establishment of clear objectives, adherence to applicable standards, and a comprehensive understanding of end-user requirements to ensure both the efficacy and long-term sustainability of the transformation. It represents a shift from conventional operational paradigms toward a more collaborative and experimental framework, one that facilitates the identification of innovative solutions, enhances the user experience, fosters employee-driven innovation, and supports organizational growth at a foundational level[129].

CIMEA's early adoption of digital frameworks established a foundation that would eventually lead to the full-fledged digital transformation represented by DiploMe. The initial phase of development for the DiploMe platform in 2019 marked the beginning of CIMEA's journey towards digital transformation. The preliminary focus was on identifying, structuring, and classifying the data essential for the recognition of academic qualifications, leading to the creation of a conceptual ontology capable of comprehensively categorizing the various educational and personal documents required in credential evaluation processes. This systematic approach aimed to optimize information accessibility for credential evaluators, reducing procedural inefficiencies by ensuring that only relevant data were collected while eliminating redundant or non-essential information from the evaluation workflow.

A critical component of this effort was the mapping of metadata for key academic documents, including final diplomas, provisional certificates, transcripts of records, Diploma Supplements, visas, residence permits, and other supporting materials. This process was conducted in strict alignment with national and international regulatory frameworks governing access to higher education, incorporating established standards such as the Lisbon Recognition Convention[130], Europass[131], and best practices consolidated within the ENIC-NARIC network[132]. However, the most significant contribution to this framework was derived from CIMEA's extensive expertise accumulated over four decades in the evaluation of academic qualifications. This institutional knowledge enabled the development of a *comprehensive repository* that systematically categorizes secondary and post-secondary qualifications for each country, preserving original linguistic and typographic characteristics while specifying the corresponding eligibility criteria for higher education access.

Beyond the classification of required documentation, this initiative also extended to the verification of academic credentials, incorporating a rigorous comparative analysis of authentication methods across different jurisdictions. The research undertaken allowed CIMEA to continuously update and refine

[129] Accenture, *What is digital transformation?* Available at: https://www.accenture.com/us-en/insights/technology/digital-transformation-index [last accessed 7 May 2026].
[130] Council of Europe and UNESCO, *Lisbon Recognition Convention*. Available at: https://www.coe.int/en/web/higher-education-and-research/lisbon-recognition-convention [last accessed 7 May 2026].
[131] European Commission, *Europass*. Available at: https://europass.europa.eu/ [last accessed 7 May 2026].
[132] ENIC-NARIC Networks, *ENIC-NARIC Networks*. Available at: https://www.enic-naric.net/ [last accessed 7 May 2026].

mechanisms for determining the authenticity of foreign qualifications, encompassing all levels of education – secondary, post-secondary, and higher education – on a global scale. This analysis facilitated the development of a *taxonomy of authentication methodologies*, differentiating verification systems according to their structural and operational characteristics. The study examined:

- Online verification platforms, distinguishing between centralized national systems managed at the ministerial level and institution-specific verification services.
- Security features embedded in original diplomas, analyzing document authentication mechanisms integrated at various stages of the printing process (pre-press, press, and post-press).

This analytical process was conducted through the combined use of CIMEA's internal archival resources, systematic reviews of primary documentation and the shared knowledge infrastructures of international cooperation networks such as ENIC-NARIC. The resulting framework contributed not only to improving operational efficiency, but also to strengthening institutional knowledge management and standardization practices within credential evaluation procedures.

5.5. Evolution of Digital Solutions at CIMEA

The evolution of digital solutions in qualification recognition at CIMEA has been marked by incremental but significant changes in response to growing demands for efficiency, security, and user-centricity. Each stage in this progression has laid the groundwork for the fully integrated DiploMe platform launched in March 2024, transforming the once labor-intensive process into a streamlined, transparent, and secure digital experience. This New DiploMe platform is, therefore, the culmination of years of incremental digital improvements, each one building toward a comprehensive system capable of meeting the contemporary demands of academic recognition.

By integrating digital technologies into the recognition and verification of academic qualifications, CIMEA's model represents a paradigm shift in the administration of international student mobility. The DiploMe infrastructure exemplifies how digitalization can serve as both an enabler of institutional efficiency and a mechanism for ensuring equity, security, and trust in global academic recognition systems.

5.5.1 Pre-Digital Phase: Manual Processes

In the initial stages, CIMEA managed qualification recognition requests through a decentralized, manual process, primarily relying on email notifications rather than a centralized digital platform. Applicants would complete an online form on the CIMEA website, which collected essential details such as the applicant's personal information, qualification details, and supporting documents. Once the applicant submitted the form, it did not enter an integrated digital system. Instead, the system sent an automatic email, directly to the credential evaluator's inbox. This email contained the applicant's data, the specifics of the qualification in question, and links to any attached documents, initiating the evaluation request.

This fragmented process required evaluators to manually track cases across multiple, unstructured email threads, making it challenging to maintain an aggregated overview of pending evaluations and effectively manage workflows.

Without a unified system, CIMEA evaluators had to manually download and manage attached documents for each case, leading to increased processing times, inconsistencies, and inefficiencies in tracking evaluations. Applications were submitted through separate channels based on language (Italian or English) and institution type, further complicating data consolidation and preventing real-time aggregation of evaluation volumes. Additionally, the absence of a centralized database meant that case information remained dispersed across individual email threads, limiting access to verified records for future reference or statistical analysis. Each evaluation was processed as an isolated request, making it difficult to ensure continuity, track cases efficiently, or maintain consistency in assessment criteria across different evaluators. Upon completing the evaluation, the credential evaluator prepared a *Statement of Comparability*, which was stamped and hand-signed to ensure authenticity. The signed

document was then scanned and emailed to the applicant, concluding a largely manual and multi-step process. This workflow, while functional at that time, had significant limitations. The lack of digital integration resulted in extended processing times and heightened logistical challenges, as all elements of verification had to be completed in individual, isolated steps.

There was no standardized or digital appeal procedure, as all appeals were handled exclusively via email, without a dedicated platform for submission or tracking. No deadlines were established, and neither appeal cases nor reasons for rejection were systematically recorded. Additionally, there was no alert system for fraud detection, nor were there integrated communication channels for applicant interactions, document resubmission or follow-up requests. All correspondence was managed through a shared email account leading to challenges in email assignment and case distribution. Furthermore, there was no standardized format for *Evaluation Notes* or a common framework for assessment policies across different countries. The digitalization process presented an opportunity to improve not only procedural efficiency but also the quality of internal workflows, shared policies, evaluation criteria, methodologies and comparative analyses. It fostered a deeper understanding of the rationale behind variations in evaluation approaches for qualifications from different countries, encouraging alignment in assessment perspectives. Both in the initial digital transformation and the subsequent evolution of DiploMe, digitalization became a means to expand knowledge, enhance competencies, and refine internal mechanisms. This process facilitated a growing awareness of procedural intricacies and team workflows, allowing both junior and senior evaluators to identify commonalities and differences in case assessments. It also provided critical insights into the specific analytical, research, annotation, and comparative needs that the initial platform had not fully addressed, informing the transition from DiploMe 1.0 to DiploMe 2.0.

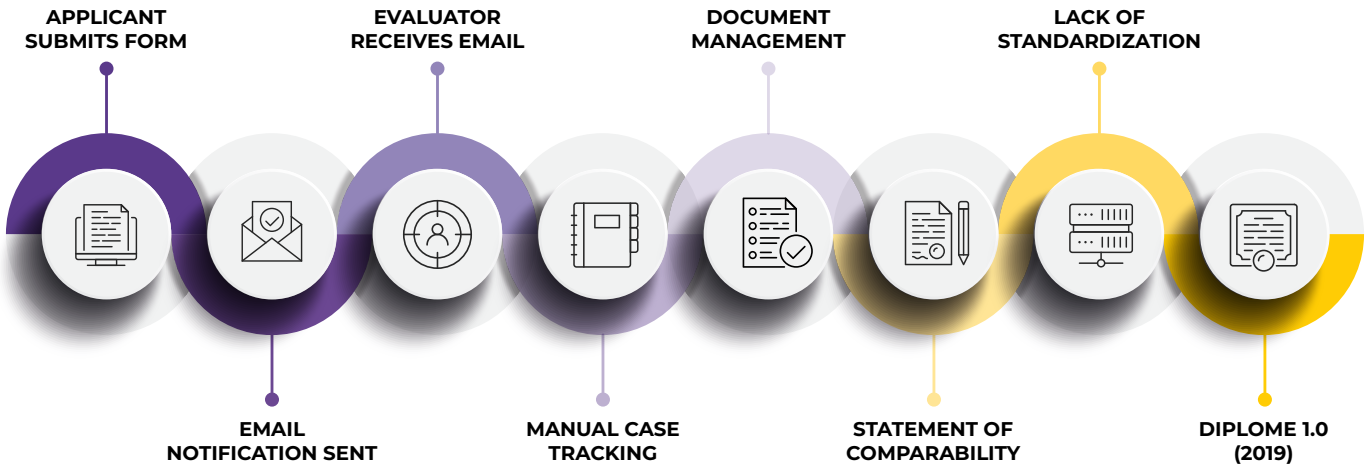

ORIGINALE

NARIC Italia

ATTESTATO DI COMPARABILITÀ DEL TITOLO ESTERO

CINEA

Transition from Manual to Digital Qualification Recognition



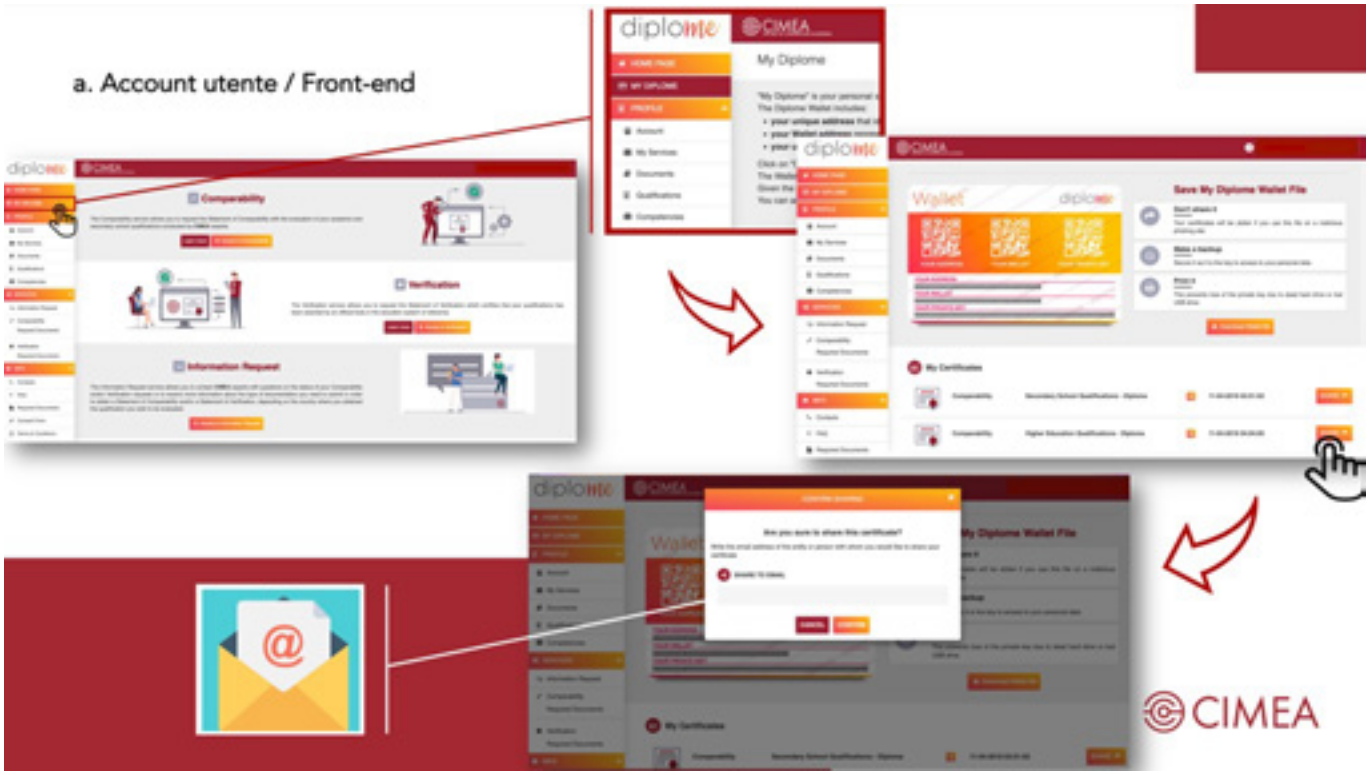
5.5.2 Initial Digitalisation: DiploMe 1.0

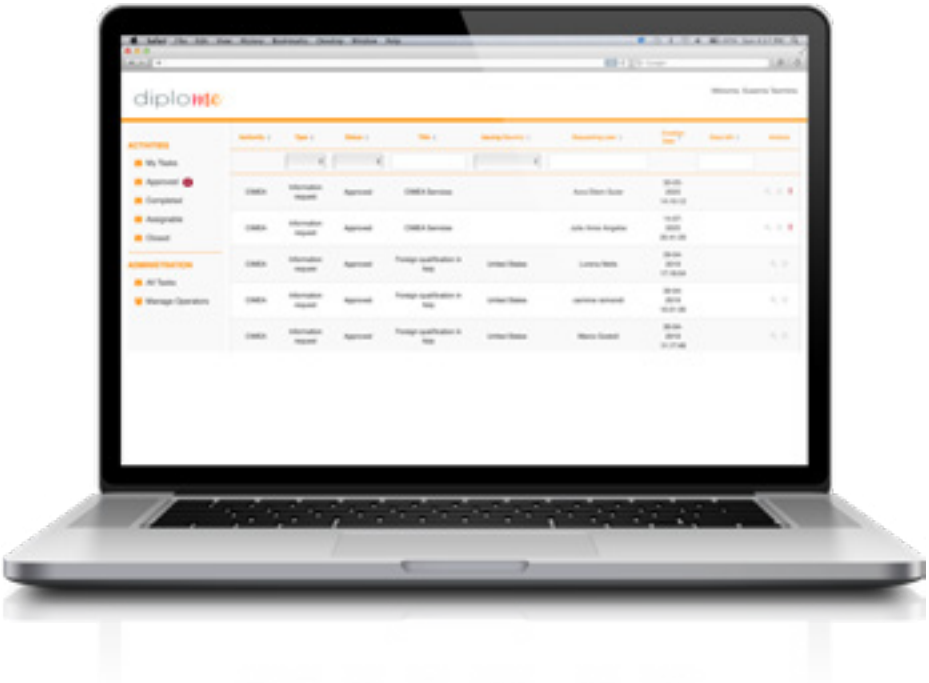
Acknowledging these challenges and the necessity of a more intuitive system, CIMEA launched a fully digitalized recognition process in April 2019, overhauling all workflow phases, including input (document submission and authentication), throughput (evaluation and decision-making) and output (issuance of verified digital credentials). This transformation was founded on three fundamental pillars:

- A digital-first reconfiguration of the recognition process, reinforced by substantial investment in human capital.
- The creation of a structured ontology and metadata framework for the classification of qualifications.
- The implementation of digital Statements of Comparability and Statements of Verification, secured via blockchain technology.

By incorporating these components, CIMEA optimized evaluation procedures, reinforcing security, transparency, and interoperability in qualification recognition. This transition not only enhanced operational efficiency but also broadened access to evaluation services, streamlining interactions with both domestic and international applicants through a more structured and user-friendly digital platform. Applicants were given the ability to upload their documents directly to the platform, allowing credential evaluators to retrieve and review submissions in an organized and consolidated manner

via the back-office system. Compared to the previous web-based form, this centralized approach significantly improved the document evaluation process, enabling faster and more effective assessment of qualification data.





A significant improvement in this system was the integration of a structured ontology for qualification recognition, ensuring that uploaded documents were categorized and processed following predefined criteria. This classification system allowed for a more precise alignment between the information submitted by users and the requirements of credential evaluators, improving both efficiency and accuracy in the recognition process. Additionally, the customer journey was meticulously designed to enhance user interactions, facilitating a seamless transition between the front-end interface and the back-office evaluation system.

Moreover, the platform was built on a fully integrated technological framework, ensuring secure data transmission, automated workflow management, and strict compliance with GDPR regulations. This structure not only strengthened data security and privacy protection but also improved interoperability between user-submitted inputs and back-office processing. One of the most notable advancements in this version was the transition from traditionally signed and stamped statements to digital documents authenticated via blockchain technology. This secure digital format not only reinforced document security but also streamlined the issuance of Statements of Comparability and Statements of Verification, ensuring unprecedented levels of integrity and traceability. Despite these advancements, the platform's interface remained – face technical challenges, including slow processing speeds and the absence of automated workflows – both essential for achieving a seamless, fully digital process.

Particularly, while user accessibility and front-end functionality had been a primary focus during the design and development phase, the back-office system remained underdeveloped. At this stage, it served primarily as a repository for applicant-submitted documents and a basic interface for metadata compilation and certificate issuance. The actual evaluation process itself continued to take place outside

the platform, meaning the system did not yet support or assist credential evaluators in conducting analyses or research activities. Despite these constraints, the digital infrastructure enabled CIMEA to distinguish itself as the only ENIC-NARIC center capable of continuing evaluation services uninterrupted during the COVID-19 pandemic.

5.5.3 Strategic Drivers Behind DiploMe 2.0

CIMEA processes a high volume of requests annually, with a steady increase in demand over recent years. This surge has been driven by various international dynamics, including increased student mobility, evolving migration patterns and shifts in higher education policies worldwide. Consequently, credential evaluators have faced mounting challenges in efficiently managing and processing these requests while ensuring the quality and reliability of their assessments.

Moreover, an uneven distribution of requests across different countries has added another layer of complexity, necessitating a uniform and standardized approach to evaluation. These challenges served as the foundational impetus for the conceptualization of a new, more advanced platform capable of streamlining workflows, enhancing data management and improving responsiveness to stakeholder needs. The overarching objective was to develop a digital ecosystem that not only optimizes operational efficiency but also upholds the highest standards of transparency and reliability in credential evaluation processes.

5.5.4 DiploMe 2.0 (2024): Consolidation and Innovation

Following the insights gained from the initial version, the platform underwent a series of major upgrades between September 2023 and March 2024, incorporating structural enhancements and significantly expanding its functionalities. These refinements culminated in the release of an upgraded version, designed to better address the needs of both applicants and credential evaluators. The new platform introduces critical improvements that align with broader trends in digital transformation, reinforcing CIMEA's commitment to optimizing qualification recognition processes.

The 2024 iteration of the DiploMe platform is distinguished by its integrated approach, merging all stages of the recognition process into a cohesive and streamlined workflow. Applicants can now initiate requests, upload documents and monitor their application status through a single, user-friendly interface. The system guides users through each step, reducing errors and incomplete submissions, while real-time status updates ensure that applicants remain informed throughout the evaluation process. From the moment an application is submitted, the platform generates a secure digital record accessible to credential evaluators, significantly reducing processing times.

The DiploMe platform also features a dedicated "Restricted Area for Universities", enabling Italian higher education institutions to directly access verified applicant statements through a secure, institution-specific portal. Designed to assist universities in assessing foreign qualifications for admission, this feature allows institutions to verify credentials without requiring additional documents from applicants, thereby streamlining admission procedures and improving decision-making accuracy, so enhancing the Automatic Recognition of foreign qualification.

A key upgrade in DiploMe 2.0 is the "Required Documents" section, aimed at resolving inconsistencies in document submissions, one of the most common challenges in credential evaluation. This section offers a country-specific, detailed list of required documents, providing applicants with greater clarity on submission requirements and ensuring that evaluations are completed without unnecessary delays. While this feature existed in the original version of DiploMe, the March 2024 update significantly improved its visibility. Now, the section is clearly accessible within the platform and referenced throughout the application process, resolving previous usability concerns and increasing applicant compliance with document requirements.

In conjunction with the platform updates, CIMEA launched a dedicated website exclusively for the DiploMe service, separating it from the institutional website[133]. This decision was taken to improve clarity and transparency for international students interested in DiploMe services. The "Required Documents" section is now publicly available on the new website[134], allowing prospective applicants to review documentation requirements before creating an account. This change enables students to prepare their documents in advance, while also providing foreign universities with a preview of CIMEA's expectations. Additionally, Italian universities now have access to a comprehensive repository containing global document requirements for qualifications from different countries.

DiploMe seeks to establish a global digital ecosystem where higher education institutions, awarding bodies and certifying authorities collaborate to create a secure, transparent environment for fair and efficient qualification recognition, adhering to the principles outlined in the Lisbon Recognition Convention. The integration of blockchain technology within DiploMe further enhances consistency, reliability, and security in digital student data management, significantly reducing the risk of fraudulent documentation.

From a technological perspective, DiploMe 2.0 consists of four core layers, designed to offer a seamless and user-friendly experience for universities, credential evaluators, and applicants:

- The front-end layer: this user interface prioritizes ease of use, incorporating established technologies to deliver an engaging and intuitive user experience.

[133] CIMEA, CIMEA – *Information Centre on Academic Mobility and Equivalence*. Available at: https://www.cimea.it/ [last accessed 7 May 2026].
[134] CIMEA, *CIMEA Diplome*. Available at: https://www.cimea-diplome.it/ [last accessed 7 May 2026].

- The back-end layer: this middleware service engine, developed using open technologies, facilitates the integration of blockchain and other emerging technologies with the user interface.

- The infrastructure layer: a blockchain-based service that ensures secure, interoperable and accessible data storage, guaranteeing data protection and portability across platforms.

- The management layer (enterprise network): this serves as the centralized control point for all entities involved in certification services, facilitating efficient system management.

5.6. Design and Development of the DiploMe Platform

The development of DiploMe was guided by a clear objective: to create a secure, user-friendly platform that would streamline credential recognition processes while maintaining the highest standards of data integrity and authenticity.

A structured and iterative methodology was adopted to guide the development of the new platform. To ground the project in practical expertise, beginning in September 2023, CIMEA initiated two comprehensive consultations with its credential evaluators. These sessions were instrumental in gathering insights and formulating recommendations to determine the platform's essential features and structural requirements. Based on the feedback from these discussions, a core team of seven experienced professionals was established, including experts deeply versed in credential evaluation processes and the competencies essential for digital transformation. This multidisciplinary approach ensured that the platform design was aligned with both institutional needs and the operational realities of credential evaluators.

This specialized team began by developing a structured framework for the platform, systematically defining the sequential steps for document processing, from data input to evaluation and final output. Leveraging their in-depth knowledge of credential evaluation workflows, particularly among those who had previously contributed to the development of DiploMe 1.0, they designed an architecture aimed at optimizing usability not only for the applicants but also for higher education institutions, ambassies, Cimea's credential evaluators and anyone else who needs to interact with the platform, for example to issue invoices or upload scanned comments in the case of originals (e.g. CIMEA's internal administrative and secretarial staff).

The design process was highly iterative, involving extensive planning and brainstorming sessions. The development phase was carried out in close collaboration with a team of designers and technical specialists, who contributed to defining the platform's specifications and enhancing its overall functionality. This initiative was strategically framed to integrate both technological innovation and user-centric design, ensuring a seamless and efficient workflow for credential evaluators.

5.6.1 Development Phases

September 2023: Foundational Discussions and Initial Assessments

The first phase of discussions focused on presenting the existing work platform to external technical experts and providing a comprehensive analysis of CIMEA's operational landscape.
A key issue that was introduced during these discussions was the concept of the file "Country's Evaluation Policies", a repository of country-specific evaluation policies that was initially maintained in a Microsoft Excel spreadsheet and later transferred to the CIMEA internal Wiki. The discussions highlighted the need for a machine learning-driven system that could automate the retrieval of relevant policy information for the evaluators, thereby increasing the efficiency and consistency of the decision-making process.
In addition, an extensive archive of verification methos ("Verification Chart") was reviewed. The integration of this repository into the new platform was considered critical to optimizing the document review process. Other critical areas discussed included improving the ability to track the history of requests, implementing a structured student communication system, and integrating an AI-powered customer service function to effectively handle external requests without overburdening the credential evaluators.

October 2023: Implementation Planning and Workflow Optimization

By October, the project had transitioned into a more advanced phase, with discussions focusing on the practical implementation of previously defined concepts. Specific areas of focus included:

- Introducing new status tags to monitor the progress of cases and improve the transparency of processing times.

- Defining role-based access control to ensure that different user profiles (Administrators, Senior Credential Evaluators, Junior Credential Evaluators and Support Staff) had appropriate permissions within the platform.

- Developing a mandatory document management system with country-specific exceptions to accommodate the varying regulatory landscapes of international educational systems.

- The refinement of the workflow automation mechanisms, including the systematic assignment of tasks to the credential evaluators in order to balance the workload and improve operational efficiency.

November 2023: Prototype Evaluation and System Integration

By November, the first draft of the platform's user interface was presented, receiving positive feedback regarding its clarity and usability. While minor design preferences related to color schemes and logos were raised, the overall structure was well-received.

Key areas discussed during this phase included:

- Integrating DiploMe with other institutional platforms, such as ARDI and WIKI, to create a comprehensive and interoperable digital ecosystem for assessing credentials.

- Implementing dedicated workflows for refugee applicants to ensure that the platform can accommodate applications with varying documentation requirements.

- The introduction of an advanced reporting system that allows for data-driven decision making and the optimization of processes.

- Establishing clear Service Level Agreements (SLAs) and turnaround time benchmarks to improve the predictability of service delivery.

March 2024: Collaborative Review and Future Enhancements

A critical milestone was reached in March 2024, with a comprehensive evaluation of the platform conducted during an internal Credential Evaluation Department's meeting. The session adopted a roundtable format, allowing for an open exchange of perspectives and real-time identification of emerging challenges.

Key themes addressed included:

- Improving methods for verifying documents, especially for countries with high application flows.

- Refinement of automated systems for the allocation of tasks to ensure a fair distribution of the evaluation workload.
- Development of structured verification tables that systematically map the procedures for the verification of credentials for different countries.
- Addressing internal communication challenges, emphasizing the need for knowledge sharing mechanisms between junior and senior qualification assessors.
- Optimizing workflows for e-mail correspondence, exploring automation solutions to improve response times while maintaining a personalized level of engagement with students and institutions.

5.6.2 Participatory and User-Centred Design

A core component of the development process was the adoption of a participatory approach in team composition, ensuring that diverse perspectives were integrated into the system design. This holistic strategy allowed the team to reconstruct the full user journey, incorporating the needs of all stakeholders interacting with DiploMe. Internally, credential evaluators, administrative staff and secretarial personnel now have customized access tailored to their specific tasks, ensuring a seamless interface for managing original document reception, student communications, payments, invoices and document returns. Externally, national-level stakeholders, such as universities and Italian ambassies, have been provided with dedicated spaces within DiploMe.

The resulting interface was aimed not only at improving functionality but also sought to accommodate varying levels of digital literacy, making the submission and review processes both efficient and user-friendly.

As DiploMe's design took shape, the CIMEA team engaged in iterative testing to evaluate and refine the user interface and evaluator workflows. Several cycles of mock evaluations were conducted, with credential evaluators testing the system in real time, followed by immediate feedback sessions. The iterative process allowed the development team to make critical adjustments, improving the intuitiveness of the user interface and ensuring that evaluators could easily navigate the new digital environment.

Key adjustments made during the testing phase included:

- Simplified navigation. The applicant dashboard was refined to offer clearer, step-by-step

instructions, guiding users through each document upload and verification step. This helped mitigate issues of incomplete information, which had previously led to frequent follow-ups with applicants.

- Enhanced document verification protocols. Automated flags were incorporated to detect potential errors or incomplete data in submitted documents, helping credential evaluators quickly identify and address issues. These flags reduced manual oversight needs and improved overall processing speed

5.6.3 Implementation and Capacity Building

Rather than a wholesale system overhaul, DiploMe was introduced in a phased manner, allowing users to gradually familiarize themselves with new functionalities. This incremental approach reduced operational risks and provided opportunities for iterative improvements based on user feedback. The transition strategy was further reinforced through hybrid operational models, where legacy systems remained functional during the initial rollout phase to ensure business continuity.

To maximize the effectiveness of this transition, CIMEA recognized that technological advancements are only as valuable as their users' ability to leverage them. As a result, it invested in comprehensive training programs to equip staff with the necessary skills to navigate the new platform efficiently. Customized training sessions were designed for different user roles, ensuring that each department could fully utilize DiploMe's capabilities. Additionally, the development of an internal knowledge repository facilitated continuous learning and peer-to-peer support, strengthening institutional knowledge management practices.

5.7. Organisational and Strategic Implications

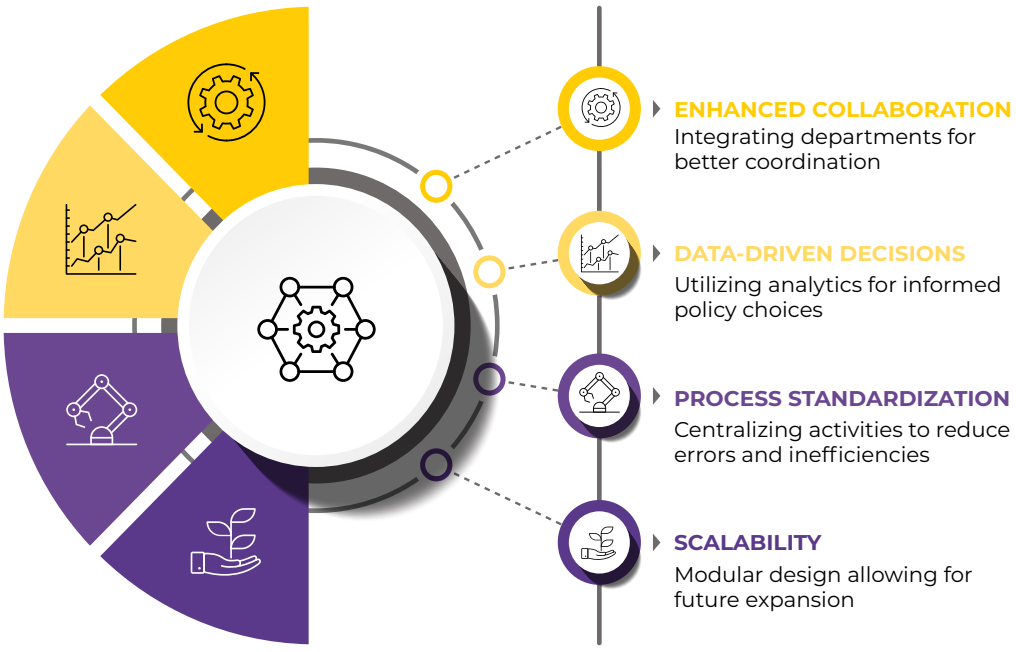
The introduction of DiploMe represents much more than a simple technological enhancement; it marks a fundamental shift in how CIMEA structures and oversees credential evaluation processes. This transformation is rooted in several core principles of organizational management, which collectively drive a more efficient, scalable, and data-informed approach to credential recognition. A key component of this evolution is the standardization of processes and the improvement of operational efficiency. By consolidating all credential evaluation activities within a single digital ecosystem, DiploMe reduces inconsistencies in case management, minimizing the likelihood of errors and inefficiencies stemming from redundant or disjointed workflows. This operational alignment not only optimizes procedural execution but also enhances the precision and dependability of evaluation outcomes.

Another fundamental principle guiding the design of DiploMe is its scalability and adaptability for future growth. Its modular architecture allows for the seamless integration of new capabilities as institutional requirements evolve, ensuring that CIMEA remains at the forefront of digital innovation in credential evaluation. This forward-thinking strategy guarantees that the platform can accommodate emerging challenges and regulatory changes without necessitating a full structural redesign.

Additionally, the deployment of DiploMe strengthens data-driven decision-making by incorporating advanced analytics and reporting tools. These features enable CIMEA to extract valuable insights that inform policy development, track trends in credential recognition and evaluate the effectiveness of various assessment methodologies. This analytical capacity enhances strategic planning and facilitates the ongoing refinement of evaluation protocols in response to global educational shifts.

Moreover, DiploMe fosters cross-departmental collaboration by unifying previously disconnected processes into a cohesive digital environment. By breaking down operational silos, the platform supports a more agile and interconnected institutional structure, streamlining communication and promoting knowledge-sharing across teams. This integration improves internal coordination while reinforcing CIMEA's ability to address the complexities of credential evaluation in a rapidly digitalizing and globalized academic landscape.

Through this comprehensive transformation, DiploMe emerges as a benchmark for digital evolution in credential evaluation, illustrating how technology can drive operational excellence, strategic flexibility and institutional synergy.



Lastly, the development of DiploMe exemplifies best practices in digital transformation within the credential evaluation sector. By employing a participatory methodology, leveraging effective change management strategies, and prioritizing user experience, CIMEA has successfully launched a future-ready platform that balances efficiency and inclusivity.

5.8. Assessing Impact: Insights from Credential Evaluators

The digital transformation process within CIMEA represents a profound organizational shift that has redefined credential evaluation practices, communication structures, and professional roles within the institution. Through an in-depth analysis of interviews with both junior and senior credential evaluators, aged between 26 and 68, a clear pattern emerges regarding the extensive impact of digitalization. While the implementation of DiploMe and related digital tools has significantly enhanced efficiency and standardization, it has also reshaped work methodologies, introducing both opportunities and challenges at various levels of experience and responsibility.

A primary outcome of this transformation is the increased efficiency in credential evaluation. Evaluators consistently reported that the transition from a manual, paper-based system to an automated platform reduced processing times dramatically. Senior evaluators recalled a time when individual evaluations required over an hour to complete, whereas the current system enables straightforward cases to be processed in approximately six to seven minutes. This shift has not only optimized individual workflows but has also facilitated a more structured and uniform approach to evaluations. The standardization of procedures has been particularly instrumental in minimizing discrepancies between evaluations, ensuring consistency in credential recognition across different regions and educational systems. Moreover, junior evaluators emphasized that this efficiency has not only streamlined their tasks but has provided them with the tools to handle increasing workloads more effectively, ensuring that each evaluation is completed within set time frames without compromising quality.

However, this increased efficiency has also led to a reconfiguration of the responsibilities and roles of credential evaluators. Junior evaluators, who previously relied on extensive supervision for assessments, now engage in a more autonomous workflow, with digital tools guiding their decision-making in standardized cases. This shift has provided them with greater independence, while simultaneously reinforcing the role of senior evaluators as mentors and overseers of complex cases. The transition to digital tools has created a clear division of labor where senior evaluators focus on strategic oversight and policy development, ensuring that complex or non-standard evaluations receive the attention they require. Many senior evaluators noted that their role has transitioned toward more strategic and advisory tasks, underscoring the importance of their expertise in dealing with nuanced, non-standard cases that require more contextual judgment. This realignment has led to a "sectorized" model of specialization, where evaluators focus more intensively on specific country or regional qualifications, fostering deeper expertise in assigned areas. A senior evaluator reflected that being able to specialize in a region with which they are deeply familiar has increased their confidence in decision-making and enhanced the quality of their evaluations.

Beyond changes in workflow and responsibility distribution, digitalization has had a profound effect on collaboration. The integration of communication tools within DiploMe has facilitated seamless peer-to-peer interactions, as well as more structured engagement between junior and senior staff. Prior to digitalization, evaluators relied primarily on emails and in-person consultations, which, while effective in fostering dialogue, often resulted in slower response times and difficulties in tracking decision-making processes. The introduction of shared digital workspaces has enhanced transparency, enabling real-time collaboration and more efficient exchange of information. Junior evaluators in particular emphasized the value of having immediate access to previously completed evaluations, verification policies and country-specific guidelines, which have significantly reduced the reliance on ad hoc consultations. A junior evaluator noted that having all relevant information available in a single system eliminates the need to wait for responses from colleagues, as answers can be accessed directly within the platform. This streamlines the workflow, increases efficiency, and reduces interruptions throughout the working day. Yet, while digital transformation has enhanced accessibility to institutional knowledge, evaluators highlighted the importance of preserving the depth of analysis in credential evaluation. The availability of pre-filled templates and automated recommendations streamlines many processes, but evaluators expressed concerns regarding the potential for over-reliance on automation. Several interviewees pointed out that while standardized cases benefit from automation, complex or ambiguous evaluations require a degree of analytical scrutiny that cannot be replicated by digital tools alone. This perspective was shared across both junior and senior evaluators, with the latter emphasizing the necessity of maintaining human oversight to safeguard the integrity of the evaluation process.

Training and adaptation to digital tools emerged as a key theme across interviews. While most evaluators adapted swiftly to the digital platforms, differences in learning curves were evident based on experience levels and prior familiarity with technology. Junior evaluators, having entered the profession at a time when digital tools were already in place, generally found the transition smoother, whereas

some senior evaluators, accustomed to manual workflows, required additional time to adjust. Despite this, a common sentiment among evaluators was the need for continuous training, particularly as new features and functionalities are integrated into the platform. Some evaluators suggested that while initial training sessions provided a strong foundation, periodic refresher courses and targeted workshops on more advanced digital functionalities would enhance long-term proficiency.

The broader implications of digital transformation extend beyond internal workflow optimization. Several evaluators underscored the strategic role of digitalization in positioning CIMEA as a leader in credential evaluation. The ability to process a higher volume of applications with increased accuracy has strengthened CIMEA's capacity to support international student mobility, a key institutional objective. However, as demand for credential evaluations continues to rise, evaluators expressed concerns regarding scalability. While automation has alleviated many operational bottlenecks, evaluators cautioned that the sheer increase in credential requests may eventually outpace the capacity of even the most efficient digital platforms. This raises important considerations regarding the future integration of artificial intelligence (AI) within the evaluation process.

While AI has not yet been fully incorporated into daily credential evaluation workflows, evaluators acknowledged its potential as an adjunct tool. Some noted that AI-driven systems could be leveraged for preliminary assessments, document verification, and data organization, thereby allowing human evaluators to focus on cases requiring contextual judgment and expert analysis. However, skepticism remains regarding the extent to which AI can replicate the nuanced decision-making required in credential evaluation. Senior evaluators, in particular, emphasized that while AI may facilitate operational efficiency, it should be implemented cautiously to ensure that evaluative integrity and contextual understanding remain central to decision-making processes.

In reflecting on the broader impact of digital transformation, evaluators described a shift in their professional engagement and job satisfaction. With many repetitive and administrative tasks now automated, evaluators expressed an increased ability to engage in more intellectually stimulating aspects of their roles, including policy development, case studies, and cross-border collaboration. Several noted that this shift has reinforced a sense of professional purpose, as they are able to contribute more meaningfully to the refinement of credential evaluation practices.

Despite these positive developments, digital transformation remains an ongoing process. Evaluators acknowledged that while substantial progress has been made, further refinements are necessary to optimize system integration and ensure that digital tools continue to evolve in response to institutional and operational needs. Moving forward, the continuous adaptation of processes and the strategic alignment between digitalization and credential evaluation expertise emerge as fundamental elements for enhancing CIMEA's operational efficiency and optimizing the provision of information, verification, and qualification compatibility services.

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CHAPTER 6

Implementing AI in CIMEA's Qualification Recognition Processes

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6.1. Preliminary Assessment of AI Applications

As part of a joint academic collaboration aimed at modernizing the recognition of academic credentials, CIMEA, together with the Laboratory on Innovation and Artificial Intelligence (IALAB) (IALAB) at the University of Buenos Aires, in 2023 carried out an initial evaluation to assess the feasibility of incorporating artificial intelligence into its qualification recognition processes. The first stage of this research centred on an extensive review of existing case studies to analyse the worldwide implementation of artificial intelligence (AI) and blockchain technologies in the enhancement of academic credential assessment. A total of nineteen case studies were examined, encompassing regions such as Europe, Latin America, Japan, and the United States, highlighting instances where AI was implemented in educational institutions and government management.

Blockchain technology has emerged as a fundamental enabler in this process, ensuring the creation of secure, tamper-proof academic records that enhance the integrity of credential verification. Simultaneously, AI-powered tools have been instrumental in identifying fraudulent credentials and instances of plagiarism, thereby reinforcing the trustworthiness of academic documentation.

Moreover, the integration of digital platforms has significantly streamlined the authentication process, reducing the administrative burden associated with credential evaluation while facilitating cross-border recognition. These technological advances highlight the increasingly pivotal role of digital transformation in academic credential recognition and lay a robust foundation for the adoption of AI-driven innovations within CIMEA. A comprehensive overview of these technological initiatives is provided in Annex 1.

Building on the identified use cases, a deeper analysis was conducted to examine how various technologies, techniques, and functionalities could be leveraged to enhance and streamline academic qualification recognition. Artificial intelligence and digital authentication methods offer significant opportunities to improve the accuracy, security, and efficiency of verification processes.

Among these innovations, computer vision and image analysis techniques allow AI systems to recognize key features of authentic diplomas, such as official seals and signatures, while optical character recognition (OCR) facilitates the digitalization of physical documents, enabling automated comparison with institutional records. Metadata analysis further strengthens authenticity verification by examining document origins, timestamps, and modification history.

Security enhancements also play a crucial role in mitigating fraudulent credentialing. Two-factor authentication systems add an additional verification layer when diploma validation is requested, ensuring that only authorized individuals can access or confirm academic records. Likewise, anomaly detection models trained on neural networks can identify irregularities in document formatting, font usage, or design inconsistencies that may indicate forgery.

Advanced cryptographic techniques such as digital signatures and steganography introduce an extra layer of protection by embedding hidden authentication markers within documents. Watermarking and encrypted signatures embedded in diplomas can be cross-referenced with official registries to confirm authenticity. Similarly, biometric recognition offers a personalized verification mechanism by linking academic credentials with the individual's facial features or biometric data.

Interoperable and decentralized verification methods also present promising applications. Searchable databases and blockchain-based registries enable institutions to maintain secure, tamper-proof academic records that can be easily retrieved and validated. Additionally, NFC (Near Field Communication) and RFID technologies provide embedded digital storage solutions within diplomas, allowing real-time authentication when scanned by compatible devices. Complementary to this, QR codes can serve as direct links to official databases, offering instant access to a diploma's digital counterpart. A detailed breakdown of these techniques and their specific applications is provided in the table below:

Technique / functionality	Description
Artificial vision	AI can be trained to recognize specific features of authentic diplomas, such as seals or signatures.
Optical Character Recognition (OCR)	OCR can scan and read physical diplomas, converting them into digital text. This facilitates comparison with official databases and records to verify authenticity.
Two-factor authentication systems	When requesting a diploma verification, additional authentication, such as a code sent via SMS or an authenticator app, may be required to ensure the request is legitimate.
Image analysis and pattern recognition	Neural networks can be trained to detect forgeries in documents by identifying inconsistencies in design, text, or images. They can also be trained to detect certain characteristics in diplomas such as seals, signatures, and other elements.
Metadata analysis	By analyzing the metadata of a digital document, you can determine its origin, creation date, and whether it has been modified.
Anomaly detection	AI can be trained to detect anomalies in diplomas, such as unusual fonts, incorrect spacing, or altered logos.
Steganography	Steganography involves hiding information within images or documents. Diplomas could contain hidden information that verifies their authenticity, such as a digital signature or a unique code. Diplomas could also incorporate digital watermarks (watermarking) to make counterfeiting more difficult and easier to verify.
Verification of the authenticity of digital signatures	It is possible to compare the digital signature of a document with that of the authentic diploma to determine if it has been altered.
Search systems and databases	Educational institutions can maintain centralized and interoperable databases between different organizations that can be consulted to verify the authenticity of a diploma. These systems convert words or documents into numerical vectors that represent their meaning. By comparing these vectors, semantic similarity between different texts can be determined.
Facial and biometric recognition	Systems could identify features in facial images or biometric data to compare with a database that allows recognition of individuals. If the diplomas include photos, it can be verified that the person presenting the diploma is the same as the person in the official registered photo.
NFC (Near Field Communication) Technology	It is feasible to incorporate NFC chips into diplomas that store digital information about the diploma. By scanning the chip with a compatible device, this information can be accessed and its authenticity verified.
RFID technology	Similar to NFC, diplomas could incorporate RFID tags that contain information about the diploma, such as the date of issue or the name of the graduate. These labels can be scanned to verify the authenticity of the document. RFID devices emit a signal that can be read by a scanner to access stored information.
QR Code	QR codes contain information that can be read by a scanner or camera. A QR code on the diploma could link to an official database or a digital version of the diploma to verify its authenticity.

Table 1. *Strategic Use of Data and Artificial Intelligence in Qualification Recognition*

During the second phase of this study, after conducting a thorough evaluation of the proposed solutions, interviews were carried out with representatives from different initiatives to gain comparative insights into the role of different technologies in academic qualification recognition, identifying both commonalities and varying approaches across diverse contexts.

In a third phase, and prior to identifying concrete opportunities for integrating AI into CIMEA's credential evaluation workflow, a comprehensive diagnostic was conducted through a participatory methodology that directly involved CIMEA credential evaluators, technical staff, and AI Lab researchers.

This analysis examined each stage of the qualification recognition workflow, mapping out all procedures, tasks, and subtasks to pinpoint areas where automation or AI-driven solutions could provide added value. The process required a participatory and interdisciplinary approach, actively involving all key stakeholders. To ensure successful adoption, it was essential to restructure existing workflows, enhance technological infrastructure, and provide continuous training to CIMEA's personnel, all of which are crucial for the effective deployment of AI solutions.

Consequently, the assessment carried out and the AI implementation opportunities identified were aligned with the OECD AI System Life Cycle[135], which consists of four essential stages:

i) Planning and design, encompassing data collection, processing, model creation, and interpretation.
ii) Verification and validation.
iii) Deployment.
iv) Operation and monitoring

[135] OECD, *Recommendation of the Council on Artificial Intelligence*, OECD/LEGAL/0449, adopted on 22 May 2019 and revised on 3 May 2024. Available at: https://legalinstruments.oecd.org/en/instruments/OECD-LEGAL-0449 [last accessed 7 May 2026].


OECD AI Life Cycle Framework
PLANNING AND DESIGN
Initials phase involving data collection and model creation
VERIFICATION AND VALIDATION
Ensuring accuracy and reliability of models
DEPLOYMENT
Implementing the model into operational environments
OPERATION AND MONITORING
Ongoing oversight and adjustment of operations

6.2. Opportunities AI Integration

As a result of the holistic diagnosis of CIMEA's internal workflows, six opportunities were identified for integrating automation and artificial intelligence into the qualification recognition process. These opportunities are designed as specific solutions to incorporate data-driven enhancements and AI-based optimizations into CIMEA's existing methodologies. In order to prioritize process improvement from a systemic organizational perspective, the opportunities were grouped into three key axes of analysis:

1. the detection of anomalies in academic credentials that may indicate potential fraud;
2. customer services;
3. prediction of the behavior of workflow procedures.

The analysis of CIMEA's administrative procedures reveal several areas for technological advancement, particularly given the absence of comprehensive AI solutions and the high complexity, lack of standardization, and variability in qualification recognition procedures. Implementing solutions that facilitate data interoperability and automate processes, such as the automatic extraction of relevant document information, document authentication through pattern detection, and the identification of discrepancies, could significantly enhance the qualification recognition process. Moreover, predictive capabilities would allow CIMEA to anticipate emerging trends, including fluctuations in application volumes.

To enhance operational efficiency and optimize CIMEA's workflows, the following opportunities were identified. These opportunities will be further examined in the following sections, with particular attention to the regulatory and ethical frameworks that condition their implementation.

6.2.1 Operational Efficiency and Case Allocation

Currently, CIMEA's Senior Credential Evaluators are responsible for manually reviewing incoming applications and assigning them to appropriate staff members for verification and comparability assessments. Although this method is effective, it could be significantly improved through the integration of artificial intelligence. AI-driven automation could facilitate case assignments by considering key factors such as an evaluator's current workload, linguistic expertise, and familiarity with similar cases. Furthermore, the introduction of a real-time dashboard would refine the allocation process by offering a clear and dynamic visualization of staff workload distribution.

An additional benefit provided by the information displayed on the dashboard is the ability to cross-reference such information with key quality and service indicators of the area, related to the number of open and pending requests. In this way, operational delays in daily activities can be detected in advance. Moreover, this tool will enable the Senior Credential Evaluator to access early information for conducting comparative analyses between countries in the case studies that are routinely carried out. These analyses serve as a necessary guide for consultation and support in the daily tasks of junior credential evaluators. In summary, the data generated through this system would also provide CIMEA with valuable insights, supporting strategic decision-making in areas such as resource allocation and workflow efficiency improvements.

6.2.2 Fraud Detection and Document Authentication

During the comparability and verification processes, CIMEA's credential evaluators are responsible for assessing the authenticity of submitted documents, ensuring that no irregularities indicate potential fraud. The integration of AI-driven tools could provide valuable support in detecting fraudulent elements within applicant documentation, enhancing the efficiency of the validation process. For instance, AI could cross-reference submitted documents against official databases or internal digital forensic checklist to verify consistency by recognizing patterns in documents issued by different institutions or countries. If discrepancies emerge - such as an altered seal or an atypical signature, inconsistencies in fonts, pixelated stamps, or distorted signatures - the system could generate an alert, prompting further review by the evaluator. While AI would not determine final outcomes, it would serve as an early detection tool, highlighting documents that warrant additional scrutiny and prioritizing cases that require deeper examination.

An AI model trained to identify anomalies could generate automated alerts when a suspicious element is detected. If an irregularity, such as a misaligned signature, is found, the system could issue a notification: "Anomaly detected." Conversely, when no discrepancies are identified, it would confirm: "No anomaly detected."

This feature could be seamlessly integrated into the DiploMe platform, offering multiple benefits:

- Assisting evaluators in detecting document inconsistencies.
- Reducing the time required for fraud identification.
- Shifting the evaluator's role from manually identifying anomalies to reviewing AI-generated insights.

This shift would not only enhance the validation process but also minimize errors associated with fatigue or lapses in attention, common challenges in prolonged verification tasks. Crucially, AI would act as a support system rather than a decision-maker, flagging potential concerns while ensuring that human evaluators maintain full authority over the final assessment.

Different ways to achieve this opportunity:

Option 1: Natural Language Processing for Assessing Title Accuracy

This method consists of training the system to apply natural language processing (NLP) to evaluate the accuracy of text within submitted academic qualifications at CIMEA. The AI would analyses content by verifying terminology, grammar, and other predefined review criteria established by CIMEA.

Option 2: Machine Learning for Fraud Detection[136]

In this alternative, the system would be designed to identify typical characteristics of authentic credentials, allowing it to detect deviations that may indicate potential falsifications. Beyond analysing document content, AI could enhance the verification process by cross-referencing metadata with official and regularly updated databases; AI-driven system could use this data to verify accuracy and consistency by automatically matching it against official records. Detecting discrepancies at this initial stage would facilitate the identification of basic inconsistencies early on, potentially reducing the need for more extensive manual verification when anomalies are found from the outset.

[136] See more about Machine Learning in: *What is Machine Learning?*, Oracle Cloud Infrastructure (OCI), available at: What is machine learning? | Oracle Argentina

Option 3: Computer Vision for Anomaly Detection[137]

This approach aims to optimize and streamline the review of academic credentials. By leveraging computer vision, AI algorithms can be trained to detect and highlight specific features within documents that might indicate fraudulent activity. The system would automatically mark these elements by outlining critical areas within the document that require further validation by credential evaluators.
This method not only simplifies document review but also minimizes the risk of overlooking essential details, ensuring that key elements are thoroughly examined. Additionally, the AI could be programmed to recognize specific components outlined in CIMEA's Digital Forensic Checklist, enabling it to focus on the most relevant indicators of authenticity. By doing so, the evaluation process would become more precise and reliable, equipping evaluators with an advanced tool to strengthen the integrity of academic credential verification.

AI Model Training: additional considerations

If AI systems based on supervised learning are to be implemented, several critical factors must be taken into account.:

- Training Databases: Training datasets should align with the specifications defined by interdisciplinary teams overseeing the AI lifecycle. Furthermore, data formats must be compatible with the requirements of the selected AI models.
- Dataset Preparation: Dataset preparation should ensure sufficient volume and diversity to adequately represent all relevant classification criteria required for detection tasks.
- Object Identification: It is crucial to define and annotate key elements that characterize an authentic credential within images. These may include official logos, seals, signatures and specific text structures.
- Data Labelling and Training: Accurate labelling of data, either through manual annotation or self-labelling tools, is essential for training the AI system effectively.
- Testing Data: A separate test dataset must be allocated to assess the model's performance after training. Given CIMEA's existing resources, it is assumed that relevant examples are available to support this evaluation phase.
- Technological Infrastructure: A robust infrastructure is necessary, including data pipelines, storage solutions, and computational resources to support AI model deployment.

[137] See more about Computer Vision in: "What is computer vision?" , IBM, available at: What is computer vision? | IBM

- Data Protection Compliance: Ensuring compliance with data protection regulations is imperative.

This may involve anonymizing sensitive data and implementing restrictive yet proportionate access controls. Additionally, adherence to ethical principles and legal frameworks governing AI development, deployment and application must be maintained.

6.2.3 Automated Communication with Applicants

During the document review process, CIMEA staff may need to inform applicants of missing documents or required corrections. AI could enhance this process by automatically generating and dispatching email notifications whenever an issue is identified and confirmed by an Evaluator. For instance, if an AI system detects a discrepancy in a submitted document, and the Evaluator validates the issue, the system could automatically draft and send an email to the applicant.

Currently, Evaluators have access to customizable email templates that can be sent automatically. This functionality could be incorporated into the DiploMe platform, where AI would handle the notification process.

This integration would allow Evaluators to transition from manually composing and sending emails to reviewing and approving AI-generated messages. With this optimization, the likelihood that errors, anomalies, or other omissions in the supporting documentation remain unnoticed – without being reported to the applicant during the course of the procedure's lifecycle, from initiation to completion – would be reduced. In this way, the overall productivity of the credential validation process would be improved. Automating this task would free up time, enabling employees to concentrate on more complex responsibilities. Additional details regarding this workflow can be found in the process map in Annex 2.

6.2.4 AI-Based Qualification Classification

When credential evaluators at CIMEA review a submitted degree, they must determine whether it qualifies as an academic or professional credential. AI could support this classification by analysing supplementary documentation, such as transcripts or academic records, and providing recommendations based on historical case data.

The AI system would compare the new degree with past cases from the same country, drawing from a centralized "Country Policies" and "Case Studies" repositories that consolidates relevant case details.

By referencing prior classifications, the AI could suggest whether the degree should be categorized as academic or professional, expediting the classification process and improving decision accuracy in alignment with CIMEA's established evaluation criteria.

To develop this system, well-structured historical data covering both academic and professional degrees is required. Properly labelled datasets would enable AI to recognize classification patterns effectively. Given CIMEA's extensive experience and prior assessments, the organization already possesses a strong foundation of data to support the implementation of this solution.

6.2.5 Enhancement of Customer Service Systems

Currently, CIMEA's Customer Service module allows applicants to submit inquiries through the DiploMe platform, with responses provided via a live-chat during business hours and email for after-hours queries. However, this process could be optimized by integrating a conversational agent (chatbot) to handle inquiries more efficiently, improving responsiveness and reducing processing time. This solution would reduce the operational workload of CIMEA staff, and the newly available time would facilitate the undertaking of exploratory research on the area's productivity. By way of example, if repeated questions were detected regarding currency, payment methods, and payment due dates, updates could be recommended to the explanatory texts available on the DiploMe platform.

An opportunity exists to embed a chatbot within the DiploMe platform, drawing on data from a comprehensive survey of applicant inquiries conducted by CIMEA. The collected data would help identify frequently asked questions and enable the chatbot to be programmed with accurate, predefined responses. In addition, the real-time *modus operandi* would provide essential input for updating the organization's current matrix of frequently asked questions. To ensure continuous improvement, reinforcement learning algorithms could be applied, enabling the chatbot to refine its responses over time, adapt to emerging queries, and enhance service quality.

Implementation Plan for the Conversational Agent:

Stage 1: Rules-Based System

Initially, a simple rules-based chatbot could be deployed to address frequently asked questions. Drawing from CIMEA's repository of over 300 common inquiries, this chatbot would generate responses based on predefined conditions. It would be programmed to handle specific topics, and in cases where it lacks an answer, it would offer applicants the option to contact a human representative. This setup ensures efficiency while maintaining applicant support.

Stage 2: Machine Learning-Based System

The second phase would incorporate machine learning, enabling the chatbot to handle open-ended

queries. Instead of relying solely on predefined responses, it would interpret and respond to applicant inquiries based on contextual understanding. Advanced natural language processing (NLP) models, such as Transformer-based architectures, would be integrated to improve the chatbot's ability to process diverse queries. This approach would also make the chatbot more adaptive, allowing it to learn from user interactions. Feedback mechanisms could be implemented to refine the chatbot's accuracy. If users rate responses or introduce new types of inquiries, the system would progressively adjust its replies. Moreover, integrating external databases would allow the chatbot to access real-time information on university requirements and credential recognition standards, ensuring its responses remain accurate and up to date. To maintain the chatbot's effectiveness, CIMEA should regularly monitor user interactions, collect feedback, and make necessary adjustments. Ongoing evaluation of the system's performance and improvements based on real-world data will be key to ensuring the chatbot's long-term success.

To refine responses over time, expert reviews should be scheduled. Relying exclusively on user feedback is insufficient, as professional oversight is necessary to identify potential errors or inconsistencies. Regular monitoring should be conducted to identify any limitations in the agent's performance and make the necessary adjustments for ongoing improvement. The plan for improving responses must be based on structured data collected from actual interactions with the system and CIMEA's verified resources. While incorporating external web-based learning could enhance adaptability, this approach introduces risks such as biases and inaccuracies.

6.2.6 Predictive Analysis of Application Flows

CIMEA has the potential to leverage historical data from previous requests to anticipate seasonal demand fluctuations, offering valuable insights for optimizing resource planning.

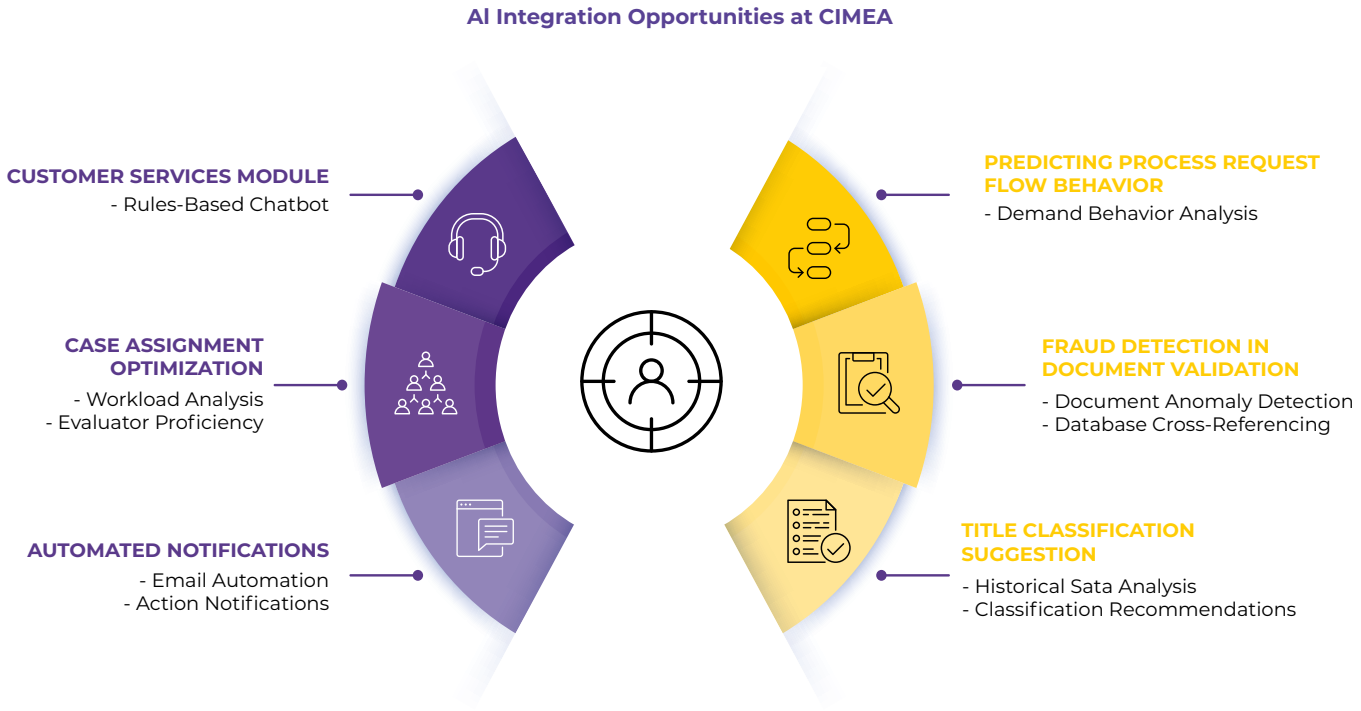
In analyzing the figures reported in the questionnaires from the preliminary consultancy survey regarding requests for comparability and degree verification, an exponential increase in operations was observed. Within the service provided by CIMEA from 2019 to 2023, an end-to-end analysis of the stock of procedures revealed a variation and growth from 1,434 procedures in 2019 to 22,578 in 2023. By analysing these demand patterns, CIMEA could proactively prepare for peak periods, such as surges in evaluation requests, allowing for more efficient resource allocation. This predictive capability would enhance operational effectiveness while enabling more strategic decision-making in managing available resources.

To take advantage of this opportunity, the current system could be upgraded with new functionalities to facilitate historical data analysis. By recognizing recurring trends in past demand, CIMEA could construct predictive models that provide projections for future workloads. Implementing such

models would enable data-driven decision-making, ensuring that resources are allocated efficiently during high-demand periods. One possible approach involves automating demand forecasting using machine learning techniques. Time-series models, for instance, could be applied to detect trends, seasonal variations, and patterns of autocorrelation within the dataset, which are critical for making accurate predictions. Models such as Recurrent Neural Networks (RNNs), specifically designed to handle sequential data, could analyse historical trends to anticipate future fluctuations, capturing long-term dependencies in demand patterns. Additionally, Transformer-based models offer a promising alternative, as they are particularly well-suited for time-series forecasting, providing greater accuracy and computational efficiency.

For these models to function effectively, CIMEA must first ensure the availability of high-quality data to enable precise forecasting. Relevant factors, such as the university admission calendar, regulatory changes, economic conditions, and historical request volumes, should be incorporated into the dataset, as these elements influence the volume of evaluation requests. The data should also cover a wide range of time periods to reflect different seasonal conditions and variations in CIMEA's activities. Data visualization tools would also be valuable in this process, allowing CIMEA to explore and identify seasonality, trends, and other key components in the demand data.

Beyond simply predicting demand, understanding the underlying drivers behind these fluctuations is equally essential. Developing analytical models to examine the factors influencing demand behaviour would provide deeper insights into its variations over time. Techniques such as Decision Trees, Random Forests, and Transformers could be employed not only to generate forecasts but also to interpret the variables affecting demand shifts. This would allow CIMEA to make more informed decisions and adopt targeted management strategies aligned with the specific factors influencing accreditation requests during different periods.



To conclude, the opportunities identified offer CIMEA the potential to leverage AI to streamline processes, enhance operational efficiency and make data-driven decisions. The implementation of AI-driven solutions can help optimize resource allocation but also improve the accuracy of document verification and fraud detection, thus contributing to a more efficient and effective qualification recognition process. By focusing on predictive capabilities and process automation, CIMEA can position itself to handle seasonal fluctuations more strategically, ensuring continuous improvements in service delivery and resource management. The following table illustrates the specific functionalities associated with each identified opportunity and their impact on process automation and predictive capabilities.

Opportunity	Automation	Intelligent detection	Intelligent assistant	Prediction	Content generation
Opportunity 1: Assistance in Assigning New Cases to Credential Evaluators	✓		✓		
Opportunity 2: AI-Supported Fraud Detection in Document verification	✓	✓	✓	✓	✓
Opportunity 3: Automated Application Notifications	✓		✓		✓
Opportunity 4: AI-Based Title Classification Suggestions	✓	✓		✓	✓
Opportunity 5: Customer Service Module Enhancement.	✓				✓
Opportunity 6: Predicting Request Flow requestion	✓	✓		✓	✓

Table 2. *Key AI Opportunities in Qualification Recognition*

In line with the holistic approach described above, the figure below illustrates the correlation between the 6 intelligent automation opportunities proposed for CIMEA's foreign qualification evaluation processes, their impact and the areas for improvement within the functional organization. It distinguishes between those directly influencing the daily operational management of the Credential Information and Evaluation Department and those contributing to the strategic objectives of the Directorate and the International Cooperation and Policy Development Department.

Opportunity	Area / Function (primary)	Dimension
Op.1: Assistance in Assigning New Cases to Credential Evaluators	Credential Information and Evaluation Department	Strategic Vision & Human Resources Planning — efficient allocation of human resources
Op.2: AI-Supported Fraud Detection in Document Verification	Credential Information and Evaluation Department and International Cooperation and Policy Development Department	Integrity in academic records & validity of stored information
Op.3: Automated Application Notifications	Secretaries (Front Office) & Credential Information and Evaluation Department	Quality of service & intelligent user assistance (Front End)
Op.4: AI-Based Degree Classification Suggestions	Credential Information and Evaluation Department	Optimized decision-making based on standardized assessment axes
Op.5: Customer Service Module Enhancement	Secretaries & Credential Information and Evaluation Department	Quality of service & intelligent user assistance (Front End)
Op.6: Request Volume Forecasting (Predicting Request Flow)	Managing Director / Credential Information and Evaluation Department and International Cooperation and Policy Development Department	Strategic Vision & Planning — impact on resource distribution

Table 3. *Operational and Strategic AI Opportunities within CIMEA's Qualification Recognition Processes*

6.3. Lessons Learned and Recommendations

Based on the research conducted, a series of recommendations are outlined for incorporating AI into CIMEA's processes.

6.3.1 Multidisciplinary Approaches to AI Development

The successful integration of artificial intelligence (AI) into CIMEA's operational processes necessitates the establishment of a multidisciplinary team that brings together a diverse range of expertise. This approach ensures a holistic and well-structured strategy for implementing digital solutions effectively, fostering a balanced integration of both technical and non-technical perspectives. By leveraging diverse skill sets, the team can comprehensively address challenges and ensure that all dimensions of the project are considered.

The core team should comprise technological experts, including Data Engineers, Systems Engineers, AI Modelling Engineers, and Computing Engineers. These professionals will lead the technical implementation of AI-driven solutions, ensuring that the digital transformation objectives are met. However, a purely technical team would be insufficient to guarantee the effective adoption and institutionalization of AI-based processes. To establish a more comprehensive approach, it is imperative

to incorporate experts in administrative sciences, particularly individuals with expertise in management, organizational processes and training. These professionals play a crucial role in overseeing the operational aspects of AI integration and ensuring that digital solutions are seamlessly incorporated into the existing institutional framework.

In addition to technical and managerial expertise, legal proficiency must be a fundamental pillar of the team. Given that AI solutions rely extensively on data, it is essential to establish robust legal and ethical frameworks to govern data usage. Legal specialists, particularly those with expertise in data governance and data protection policies, will be instrumental in ensuring compliance with privacy regulations and international legal standards. Furthermore, the development of ethical guidelines is critical to safeguarding organizational integrity and user rights, reinforcing a responsible approach to AI adoption.

Beyond these core competencies, the team must also exhibit strong institutional management capabilities. Effective collaboration with internal and external stakeholders is a prerequisite for successfully implementing the anticipated organizational changes. Given the cross-disciplinary and cross-functional nature of the team, its members should possess a combination of analytical skills, meticulous attention to detail and the ability to maintain a holistic perspective. These attributes will be essential in ensuring that the broader implications of AI integration are fully accounted for, thereby fostering collaboration and achieving sustainable, long-term outcomes.

6.3.2 Organisational Change and Institutional Adaptation

The implementation of digital transformation and AI-driven projects necessitates meticulous planning and thoughtful execution. Effectively integrating these technologies into credential evaluation workflows requires a well-structured change management strategy to guarantee that all relevant parties, particularly credential evaluators and administrative personnel, are sufficiently equipped and supported throughout the transition. Moreover, it calls for a fundamental reassessment of the role of technology within these processes, especially in the delivery of credential evaluation services, ensuring adherence to international regulatory frameworks and standards.

Organizational change is widely recognized as a complex and multifaceted process that entails modifications to key institutional elements such as structure, processes, culture, strategy and technology (De Arregui, 2023). The effectiveness of such transformations is largely contingent upon how well these changes are managed and integrated into the existing institutional framework.

A key determinant of successful organizational change is the extent to which human capital management is prioritized throughout the transformation process. As highlighted by Arregui, effective

change management necessitates a strong focus on human resources during both the planning and execution phases. Ensuring that personnel affected by institutional changes receive adequate support and preparation is fundamental to facilitating a smooth transition and fostering widespread acceptance of new operational practices.

The introduction of AI solutions and the optimization of credential recognition procedures will lead to profound transformations in the role of credential evaluators, necessitating adjustments in verification and comparability procedures. These shifts underscore the importance of identifying new control milestones to maintain rigorous quality assurance standards.

A core principle of the Lisbon Recognition Convention is the commitment to fair and equitable assessment for all applicants. To uphold this principle, recognition systems must accommodate a wide array of qualification formats and varying levels of data maturity. This includes both "born-analogue" credentials, such as scanned paper-based qualifications with associated verification mechanisms, and "born-digital" credentials, such as verifiable digital certificates[138]. Furthermore, these systems must provide applicants with transparent access to their application status throughout the process. When issuing AI-assisted and digital recognition statements, organizations must ensure that data formats adhere to robust security protocols. Verification tools should be readily available at all times, ideally incorporating self-service functionalities that enable users to obtain or request updated recognition statements without necessitating manual intervention.

Fostering the integration of professional skills is a critical component of successful change management. This process requires an evaluation of team members' competencies, including their problem-solving capabilities and individual contributions. Based on these assessments, targeted professional development programs should be implemented to enhance skill sets and support the transition to new operational models.

Lastly, recognizing achievements and actively involving team members in the transformation process will reinforce engagement and commitment. Encouraging individuals to participate in the design and implementation of the change program fosters a sense of ownership, enhances overall satisfaction, and strengthens organizational resilience throughout the transformation journey.

By incorporating these structured change management strategies, institutions can effectively navigate the complexities of digital transformation, ensuring the seamless adoption of AI-driven solutions while maintaining institutional stability and operational efficiency.

[138] Nuffic, *Digitalisation of credential evaluation workflows: practical guidelines for the ENIC-NARIC Networks*, 2023. Available at: https://www.nuffic.nl/sites/default/files/2023-09/digitalisation-of-credential-evaluation-workflows.pdf [last accessed 6 May 2026].

6.3.3 Strategic, Technical and Organizational Considerations for AI Implementation

To ensure the successful integration and long-term benefits of AI in CIMEA's processes, it is essential to consider several strategic, technical and organizational factors. Effective planning, cross-disciplinary collaboration, and a focus on continuous improvement are key to achieving the desired outcomes. The following considerations and recommendations address critical areas where attention is needed to maximize the potential of AI solutions.

First and foremost, a balanced approach to training is essential. Combining technological expertise with multidisciplinary knowledge allows team members to address challenges from diverse perspectives, enhancing the overall problem-solving capacity. Beyond technical training, fostering an understanding of broader organizational needs and dynamics ensures that the team can adapt to and respond effectively to emerging challenges. Equally important is establishing a clear communication framework between CIMEA representatives and the AI integration team. This framework should outline proposed solutions, anticipated impacts, key stakeholders and relevant AI models, while also addressing both legal and ethical considerations. Effective communication will ensure that all involved parties are aligned on project objectives and outcomes, helping to mitigate misunderstandings and risks during implementation.

For successful AI implementation, CIMEA must establish a well-organized data repository tailored to its specific needs. This repository should support an efficient ingestion pipeline, where data quality is consistently monitored. Data labelling should be carried out systematically by qualified personnel to ensure that the datasets meet the necessary standards. It is also crucial to separate training and testing datasets to maintain model integrity and avoid bias. In the model exploration phase, it is advisable to review state-of-the-art advances and start with base models that may be reusable. This allows CIMEA to leverage existing resources, ensuring a more efficient and cost-effective implementation. Thorough testing and evaluation of the developed models are essential across all system components – training, prediction, and subsystem operations – ensuring robustness and reliability.

During model deployment, tracking changes to model parameters, feature pipelines, and training datasets is crucial for maintaining transparency and accountability. Continuous monitoring and maintenance are required to address issues that arise over time and ensure the model adapts to evolving conditions. This ongoing focus on model health will contribute to the system's long-term effectiveness. In addition to these technical and operational steps, CIMEA must also focus on strategic decision-making throughout the AI lifecycle. The exploration, process analysis and reengineering phase offers a crucial opportunity to identify weaknesses within internal processes and technological opportunities that could enhance the system. Adopting agile methodologies can further streamline project organization, making it more adaptive to changes and better aligned with organizational goals.

Throughout the AI implementation process, CIMEA must prioritize ethical and legal considerations. Regular training for staff, ethical evaluations of AI solutions and compliance with relevant regulations will ensure that the solution is implemented responsibly and in line with human rights standards. Ethical principles such as fairness, transparency, privacy and security must be integrated into every phase of the project, with consistent human oversight of AI outcomes to ensure accountability.

Incorporating *Quality by Design* methodologies into this process reinforces a commitment to embedding efficiency, reliability and user-centricity into the foundational development of digital and AI solutions. Within the credential recognition landscape, this approach guarantees that the entire process – from submission to final assessment – is transparent, secure and optimally streamlined. By prioritizing user experience, institutions can address the specific needs of various stakeholders, including students, educational institutions and credential evaluators. As AI and digital tools continue to reshape credential evaluation, institutions must invest in ongoing professional development programs to equip personnel with the necessary competencies. These initiatives should encompass AI literacy, data governance, and cybersecurity, alongside hands-on training in relevant AI technologies and platforms.

6.3.4 Data-Driven Strategies for AI Implementation

As machine learning technologies continue to gain traction across various sectors, the challenge of assembling large, high-quality datasets has become increasingly complex. The rise of digitization and the proliferation of data sources have only amplified this issue. Key challenges in data collection, management and utilization now involve concerns over data privacy, sensitivity and potential harm, which further complicate the environment for AI implementation. Developing IT solutions without a guiding strategic framework can lead to inefficiencies, higher costs, and complications in scalability and long-term maintenance. The digitalization and AI integration in credential recognition processes extend beyond technological aspects, influencing organizational workflows, institutional culture, governance structures, and stakeholder engagement. Consequently, enterprise architecture assumes a crucial role in harmonizing these elements with the broader institutional vision, ensuring that technological implementations align with intended objectives.

For CIMEA, it is crucial to establish a data governance framework that aligns with the European Union's Data Governance Act (European Commission, 2022), which came into effect on June 23, 2022. This regulation was designed to enhance data availability and streamline data exchange across sectors and EU member states, ultimately maximizing data's value for European citizens and businesses. Adhering to these guidelines will be essential to ensure that AI solutions are built on a foundation of secure, ethical and compliant data practices.

Step by step for adequate data governance

The first step in implementing AI within an organization is identifying the tasks performed across different departments. Complexity and specificity often vary by area, with each task comprising a set of associated microtasks. Given the impact of AI and generative AI on these activities, a reconfiguration of roles may be necessary.

Once tasks are identified, they should be classified into three categories: automatable, semi-automatable and non-automatable. Automatable tasks are repetitive and mechanical, consuming significant work time. Semi-automatable tasks contain both standardized, mechanical components that can be automated and more complex activities that require human involvement. Non-automatable tasks are specialized and often deferred due to their complexity. It is important to note that AI implementation will absorb some tasks, while simultaneously creating new ones.

After classification, the tasks must be quantified to assess their impact on the organization's workload. This quantification will allow for an estimation of the time savings that AI can provide. Once tasks are identified, classified and quantified, the next step is to prioritize tasks for AI integration. Focus should be placed on tasks that are routine, repetitive and high-frequency, as these are most suited for automation. The following step is to diagnose the data ecosystem. It is crucial to understand where information relevant to these tasks is stored – whether in comprehensive systems, websites, or even in files like Microsoft Word or PDFs. After the diagnostic phase, selecting the appropriate AI technique is essential. AI is not a singular technique but a range of methodologies. It is crucial to choose AI approaches that fit the organization's digital, social and cultural context, ensuring they are transparent, explainable and traceable. Black-box systems, which lack full transparency, should be avoided. For the initial AI programming phase, data should be organized in an accessible and intuitive format. Developers should collaborate with end-users to understand their expectations and confirm that the available data is sufficient for their needs.

Implications of Personal Data Protection for Developing Artificial Intelligence Solutions

The challenges surrounding data collection for machine learning have led to a growing focus on enhancing traditional methods. New approaches aim to maximize the value of existing data while minimizing the need for extensive data collection and preparation (Johansson et al, n.d.).

For CIMEA to effectively integrate data and AI solutions, the qualification recognition process must rely on data that is reliable, complete, accurate and precise. This ensures that decisions regarding verification and comparability are based on high-quality information (Development Bank of Latin America and the Caribbean, 2021). Data completeness, validity, consistency and accessibility, along with proper metadata handling, are crucial in this context[139].

[139] See Art. 5 (1) (e) (f) of the GDPR, available at: https://gdpr.eu/ (accessed on 05/08/2024)

Furthermore, it is essential to adopt principles that ensure secure handling and storage of personal data, protecting it from unauthorized access, loss, destruction or damage. These measures should align with relevant regulations, such as the General Data Protection Regulation (GDPR) in Europe, which governs the processing of personal data. The GDPR mandates that data processing mechanisms be incorporated from the design phase of any product or service, ensuring *privacy by design*. It also requires clear and intelligible legal notices and privacy policies, the appointment of a Data Protection Officer and explicit consent for data collection. Additionally, the regulation enforces the right to be forgotten, limits on data processing, and data portability, along with mechanisms for complaints and compensation. This regulatory framework ensures that data processing is conducted securely and in compliance with legal requirements, which is crucial for maintaining trust and safeguarding privacy.

Adopting a *Privacy by Design* framework ensures that security and data protection measures are integrated into digital infrastructure from inception and throughout the entire lifecycle of AI-driven recognition systems. This approach entails rigorous testing and continuous monitoring of AI implementations to maintain compliance and mitigate risks associated with unauthorized access or biased data handling, ultimately fostering trust in these technologies within the credential evaluation domain. Before full-scale deployment of digital and AI-enhanced recognition systems, pilot testing should be conducted to identify potential limitations and refine solutions. An iterative development methodology that incorporates insights from pilot initiatives can further enhance system performance, reinforcing its reliability and preparedness for broader adoption.

Alternatives to the Challenge of Training Artificial Intelligence Systems with Large, Structured, and High-Quality Datasets

As the demand for high-quality data increases, many developers and engineers in the technology sector are turning to synthetic data as an alternative to real data for training artificial intelligence systems[140]. This approach helps to protect user privacy while reducing the time and resources needed to gather large, anonymized datasets.

Synthetic data offers several key benefits. Firstly, it can augment existing datasets, allowing AI models to be trained on large volumes of labelled data, which is often required for machine learning algorithms. This process also facilitates the creation of data repositories that are needed for model training and even pre-training, which can be enhanced using transfer learning techniques (Riemann, n.d.). Additionally, synthetic data supports rapid prototyping and testing by simulating hypothetical or previously unseen scenarios. This not only helps improve system robustness but also enables the development of solutions without exposing sensitive personal information.

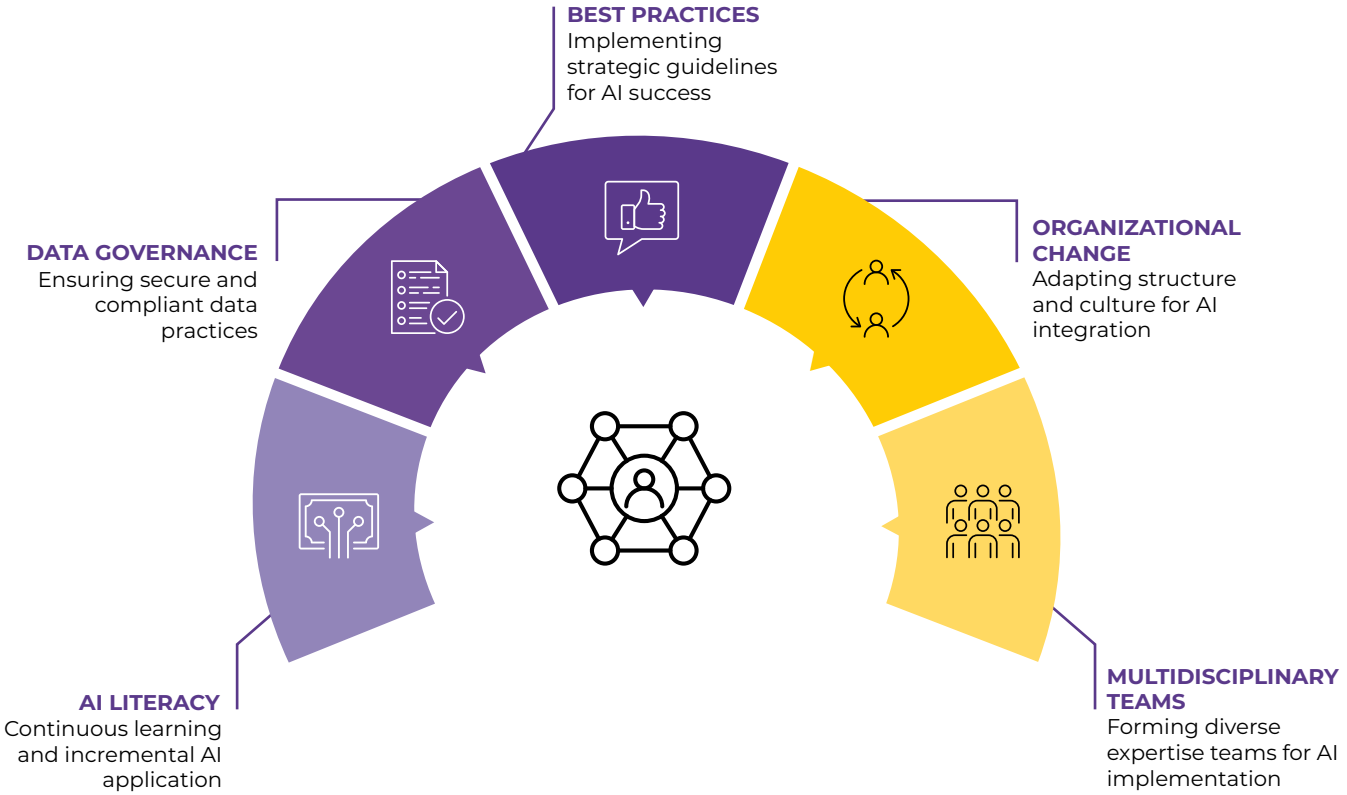
[140] BBVA, *Synthetic data: this is how artificial intelligence can be trained without using information from real people*, 2024, Available at: https://www.bbva.com/es/innovacion/datos-synteticos-asi-may-entrenarse-artificial-intelligence-without-using-information-from-real-people/ [last access 6 May 2026].

From a data protection perspective, synthetic data provides a valuable tool for safeguarding user privacy. By generating data that does not rely on real personal information, the risk of exposing sensitive data is minimized. In contrast to real data, which may contain personally identifiable information subject to privacy laws, synthetic data can be used, shared and analyzed without compromising individual privacy[141]. Moreover, synthetic data can enhance the diversity of datasets. By generating data that represents underrepresented groups or conditions, synthetic data can help reduce bias and improve the representativeness of the dataset. This can lead to more equitable AI models, as synthetic data can be designed to better reflect societal ideals, such as fairness and inclusivity, rather than simply replicating existing disparities.

However, developers must be mindful of potential privacy concerns when generating synthetic data. If synthetic data closely resembles real-world data, it may inadvertently expose information about individuals, especially if the original data contains identifiable personal information[142]. To mitigate this risk, privacy assurance assessments should be conducted to ensure that synthetic data does not inadvertently disclose sensitive information. The European Data Protection Supervisor recommends such assessments to confirm that synthetic data remains distinct from real personal data, evaluating the risk of identification and ensuring that the data cannot be traced back to individuals. Additionally, developers must be cautious of biases that may arise in synthetic data, as these can reflect biases present in the original data. Challenges also arise in representing outliers in synthetic datasets, as the generated data may not fully capture rare or exceptional cases from the original data sample.

In conclusion, while synthetic data presents a promising alternative for training AI models, its use must be carefully managed to ensure data quality, privacy, and security. Adopting appropriate technical and organizational measures, in line with European Union regulations, is essential to maximize the benefits of AI technologies while minimizing potential risks.

[141] BBVA, *Synthetic data: this is how artificial intelligence can be trained without using information from real people*, 2024, Available at: https://www.bbva.com/es/innovacion/datos-synteticos-asi-may-entrenarse-artificial-intelligence-without-using-information-from-real-people/ [last access 6 May 2026].
[142] Abowd, J. M., & Vilhuber, L. (2008). *How protective are synthetic data?* School of Industrial and Labor Relations, Cornell University, Springer. Available at: https://link.springer.com/chapter/10.1007/978-3-540-87471-3_20 [last accessed 6 May 2026].


BEST PRACTICES
Implementing strategic guidelines for AI success
DATA GOVERNANCE
Ensuring secure and compliant data practices
ORGANIZATIONAL CHANGE
Adapting structure and culture for AI integration
AI LITERACY
Continuous learning and incremental AI application
MULTIDISCIPLINARY TEAMS
Forming diverse expertise teams for AI implementation

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CHAPTER 7

Conclusions and Next Steps: Implementing GENAI-Based Agents in Academic Credential Validation

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07

The collaboration between CIMEA and the Laboratory on Innovation and Artificial Intelligence of the School of Law of the University of Buenos Aires (UBA-IALAB) made it possible to identify and validate concrete opportunities to increase institutional efficiency and deliver higher-quality services. The preliminary study, focused on detecting opportunities for applying AI at CIMEA, analyzing benefits and risks, and defining mitigation measures, created the conditions to move from diagnosis to solution design and to advance toward their development and implementation. In this context, at the end of 2024 and throughout 2025, a new phase began with its main focus being the implementation of generative artificial intelligence–based agents (GENAI), marking a transition from diagnosis and analysis to practice and effective application.

7.1. From Generative AI to Agent-Based Systems

This section outlines the transition from generative artificial intelligence models to agent-based systems, highlighting the key technological and conceptual developments that enable their application in academic credential validation.

7.1.1 Generative AI: Context and Capabilities

Beginning in 2022, a new generation of artificial intelligence models, known as Generative Artificial Intelligence (GENAI), became established. These models – among which OpenAI's ChatGPT, Google's Gemini, and Microsoft's Copilot stand out – differ from earlier AI systems in that, in addition to classifying, predicting, or identifying patterns, they are capable of producing new content (text, images, audio, video, code, synthetic data) based on the contextual interpretation of the inputs they receive[143].

The two most notable features of Generative AI are:

- Multimodality: it can process and generate content in different formats in an integrated manner (text, audio, videos, images).
- Multipurpose: it can adapt to different fields of knowledge and human activity, including education, health, justice, energy, finance, and administrative processes. Unlike specialized models, generative models are versatile and can perform multiple functions with minimal adjustments.

[143] Amazon Web Services (AWS), *¿Qué es la IA generativa? Explicación de la IA generativa*. Available at: https://aws.amazon.com/es/what-is/generative-ai/ [last accessed 7 May 2026].

In technical terms, GENAI models are based on large-scale deep neural networks, especially transformers. These models are trained with massive amounts of data and learn to predict the next unit of information (word, pixel, musical note), which enables them to generate coherent and plausible sequences across different domains.

Generative AI–based models have the potential to impact and deliver quantitative and qualitative advantages in virtually all areas of human knowledge. UBA IALAB conducted applied research consisting of testing language models on 83 tasks across five areas of human knowledge – education, public administration, justice, legal departments of organizations, and translation – and, on average, achieved a 77% increase in efficiency[144].

Additionally, the opportunities for applying GENAI in education have led UNESCO to publish a guide with recommendations[145].

7.1.2 The Emergence of GENAI-Based Agents

In 2025, the technology and scientific community identified a major advance: the development of GENAI-based agents[146].

An agent can be defined as a software system that:

- Has an assigned objective.
- Possesses the ability to perceive information from its environment (documents, databases, user interactions).
- Can decide on and execute actions based on rules, prior learning, and expected outcomes.
- Learns from experience, adjusting its behavior over time.
- Enables end-to-end automation of production processes.

[144] International Labour Organization, *Generative AI and jobs: a global analysis of potential effects on job quantity and quality*, 2024. Available at: https://www.ilo.org/publications/generative-ai-and-jobs-global-analysis-potential-effects-job-quantity [last accessed 7 May 2026]. World Economic Forum, The Future of Jobs Report 2025, 2025. Available at: https://www.weforum.org/reports/the-future-of-jobs-report-2025/ [last accessed 7 May 2026].
[145] UNESCO, *Guidance for generative AI in education and research*, 2023. Available at: https://unesdoc.unesco.org/ark:/48223/pf0000386693 [last accessed 7 May 2026]. See also: CAF – Development Bank of Latin America, *AI and Education: Building the Future Through Digital Transformation; OECD, What should teachers teach and students learn in a future of powerful AI?*
[146] See, as an example, Ivan Belcic and Cole Stryker, *AI Agents in 2025: IBM, AI agents in 2025: expectations vs reality, 2025*. Available at: https://www.ibm.com/es-es/think/insights/ai-agents-2025-expectations-vs-reality [last accessed 7 May 2026].

The novelty of GENAI-based agents lies in their incorporation of the creative and linguistic capabilities of generative models, which makes them able to:

- Dynamically orchestrate tasks and subtasks: they are not limited to executing preprogrammed steps; but can instead plan, break down a problem into phases, and resolve it sequentially.
- Connect to external systems through APIs: they integrate data from institutional records, government platforms, international repositories, or third-party services.
- Collaborate with other agents: they can communicate with one another, exchanging information and coordinating actions (for example, one agent validates documents while another notifies results to the user).
- Enhance the quality of processes: by interacting with generative models, they not only execute predefined rules but also produce explanations, reports, and recommendations tailored to each case.

In technical terms, GENAI-based agents combine three main components:

- Generative models (LLMs, multimodal models) that provide reasoning, drafting, and contextual analysis.
- Orchestration systems, agent frameworks such as LangChain, LangGraph, AutoGen, Flowise, and non that allow the design of complex workflows and their connection to APIs.
- Memory and feedback mechanisms that enable them to record past interactions in order to adjust the agent's future behavior.

UBA IALAB has experience in the design and implementation of IAGEN-based agents in numerous case studies involving organizations from both the public and private sectors[147].

[147] Corvalán, J. G., and Sánchez Caparrós, M., *Agentes de inteligencia artificial y workflows agénticos. La nueva frontera de la automatización*, UBA IALAB and Thomson Reuters, 2025. Available at: https://ialab.com.ar/webia/wp-content/uploads/2025/02/Agentes-de-inteligencia-artificial-y-workflows-agenticos.pdf [last accessed 7 May 2026].
See also: UBA IALAB, *Desarrollo de workflows agénticos*. Available at: https://ialab.com.ar/desarrollo-workflows-agenticos/ [last accessed 7 May 2026].
Kasirzadeh, A., and Gabriel, I., *Characterizing AI Agents for Alignment and Governance*, arXiv preprint arXiv:2504.21848, 2025. Available at:. [2504.21848] Characterizing AI Agents for Alignment and Governance [last accessed 7 May 2026].

7.2. Pilot Demonstration and Proof of Concept

At the end of 2024, UBA IALAB presented a demo to CIMEA showcasing the way in which:

- An agent received an academic credential submitted by a student;
- It processed the document;
- It connected with a language model based on GENAI;
- It performed validation checks in accordance with CIMEA's rules;
- A report was generated stating the percentage of alignment between the requirements established in CIMEA's checklist and the credential itself;
- The report was sent by email.

Following this meeting, CIMEA and UBA IALAB decided to resume collaboration in order to dedicate efforts toward the design, development, and implementation of an GENAI-based Agent which, connected to DiploMe, would assist staff in the academic credential validation process on a pilot basis.

7.3. Functional Design and Process Analysis

The incorporation of generative artificial intelligence–based agents represents a major advance in CIMEA's digital transformation. Whereas the initial digitization phase and the subsequent evolution toward DiploMe 2.0 made it possible to unify procedures, shorten processing times, and improve the traceability of requests, the application of agents marks the transition toward an intelligent and adaptive organizational model.

Agents can be embedded organically into the DiploMe 2.0 ecosystem, enhancing its current functionalities. In this context, agents make it possible to:

- Assist CIMEA staff in evaluation processes.
- Detect anomalies and patterns considered to be risks in credentials and documents, generating early alerts for evaluators.
- Communicate results and interactions proactively.

In this new stage, meetings were held between CIMEA's internal team and the UBA IALAB team with the purpose of surveying the process involved in the validation of academic credentials.

At this phase, it is highly relevant to analyze each of the tasks and subtasks that make up the production process, the systems involved, the roles performed by users, validation requests most frequently submitted by different countries, and the types of data.
Functional analysis is one of the most critical stages when implementing generative artificial intelligence–based agents, as it:

- Makes it possible to design, develop and implement GENAI-based agents tailored to the organization's requirements.
- Anticipates and defines the instances of supervision, intervention, and human oversight required within the agent's process.
- Establishes the degree of autonomy – high, medium, or low – that the GENAI-based agent will have.
- Trains the GENAI model operated by the agent so that it adapts to the organization's requirements, rules and specific inputs.
- Identifies risks and implements the necessary mitigation measures.

The joint work between CIMEA experts and UBA IALAB experts is particularly noteworthy for achieving a sustainable solution. As said above, interdisciplinary collaboration with the participation of the subject-matter expert is essential for achieving adaptable and responsible solutions.

Currently, technical studies and analyses are underway to assess the feasibility of deployment. This phase represents a critical bridge between technological potential and institutional applicability, translating innovation into operational practice.

7.4. Architecture and Core Functionalities of the Agent

The GENAI-based Agent operates on a previously designed workflow which, as of today, is expected to include the following functionalities:

Workflow Architecture (Envisioned)

- Connection with DiploMe.
- Detection of the initiation of a certificate validation request from a Country X.
- Text extraction from the documents submitted by the applicant.
- In the “In Evaluation” tab in DiploMe, automatic completion of eight data fields derived from the credentials submitted.
- Forensic analysis through the language model integrated into the agentic workflow.
  - The model is trained with prompts containing rules and a checklist prepared by CIMEA with the data points to be verified.
  - In addition, it incorporates a proactive detection layer for fraud indicators not explicitly listed (e.g., graphic or metadata anomalies, inconsistencies in format or content across documents), leveraging the exploratory potential of GENAI.
  - Outcome: a detection report in which the model establishes the percentage of correspondence between the conditions, elements and criteria of the credential and the rules predefined by CIMEA. When applicable, it reports “out-of-checklist findings,” including an explanation and an estimated risk level (for evaluator review).

Possible Outcomes and Actions

- Checklist control passed: interpreted as “Absence of Suspicious Elements”
- Checklist control not passed – High-Criticality Alert
  Percentages of correspondence are not met in elements prioritized by CIMEA or associated with a high probability of forgery.
- Checklist control not passed – Reinforced-Conformity Alert
  Certain standards required in complementary validation elements defined by CIMEA are not achieved.

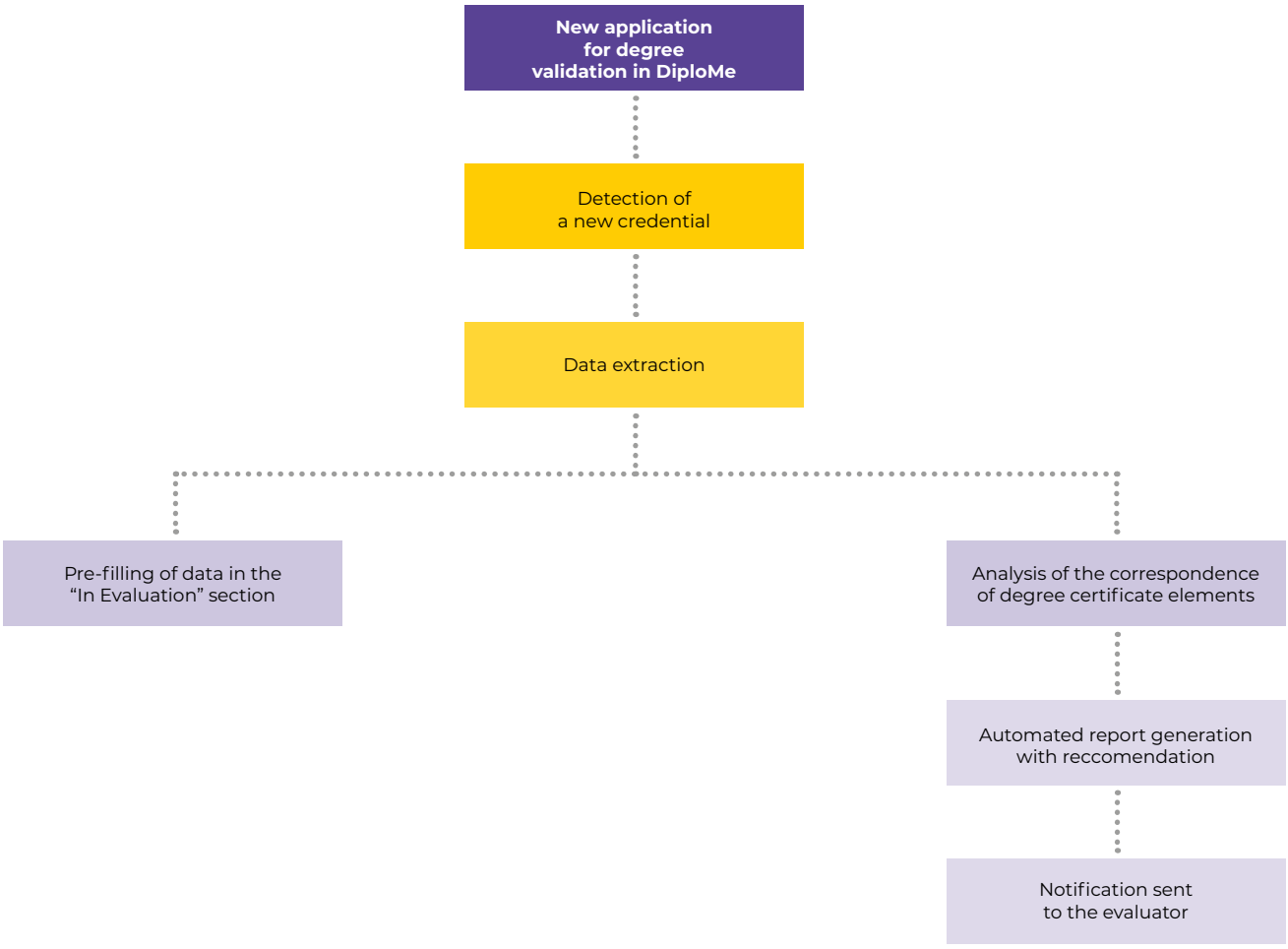
Report Format

- Specifies the percentage of correspondence for each checklist element.
- Includes a conclusion with recommendations for the evaluator.
- The GENAI model is also expected to detect additional indicators (elements not explicitly listed) that may suggest suspicion of fraud.

Notifications

- The agent sends the results to the corresponding evaluator, including:
  - The detection report;
  - The recommendation;
  - A draft email template for submission to the validation board in cases B and C, in order to confirm authenticity;
  - A draft email template for communication to the student, where applicable.

Design of CIMEA's Generative AI Agent



It should be noted that CIMEA and UBA IALAB are still working on the functional analysis phase; therefore, changes may occur both in the design of the agent and its functionalities, as well as in the credentials selected as pilot models.

7.5. Organizational Impact and Added Value

The implementation of generative artificial intelligence-based agents in the academic credential evaluation process will have an impact within the organization.

1. Quantitative Advantages

GENAI-based agents introduce directly measurable benefits:

- Significant reduction in validation times, through automation of the initial phases of document analysis.
- Increased capacity for processing requests, enabling the organization to absorb demand peaks without compromising service quality.
- Optimization of institutional resources, by avoiding task duplication and reducing the need for repeated manual checks.

2. Qualitative Advantages

Beyond efficiency, agents also improve the quality of the outcomes:[148]

- Consistency in the application of criteria: by adhering to standardized rules, they reduce subjective variation among evaluators. While, according to CIMEA's evaluation methodology, assessments are conducted on a "case-by-case" basis, this does not preclude the possibility of fostering greater standardization of criteria and policies, in line with the principles of Automatic Recognition.

- Ability to detect unforeseen anomalies, issuing alerts when a credential presents atypical characteristics compared to usual patterns.

- Generation of reasoned recommendations, which accompany the alert and guide the human evaluator in their final decisions.

[148] The improvement in quality of outcomes has also been highlighted by the ILO, which stated: "According to the study's estimates, the greatest effect of generative AI on occupations concerns the transformation of work. The integration of generative AI into the work context alters the functions performed in each occupation, with potentially far-reaching consequences for job quality. If the automation of certain tasks gives workers more time to perform more satisfying work or strengthens their skills with the assistance of AI tools (Author 2024), the result could be positive for job quality."
See more in: Gmyrek, P., Berg, J., Kamiński, K., Konopczyński, F., Ładna, A., Nafradi, B., Rosłaniec, K., and Troszyński, M., *Generative Artificial Intelligence and Employment: 2025 Updated Edition*, International Labour Organization (ILO), May 2025. Available at: https://www.ilo.org/sites/default/files/2025-05/BRIEF_ESP_AI_and_Jobs_2025_19%20may.pdf [last accessed 7 May 2026].

7.6. Governance, Security and Deployment Models

We are currently evaluating two architectural alternatives for deploying the GENAI-based Agent that assists in academic credential validation:

1. Local (On-Premise) Implementation

Execution within CIMEA's own infrastructure, with processing and storage within the institutional perimeter.

2. Enterprise Cloud Implementation

Use of cloud services with dedicated logical isolation, end-to-end encryption, customer-managed keys, data residency in the European Union, no data retention, and no use of CIMEA's information for model training. This option will be considered only under data-processing agreements and verifiable controls that ensure regulatory compliance and traceability. The possibility of using enterprise versions of the models is also being assessed.

The final selection will be defined after technical and compliance testing (security, privacy, performance, cost, scalability, and maintainability). In all cases, human oversight, full workflow auditability, and minimization of personal data will be preserved. If the process currently underway proves successful, CIMEA, together with UBA IALAB, could become an international reference in the implementation of GENAI-based Agents for academic credential evaluation.

3. Human Supervision and Control[149]

A guiding principle of the project is that the agent does not make decisions autonomously. Its role is to provide suggestions and recommendations that remain subject to human supervision, control and approval.

This hybrid model ensures:

- Complete traceability of the process, since every step of the agent is recorded and auditable.
- Institutional accountability, maintaining that the final decision rests with CIMEA's evaluators.
- Flexibility in supervision, allowing for different degrees of autonomy (high, medium, or low) depending on the type of case.

4. Impact Assessment

We are currently designing a controlled-environment test for CIMEA to safely evaluate the impact, benefits, and opportunities in a safe manner. In this way, it will be possible to:

- Measure operational improvements (validation times, processing capacity, reduction of rework).
- Verify technical quality (extraction accuracy, consistency with the checklist, false-positive/false-negative rates in forensic analysis).
- Confirm regulatory compliance (traceability, recordkeeping, human supervision, data minimization).
- Assess the evaluator's experience (usefulness of reports, explainability, workload).
- Compare the technological alternatives under evaluation (on-premises deployment vs. enterprise cloud meeting EU standards).

5. Compliance with Applicable Laws and Regulations

CIMEA and UBA IALAB are dedicating their efforts to achieving a solution that conforms to the standards and requirements set forth in the applicable legal framework. The following comparative table demonstrates the agent's compliance with the European Union's General Data Protection Regulation (GDPR).

[149] In line UNESCO, *Recommendation on the Ethics of Artificial Intelligence*, adopted on 23 November 2021. Available at: https://unesdoc.unesco.org/ark:/48223/pf0000381137 [last accessed 7 May 2026].

Compliance Area	Description	Project Measures and Evidence	GDPR Reference
1. Data Protection by Design and by Default	Interdisciplinary approach with legal, ethical, and technical considerations from the outset; human supervision/intervention/ control; data minimization.	Assisted agent (non-autonomous); organization-specific prompts and rules; processing limited to what is necessary for the purpose.	Privacy-by-design and by default.
2. Legal Basis and Associated Principles	Clearly defined purpose: validation of academic credentials; legitimate legal basis in a legal obligation or the exercise of public authority; enhances accuracy by reducing variability.	Processing for credential validation; consistent application of validation criteria; reduction of human error.	Art. 5 and 6; Principle of purpose limitation; accuracy.
3. Allocation of Roles and Responsibility	Confidentiality agreements; regulation of the conditions of processing.	CIMEA provides datasets under security standards; agreements that define the purpose, duration, data types, and categories of data subjects.	Art. 28 (data processor)
4. Risk Management and Data Protection Impact Assessment (DPIA)	Risk assessment inherent to the use of AI; anticipatory approach and mitigation measures to protect rights and freedoms.	Functional analysis with risk identification; implementation of safeguards for confidentiality and integrity.	DPIA (Data Protection Impact Assessment).
5. Technical Security and International Data Transfers	Preference for a local or cloud solution, only under agreements and verifiable controls (EU data residency, no use for model training, etc.).	On-premises execution on CIMEA servers; if cloud, under a DPA, EU data residency, and guarantees of no unauthorized transfers / no training use.	Safeguards for international data transfers.
6. Right Not to Be Subject to Automated Decision-Making	The agent does not decide validity; it generates reports/ recommendations under final human control.	Human oversight as the final step in the process; responsibility resting with CIMEA evaluators; prevention of automated legal effects.	Art. 22; Limits on automated decision-making.

Table 4. *GDPR Compliance Measures and AI Governance Framework for Qualification Recognition*

EU AI Act — High-Risk)	Why It Applies	How the CIMEA Project Complies
1. Classification as a High-Risk System	The use case impacts a public service affecting fundamental rights (validation of academic credentials)	The system is classified as high risk due to its potential effect on academic recognition.
2. Human supervision	The Law requires avoiding fully automated decision-making with significant impact.	The agent does not determine validity; it generates recommendations/alerts that are reviewed and validated by CIMEA's human evaluator (hybrid model).
3. Transparency and Explainability	It must be explainable and transparent so that the basis for the recommendation is understandable.	The report details the percentage of correspondence by checklist item and out-of-checklist findings, with an explanation for the evaluator.
4. Data Governance and Data Quality	Representative, high-quality data for training/testing; control over its use.	Use of credential examples provided by CIMEA and an expert team; on-premises execution or cloud deployment under standards that conform to the applicable regulatory framework.
5. Risk Management and Robustness	High-risk systems must be technically robust and accurate, with mitigations in place; proactive risk management.	Prior risk analysis and mitigation measures; a defined workflow, a limited degree of autonomy insofar as human validation and control are required, and planned alerts to ensure reliability.

Table 5. *Alignment of the CIMEA Project with EU AI Act High-Risk System Requirements*

Overall, the project demonstrates alignment not only at a formal level, but also in its operational design, embedding compliance directly into the system architecture and ensuring that legal and ethical requirements are integrated into the functioning of the agent itself.

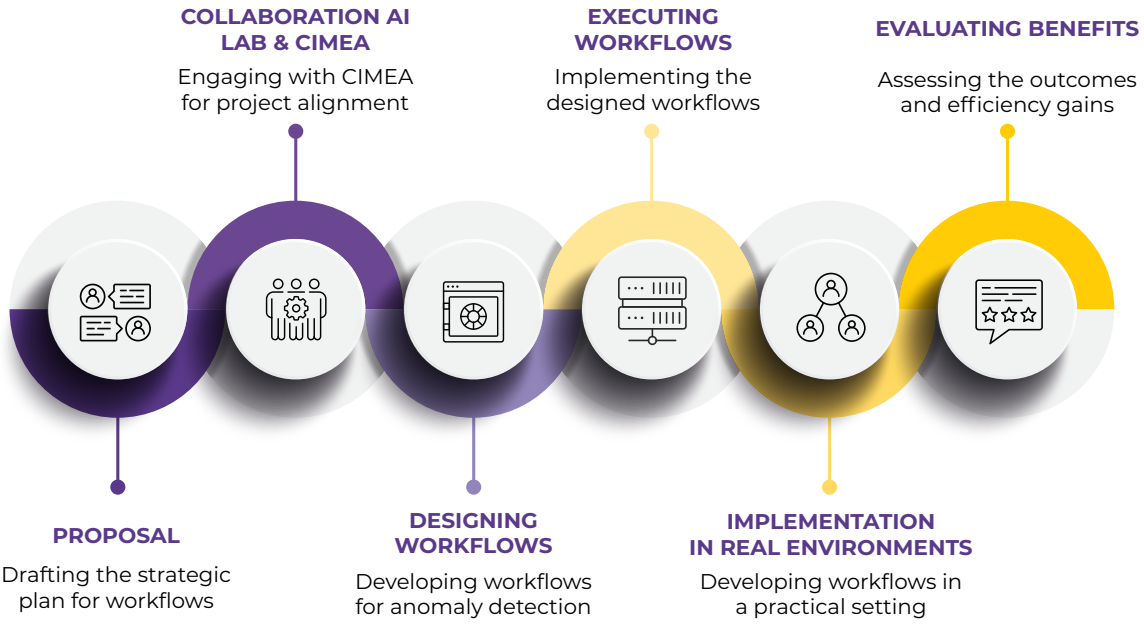
7.7. Expected Strategic Outcomes and Future Development

The research and application of generative AI–based agents strengthens CIMEA as a pioneering institution in the responsible and sustainable deployment of this type of technology. It can serve as an example for:

- Consolidating an organizational culture centered on responsible innovation.
- Raising the standards of quality and transparency in academic credential recognition.
- Increasing institutional resilience by establishing processes that are more stable, auditable and less exposed to human risks such as fatigue or unintentional error.

Additionally:

- If a sustainable solution is achieved, CIMEA will be able to share with other countries the experience of having designed, developed and implemented – together with UBA IALAB – an GENAI-based agent that operates locally and complies with the standards required by legal frameworks.
- In subsequent stages, CIMEA is expected to acquire the capacity and training needed to continue developing agents. Indeed, one could even envision the possibility of working with networked agents that cooperate with one another: one agent assisting in fraud detection, another in document classification, and another in providing personalized user support.



In conclusions, this volume has examined the intersection between digital transformation, regulatory frameworks, and the application of artificial intelligence in the field of academic credential recognition. Through the case of CIMEA, it has shown that the transition from digitisation to intelligent systems represents not only a technological evolution, but a structural transformation affecting organisational processes, evaluation practices, and institutional responsibilities. The collaboration between CIMEA and the Laboratory on Innovation and Artificial Intelligence (IALAB) of the University of Buenos Aires has been instrumental in identifying concrete opportunities to enhance operational efficiency, precision, and scalability. In particular, the development of AI-driven agent-based workflows for anomaly detection in academic credentials – focused on specific national contexts and temporal patterns – builds upon prior research in AI-assisted credential verification, demonstrating the potential of integrating automation with generative models. In this perspective, artificial intelligence emerges not as a substitute for human evaluators, but as a tool to augment institutional capacity, improve consistency, and support decision-making in increasingly complex and internationalised environments.

At the same time, the study underscores that technological innovation must be accompanied by robust governance frameworks, ensuring compliance with legal standards, protection of fundamental rights, and accountability in decision-making processes. The ongoing phase of collaborative design and implementation – focused on refining detection parameters, optimising model performance, and ensuring integration within existing recognition systems – illustrates how AI solutions can be developed in a controlled and responsible manner. The alignment with the GDPR and the EU AI Act confirms that it is possible to design systems that are not only efficient, but also transparent, trustworthy, and human-centred. Looking ahead, this initiative positions CIMEA at the forefront of digital transformation

in credential evaluation, equipping it to address emerging challenges, strengthen fraud detection mechanisms, and contribute to the development of shared standards and best practices at the international level.

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Annex 1

Strategic use of Data and Artificial Intelligence for the validation of academic degrees

Technique / functionality	Description
Optical Character Recognition (OCR)	OCR can scan and read physical diplomas, converting them into digital text. This facilitates comparison with official databases and records to verify authenticity.
Image analysis and pattern recognition	AI can be trained to recognize specific features of authentic diplomas, such as seals or signatures.
Artificial vision	Neural networks can be trained to detect forgeries in documents by identifying inconsistencies in design, text or images. They can also be trained to detect the existence of certain specific characteristics in diplomas such as seals, signatures and other elements.
Metadata analysis	By analyzing the metadata of a digital document, you can determine its origin, creation date, and whether it has been modified.
Anomaly detection	AI can be trained to detect anomalies in diplomas, such as unusual fonts, incorrect spacing, or altered logos.
Steganography	Steganography involves hiding information within images or documents. Diplomas could contain hidden information that verifies their authenticity, such as a digital signature or a unique code. Diplomas could also incorporate digital watermarks (watermarking) to make counterfeiting more difficult and easier to verify.
Two-factor authentication systems	When requesting a diploma verification, additional authentication, such as a code sent via SMS or an authenticator app, may be required to ensure the request is legitimate.
Search systems and databases	Educational institutions can maintain centralized and interoperable databases between different organizations that can be consulted to verify the authenticity of a diploma. In this way it is possible to search databases of graduates and compare the information with that provided in the diploma to verify its authenticity. These systems convert words or documents into numerical vectors that represent their meaning. By comparing these vectors, semantic similarity between different texts can be determined. In this way, when combined with graduate databases, the information on a diploma can be verified by comparing it with official records.
NFC (Near Field Communication) Technology	It is feasible to incorporate NFC chips into diplomas that store digital information about the diploma. By scanning the chip with a compatible device, this information can be accessed and its authenticity verified.
Verification of the authenticity of digital signatures	It is possible to compare the digital signature of a document with that of the authentic diploma to determine if it has been altered.
Facial and biometric recognition	Systems could be used that identify features in facial images or biometric data to compare with a database that allows recognition of individuals. In the event that the diplomas include photos, it can be verified that the person presenting the diploma is the same as the person in the official registered photo.
QR Code	QR codes contain information that can be read by a scanner or camera. This information can be a link, text or specific data. A QR code on the diploma could link to an official database or a digital version of the diploma to verify its authenticity.
RFID technology	Similar to NFC, diplomas could incorporate RFID tags that contain information about the diploma, such as the date of issue or the name of the graduate. These labels can be scanned to verify the authenticity of the document. RFID devices emit a signal that can be read by a scanner to access stored information.

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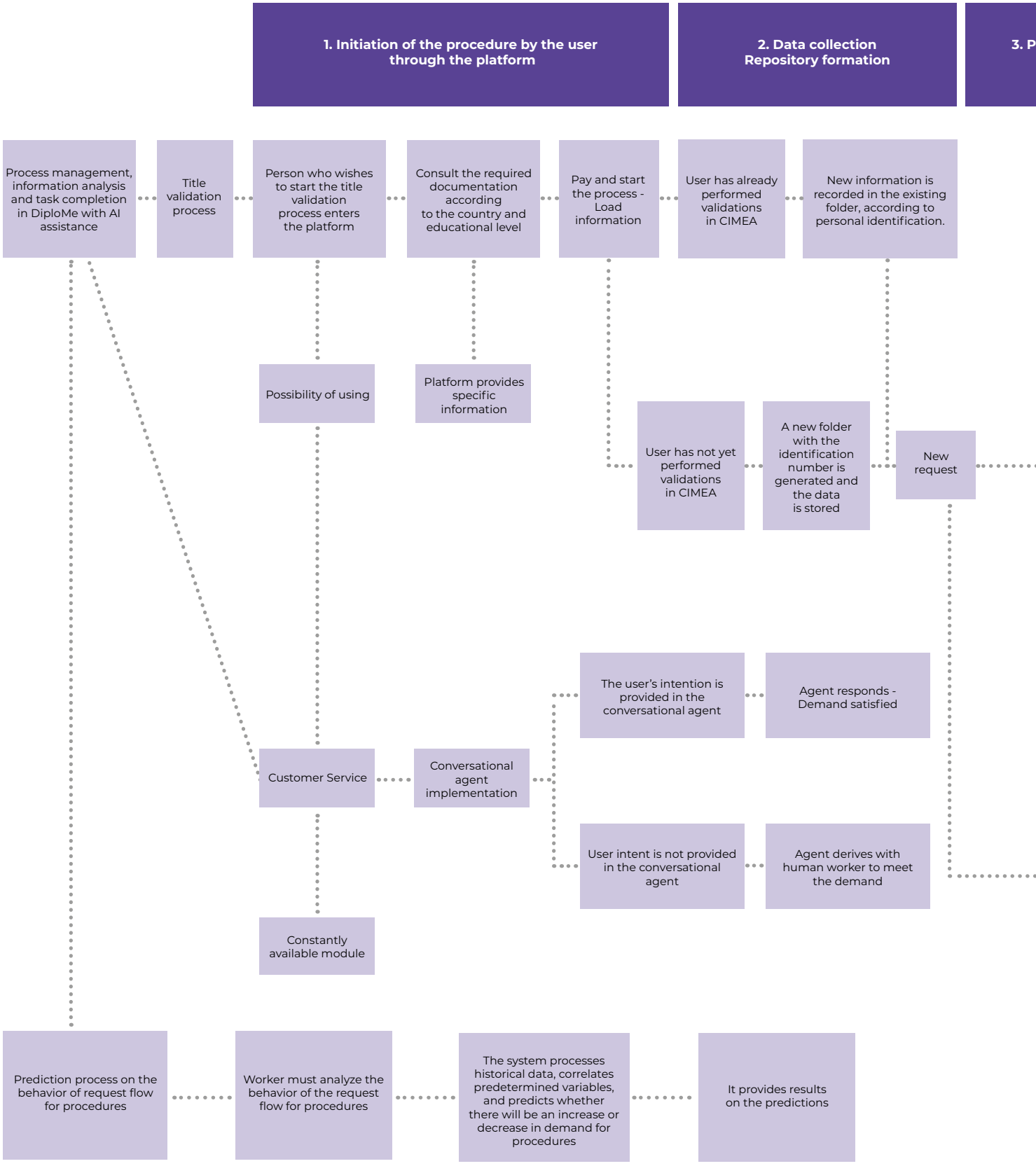
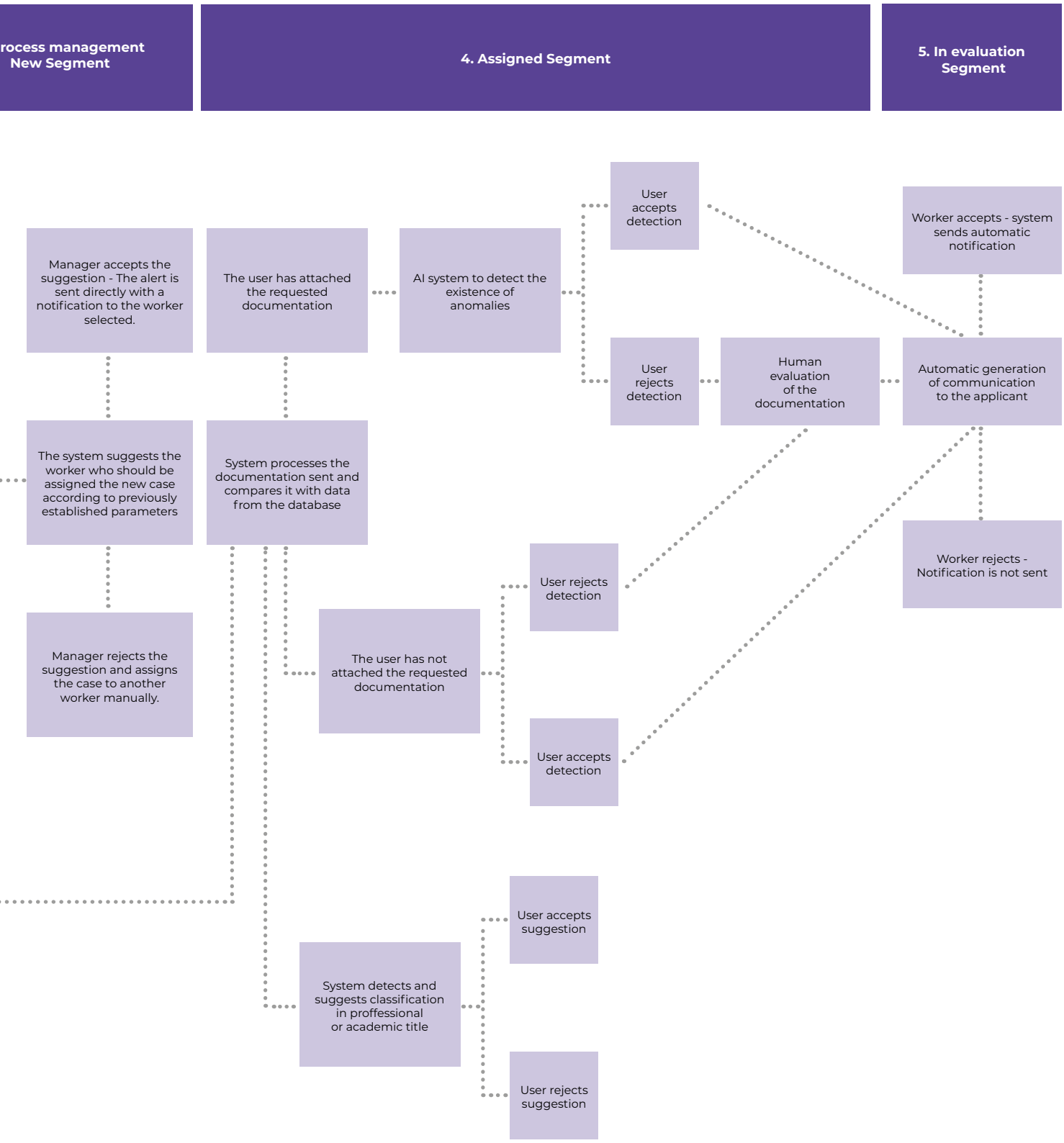
Annex 2

A2


1. Initiation of the procedure by the user through the platform
2. Data collection Repository formation
3. P
Process management, information analysis and task completion in DiploMe with AI assistance
Title validation process
Person who wishes to start the title validation process enters the platform
Consult the required documentation according to the country and educational level
Pay and start the process - Load information
User has already performed validations in CIMEA
New information is recorded in the existing folder, according to personal identification.
Possibility of using
Platform provides specific information
User has not yet performed validations in CIMEA
A new folder with the identification number is generated and the data is stored
New request
The user's intention is provided in the conversational agent
Agent responds - Demand satisfied
Customer Service
Conversational agent implementation
User intent is not provided in the conversational agent
Agent derives with human worker to meet the demand
Constantly available module
Prediction process on the behavior of request flow for procedures
Worker must analyze the behavior of the request flow for procedures
The system processes historical data, correlates predetermined variables, and predicts whether there will be an increase or decrease in demand for procedures
It provides results on the predictions


rocess management
New Segment
4. Assigned Segment
5. In evaluation
Segment
Manager accepts the suggestion - The alert is sent directly with a notification to the worker selected.
The user has attached the requested documentation
AI system to detect the existence of anomalies
User accepts detection
User rejects detection
Human evaluation of the documentation
Automatic generation of communication to the applicant
Worker accepts - system sends automatic notification
Worker rejects - Notification is not sent
The system suggests the worker who should be assigned the new case according to previously established parameters
System processes the documentation sent and compares it with data from the database
Manager rejects the suggestion and assigns the case to another worker manually.
The user has not attached the requested documentation
User rejects detection
User accepts detection
System detects and suggests classification in proffessional or academic title
User accepts suggestion
User rejects suggestion

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Brief Biographies of Editors and Authors

Luca Lantero. Is the Director General of CIMEA, the Italian Information Center for Academic Mobility and Equivalence. He is one of the main experts at Italian and international level on higher education systems, on bogus diplomas and accreditation mills, transnational education, accreditation, and the digitalization of processes applied to recognition, particularly with the advent of blockchain and AI. From 2018 to 2020 he was the Head of the Bologna Follow-Up Group (BFUG) Secretariat of the European Higher Education Area (EHEA). He is currently Head of the ASEM Education Secretariat. In 2022, Luca was elected a member of the Bureau of the Ethics, Transparency, and Integrity (ETINED) platform of the Council of Europe. In 2024, he was appointed Associate Professor of the European Law & Governance School (ELGS) and Director of the Institute for Higher Education Law and Governance (IHELG) housed by the European Public Law Organization (EPLO). He is the Director of the Centre for preventing and countering fraud in education and the Italian representative appointed in the Committee of experts on Artificial Intelligence and Education, both initiatives established by the Council of Europe. His scientific output is extensive and he participates in national and international research projects and programmes in the field of higher education studies. He is currently the Editor-in-Chief of Rivista Universitas.

Chiara Finocchietti. Is Director of CIMEA–NARIC Italy. Trained as a geographer, she comes from a research background and is an expert in policies and practices related to the internationalisation of higher education. She has coordinated national and international projects and is a member of international working groups on education and higher education policies. Formerly an executive in

the publishing sector, she is the author of around twenty publications in several languages on topics including the evaluation of educational qualifications, the internationalisation of higher education, ethics in education, recognition of refugees' qualifications, micro-credentials, transnational education, digitalisation, and artificial intelligence. She serves as President of the ENIC Network of the Council of Europe and UNESCO, and as Co-Chair of the Thematic Peer Group on Recognition within the Bologna Process and the European Higher Education Area.

Serena Spitalieri. Is Head of the Credential Evaluation and Information Center within CIMEA–NARIC Italia. She has research and teaching experience in the field of fraudulent documents and diploma mills, transnational education, international higher education systems, and digitalization. Since 2018, she has been responsible for following the design and digital developments linked to CIMEA's workflow assessment, with a particular focus on new technologies such as blockchain and Artificial Intelligence (AI) applied to the Education and Credential Evaluation field. In 2025, she earned a PhD in Business Management with a dissertation titled "Digital Transformation and Artificial Intelligence for Advancing Fairness in Recognition of Qualifications in Higher Education. A Comprehensive Approach towards Change Management for Sustainable Transformation at CIMEA-NARIC".

Juan G. Corvalán. Holds a PhD in Law and a Master's degree in Artificial Intelligence from CEUPE. He is the co-creator of Prometea and PretorIA, and has spoken at international institutions and forums including Google Talks, the United Nations, the Organization of American States, University of Oxford, and Massachusetts Institute of Technology. He currently serves as Academic Director of the postgraduate programme in Generative AI, Prompting and Law, Director of the MBA in AI Project Management at College de Paris, and Co-Director of the Master's programme in AI and Law at University of Salamanca. He is the author and co-author of sixteen books.

Débora Schapira. Completed a Specialization in Educational Policies at Torcuato Di Tella University. She also pursued studies in AI in Higher Education at University of Groningen. Author of the article Expanded and Personalized Education, published in ALGORITMOLANDIA: Artificial Intelligence for Predictive and Inclusive Integration in Latin America and the Caribbean by Inter-American Development Bank.

Laura Diaz Davila. Eng. Laura C. Díaz Dávila holds a PhD in Public Policy. She is Director of the AI Laboratory and Professor and Researcher in Applied Artificial Intelligence at National University of Córdoba.

Carina Mariel Papini. Deputy Director of IALAB. Lawyer specialized in Constitutional Law and Civil Procedural Law at University of Buenos Aires. Holds a Master's degree in Artificial Intelligence from CEUPE. Deputy Director of the postgraduate programme in Generative AI, AI Agents, Prompting and Law at the University of Buenos Aires. Lecturer in various academic programmes related to these topics.

Melisa Rabán. Lawyer graduated from University of Buenos Aires. Specialist in Public Law. Holds a diploma in Technologies and Public Administration.

Cristian Santander. Is CEO of Cognitive.la, Director of the Diploma in Artificial Intelligence and Data Science at National Technological University Buenos Aires, and Co-Director of the Centre for Applied Artificial Intelligence at UTN. Industrial Engineer from UTN.BA, he also holds a Master's degree in Marketing and Communications from University of San Andrés and postgraduate studies in Advanced Artificial Intelligence (UTN/CEUPE). He teaches Computer Vision at UCEMA and has extensive academic experience in AI, marketing, and project evaluation.

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