



DACEM

Digitising Academic Catalogues for Enhanced Mobility

DACEM Policy Recommendations

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1. Introduction

Academic Catalogues (ACs) have become a cornerstone of the European Higher Education Area (EHEA). Initially conceived as repositories of course descriptions intended primarily to support transparency and student mobility. Their role has evolved significantly in response to the increasing digitalisation, internationalisation, and flexibility of higher education. Today, ACs serve a much broader range of stakeholders and purposes, including curriculum management, quality assurance, mobility support, lifelong learning, European University Alliances (EUAs), and the emerging European Degree.

Despite this, many existing catalogues still reflect a traditional conception inherited from printed course catalogues and static institutional websites. Information is often fragmented, difficult to discover, poorly interconnected, and primarily designed for human consumption. At the same time, the increasing reliance on digital services and cross-border cooperation requires Academic Catalogues to support not only human users but also machine-to-machine interoperability.

This document presents the recommendations developed within the DACEM project to support the evolution of ACs across the EHEA. Building on the experiences and contributions of project partners, existing European initiatives, and the needs of key stakeholders, these recommendations aim to provide a shared vision and guiding principles for developing more transparent, learner-centred, interoperable, and trustworthy Academic Catalogues.

The recommendations address organisational, educational, semantic, and technical aspects of ACs and are intended to support higher education institutions, EUAs, policymakers, quality assurance bodies, technical communities, and software providers. Together, they seek to foster the emergence of a European Academic Information Space that supports mobility, lifelong learning, recognition, quality assurance, and the future European Degree.

Rather than prescribing a single implementation model, this document advocates a progressive and collaborative approach that accommodates the diversity of higher education systems and institutional contexts across Europe. The recommendations are organised within a layered framework that progresses from human and organisational considerations to educational, semantic, and technical dimensions, reflecting the conviction that ACs should first serve people, then support educational understanding, and finally enable digital interoperability and cooperation.

1.1 Vision

The DACEM initiative advocates a shift from the traditional concept of a **Course Catalogue** (CC) towards a broader notion of an **Academic Catalogue** (AC). ACs should encompass not only courses and programmes, but also institutional information, organisational structures, resources and services, mobility opportunities, quality assurance information, and other educational offerings, as recommended by the ECTS Users' Guide (European Commission, 2025). They should become comprehensive, authoritative, and trustworthy sources of information supporting students, institutions, and digital infrastructures alike.

ACs should no longer be regarded merely as institutional websites or administrative tools. Instead, they should provide a shared information infrastructure enabling learners, institutions, alliances, and digital services to discover, access, exchange, and reuse educational information in a transparent and reliable manner.

In this vision, ACs support not only the description of educational offerings but also the creation of flexible learning pathways, the emergence of European Degrees, and the development of federated ecosystems connecting institutions across national and organisational boundaries.

1.2 Guiding Principles

The proposed recommendations are founded on a set of principles that define the desired evolution of ACs:

- **Student-Centredness:** ACs should be designed primarily to support learners and other end users. Information should be understandable, relevant, accessible, and organised around the needs of students, mobility coordinators, and academic staff. User experience should be considered a fundamental requirement rather than an afterthought.
- **Trustworthiness:** Academic information should not only be accessible but also reliable. ACs should provide authoritative, up-to-date, and verifiable information. Mechanisms that support provenance, versioning, and integrity should enhance transparency and confidence in the information used for mobility, recognition, and quality assurance.
- **Interoperability:** ACs should support the seamless exchange and reuse of information across institutions and digital services. Open standards, common vocabularies, persistent identifiers, and standardised APIs are essential to enable interoperability within the EHEA.

- **Openness:** Academic information should be accessible through open and well-documented interfaces and formats. Openness facilitates innovation, promotes transparency, and enables the development of value-added services by institutions, software providers, and third-party actors.
- **Semantic Consistency:** Academic information should be described using shared concepts, vocabularies, and competence frameworks. Common semantic foundations are necessary to support meaningful discovery, comparison, and interpretation of educational opportunities across institutions and countries.
- **Modularity and Flexibility:** ACs should reflect the increasing diversity and flexibility of higher education. Educational offerings should be represented as modular and hierarchical structures, enabling the description of programmes, modules, learning components, micro-credentials, and other learning opportunities, as well as their relationships.
- **Multilingualism:** ACs should support multilingual access and facilitate international mobility. English should be available as a common fallback language whenever information in the user's preferred language is not available. At the same time, linguistic diversity should be preserved and promoted.
- **Accessibility and Inclusiveness:** Academic information should be accessible to all users, irrespective of language, disability, or device. Catalogues should adopt mobile-first approaches and comply with accessibility principles to ensure equal access to information and opportunities.
- **Single Source of Truth:** Information should be maintained in authoritative locations and reused rather than duplicated. This principle improves consistency, reduces maintenance effort, and facilitates synchronisation among systems.
- **Continuous Improvement:** ACs should be considered living systems rather than static publications. Their quality should be continuously enhanced through governance mechanisms, regular reviews, user feedback, and incremental development approaches.
- **Distributed Governance:** The responsibility for maintaining AC information should be shared among the actors with the most relevant expertise. Distributed ownership should be complemented by appropriate validation processes and coordination mechanisms to ensure consistency and quality.
- **Collaboration:** The development of ACs is a collective endeavour involving users, institutions, policymakers, technical communities, quality assurance bodies, and software providers. Effective collaboration among these stakeholders is essential to realise the vision of a European Academic Information Space.

Taken together, these principles describe a transition from traditional course catalogues towards a new generation of ACs characterised by openness, interoperability, trust, and collaboration (see Table 1).

In this perspective, ACs constitute much more than information repositories. They represent a foundational element of the digital infrastructure required to support mobility, lifelong learning, automatic recognition, EUAs, and the future European Degree. Their evolution is therefore an essential component of the broader transformation of the EHEA towards a truly interconnected European Academic Information Space.

Table 1. Towards a European Academic Information Space

Traditional Course Catalogue	Desired Academic Catalogue
Static website	Dynamic digital ecosystem
List of courses	Rich educational knowledge infrastructure
Institution-centric	Learner-centric
Human-readable	Human- and machine-readable
Isolated information	Interconnected information
Local scope	European scope
Descriptive	Discoverable and actionable
Stand-alone resource	Component of a federated ecosystem

1.3 Recommendation Framework

The proposed recommendations are organised according to a layered framework that reflects the different dimensions involved in the development of ACs. This framework progresses from the most human and organisational aspects to the most technical and infrastructural ones, emphasising that technology should ultimately serve educational goals and the needs of learners and institutions.

Three complementary layers are distinguished:

- The **Human and Organisational Dimension**, which focuses on users, governance, and the scope and quality of academic information.
- The **Educational and Semantic Dimension**, which addresses how educational offerings are represented, understood, trusted, and used to support mobility and cooperation.

- The **Digital Infrastructure Dimension**, which concerns the technical foundations required to enable interoperability and the emergence of a federated European Academic Information Space.

Although these domains are presented separately, they should not be regarded as independent. On the contrary, they are highly interconnected and mutually reinforcing. Together, they describe a progressive evolution from traditional CCs towards interoperable, trustworthy, and learner-centred AC ecosystems.

2. The Human and Organisational Dimension

The first layer focuses on the people who create, maintain, and use ACs. It recognises that the value of a catalogue ultimately depends on the quality, accessibility, and relevance of the information provided, as well as on the governance processes that ensure its continuous improvement.

Three thematic domains are included within this dimension:

- **Student Experience and Accessibility:** This domain addresses the needs of learners and other end users. It includes recommendations aimed at ensuring that ACs provide clear, accessible, multilingual, and user-friendly information. Particular attention is given to user experience, mobile access, accessibility, discoverability, and mechanisms that facilitate informed decision-making.
- **Governance, Collaboration, and Continuous Improvement:** This domain focuses on the organisational processes required to maintain high-quality ACs. It includes recommendations related to content governance, distributed responsibilities, validation workflows, user feedback mechanisms, staff training, maturity models, and recognition mechanisms promoting excellence and continuous improvement.
- **Academic Information and Educational Ecosystems:** This domain addresses the breadth and richness of information that should be available through Academic Catalogues. It extends the traditional concept of course catalogues to encompass institutions, campuses, organisational units, services, mobility opportunities, supporting documents, calendars, and other educational resources required to support the learner experience.

2.1 Student Experience and Accessibility

ACs ultimately exist to support learners and other users in identifying, understanding, and accessing educational opportunities. Consequently, the design and organisation of ACs should be driven primarily by the needs and expectations of their users rather than by institutional structures or administrative considerations.

As higher education becomes increasingly international, flexible, and digitally mediated, ACs are expected to support a wide range of stakeholders, including prospective students, full-degree students, mobility students, visiting students, programme coordinators, and mobility coordinators. These users differ in their objectives, backgrounds, and information needs, requiring catalogues to provide clear, accessible, and context-sensitive information.

Student experience encompasses not only the availability of information but also its usability, discoverability, accessibility, and relevance. Academic information should be easy to find, easy to understand, and accessible to all users regardless of their language, location, device, or specific needs. Catalogues should therefore provide multilingual information, mobile-friendly interfaces, meaningful visual elements, advanced search capabilities, and mechanisms supporting personalised discovery and informed decision-making.

Moreover, ACs should not be regarded merely as repositories of information but as digital services accompanying learners throughout their educational journeys. They should empower students to explore opportunities, compare alternatives, plan mobility experiences, and make informed choices. In this perspective, accessibility and user experience are not secondary characteristics but fundamental requirements that contribute to transparency, inclusion, and the successful realisation of a learner-centred EHEA.

Key principle: ACs should be designed around the needs of users, rather than requiring users to adapt to institutional structures

Policy recommendations:

- **1.1 Identify target users and support role-specific information.** Different categories of users, such as full-degree students, mobility students, visiting students, and coordinators, have distinct information needs. Tailoring information to specific user profiles improves relevance, usability, and decision-making.

This recommendation was implemented in the DACEM AC institutional information page, explicitly identifying the target users for mobility and admission pieces of information.

- **1.2 Provide clear and student-oriented information.** Academic information should be understandable and easy to navigate. Clear, concise, and student-oriented language helps users find and interpret information effectively, particularly international students unfamiliar with institutional terminology and administrative jargon.

Attention has been devoted to the use of clear and internationally recognised terminology, especially in English.

Since the DACEM AC is multilingual, **terminology in additional languages should also be considered**. A valuable reference for mobility-related terminology in multiple languages is provided by (Fréjaville et al., 2023).

- **1.3 Ensure the availability of appropriate contact information.** Students often require additional guidance or clarification. Providing clear contact information and responsible offices facilitates communication, reduces uncertainty, and supports efficient resolution of academic and administrative issues.

In the DACEM AC, contact information is provided at different levels, including the institution, campuses, organisational units, programmes, and courses, as well as for specific services such as student affairs, insurance, support for students with disabilities and special needs, special facilities, and visa-related matters.

- **1.4 Support multilingualism and establish English as the default fallback language.** Multilingual information enhances accessibility and promotes internationalisation. Since translations into all languages cannot always be guaranteed, English should be available as a common reference language to ensure that essential information remains accessible to international users.

In the DACEM AC, English is used as the mandatory fallback language. Information may additionally be provided in other languages. Whenever information is unavailable in the language selected by the user, the corresponding English version is displayed.

- **1.5 Adopt mobile-first approaches and responsive design.** Many students access academic information primarily through smartphones and tablets. Mobile-friendly interfaces ensure that ACs remain accessible and usable regardless of the device employed by the user.

The DACEM AC adopts a responsive design approach, and its visualisation has been reviewed on mobile devices to ensure an adequate user experience. Future developments may further strengthen the adoption of mobile-first design principles.

- **1.6 Ensure accessibility and inclusiveness.** ACs should be accessible to all users, including persons with disabilities and individuals with diverse linguistic and cultural backgrounds. Inclusive design contributes to equal access to educational opportunities and supports the principles of the EHEA.
- **1.7 Include meaningful and representative visual elements.** Appropriate visual content can improve understanding, engagement, and orientation. Meaningful

images help students better understand campuses, facilities, and services, particularly when considering mobility opportunities or studying in unfamiliar environments.

In the DACEM AC, institutions can customise visual elements, including representative images and institutional colours, allowing each catalogue to preserve its identity while maintaining an appealing and professional appearance.

- **1.8 Provide advanced search, browsing, and discovery functionalities.** Students increasingly need support in exploring educational opportunities according to their interests, languages, mobility possibilities, and learning objectives. Advanced search and browsing capabilities facilitate informed choices and enhance the discoverability of educational offerings.

The DACEM AC enables users to search programmes and courses. Several filters are available, including results available for mobility. Sorting options are also available. An option allows you to search for programmes that have a mobility agreement with a certain home programme. Current search capabilities provide the foundations for more advanced discovery functionalities to be incorporated in future versions.

- **1.9 Support personalised recommendations and intelligent exploration.** Modern Academic Catalogues should help users identify relevant opportunities rather than merely display information. Recommendation mechanisms can assist learners in discovering programmes, courses, and mobility opportunities aligned with their profiles, preferences, and academic objectives. Although not yet implemented, this recommendation represents an important direction for the future evolution of ACs.
- **1.10 Support user feedback and issue reporting mechanisms.** Students and staff are often the first to detect inaccuracies, missing information, or usability issues. Providing mechanisms for reporting problems promotes continuous improvement, enhances information quality, and fosters a culture of shared responsibility and user participation.

In the DACEM AC, users can submit feedback from any page or section of the catalogue. The origin of each feedback item is recorded, enabling the identification of the affected section and facilitating subsequent review and improvement.

2.2 Governance, Collaboration, and Continuous Improvement

The quality and sustainability of ACs depend not only on the information they contain, but also on the organisational processes and collaborative mechanisms that govern their creation, maintenance, and evolution. AC should therefore be regarded not merely as technological systems, but as living information ecosystems supported by communities of actors with complementary expertise and responsibilities.

The information included in ACs originates from multiple organisational levels and domains, ranging from institutional regulations and student services to programme descriptions and course specifications. Consequently, maintaining accurate, consistent, and up-to-date information requires clear governance structures, distributed responsibilities, effective coordination mechanisms, and appropriate quality assurance processes.

Furthermore, ACs are expected to evolve continuously in response to changing educational models, technological developments, and the needs of students and institutions. This evolution should not be perceived as a one-time effort, but rather as an ongoing process of improvement supported by regular reviews, user feedback, staff training, and collaboration among different stakeholders.

Institutions also differ considerably in terms of their digital maturity, organisational structures, and available resources. For this reason, the development of ACs should follow a progressive and inclusive approach, allowing institutions to evolve incrementally while preserving compatibility with future developments and interoperability requirements.

Key principle: ACs are not maintained by systems alone, but by communities of responsible actors operating within clear governance frameworks and committed to continuous improvement.

Policy recommendations:

- **2.1 Establish content governance and quality principles.** The quality of an AC depends not only on the information it contains, but also on how that information is organised, maintained, and presented. Clear governance principles help ensure consistency, accuracy, usability, and sustainability.

The DACEM project has produced guidelines to support institutions in the organisation, maintenance, and presentation of Academic Catalogue information, thereby promoting common governance and quality principles.

- **2.2 Promote the single source of truth and avoid unnecessary duplication of information.** Maintaining information in a single authoritative location reduces inconsistencies, simplifies updates, and improves reliability. Avoiding duplication facilitates synchronisation among systems and reduces maintenance efforts.

Most information elements in the DACEM AC are optional. However, when institutions decide to provide a particular type of information, it should be entered in the appropriate section, thereby promoting the single-source-of-truth principle and avoiding unnecessary duplication.

- **2.3 Define multi-level responsibilities and role-based permissions.** Academic information originates from different organisational levels and domains. Clearly assigning responsibilities and permissions ensures accountability, leverages local expertise, and supports efficient information management.

The DACEM Academic Catalogue distinguishes five roles with different responsibilities and permissions: HEI Administrator, Campus Editor, Organisational Unit Administrator, Programme Administrator, and Course Editor.

- **2.4 Establish editing, validation, and approval workflows.** Separating content creation, validation, and approval helps maintain information quality and consistency. Structured workflows contribute to transparency, accountability, and quality assurance.

Although editing workflows are supported, formal validation and approval workflows have not yet been implemented in the DACEM AC. Their incorporation represents an important direction for future developments.

- **2.5 Promote distributed ownership and coordinated governance.** Information should be maintained by those closest to it, while overall coherence should be ensured through coordination mechanisms. This approach balances flexibility, expertise, and consistency across the catalogue. Regular reviews, staff training, and effective communication among institutional units contribute to the long-term quality and sustainability of ACs.
- **2.6 Promote incremental development and maturity-based approaches.** Institutions differ in terms of resources and digital maturity. A progressive approach enables broad participation and allows institutions to evolve gradually towards more advanced capabilities without creating unnecessary barriers.

The DACEM AC supports a progressive approach by allowing institutions to provide only those information elements that are relevant to their context. Institutions may progressively extend their catalogues as their needs and digital maturity evolve.

- **2.7 Establish recognition mechanisms and awards for excellence.** Recognition and visibility can serve as powerful incentives for continuous improvement. Awards and quality labels help disseminate good practices and encourage institutions to pursue excellence and innovation in AC development. In the DACEM project, we have attempted to promote an award to the best catalogues in European HEIs and EUAs.

2.3 Academic Information and Educational Ecosystems

ACs should provide comprehensive and coherent information that enables learners and other stakeholders to understand not only what they can study, but also where, when, and under which conditions educational opportunities are offered. Consequently, ACs should extend beyond traditional lists of programmes and courses and encompass the broader academic ecosystem in which learning takes place.

Students, particularly international and mobility students, require information about institutions, campuses, organisational units, student services, academic calendars, mobility opportunities, and supporting documentation. Likewise, institutions and digital services benefit from richer and more structured information that facilitates transparency, comparability, and cooperation across the European Higher Education Area.

ACs should therefore represent educational ecosystems rather than isolated educational offerings. They should provide a holistic view of the learning environment and support learners throughout their educational journeys, from selecting an institution and programme to planning mobility experiences and accessing relevant support services.

Key principle: **ACs should describe educational ecosystems rather than merely lists of programmes and courses**

Policy recommendations:

- **3.1 Adopt the concept of the Academic Catalogue (AC) and broaden the scope beyond programmes and courses.** The term Course Catalogue (CC) may lead users to perceive these systems as simple listings of courses, similar to traditional printed catalogues. However, contemporary catalogues serve a much broader purpose. They provide information not only about courses and programmes, but also about

institutions, campuses, organisational units, services, mobility opportunities, regulations, and other elements that shape the learner experience. Adopting the term Academic Catalogue (AC) better reflects this broader scope and emphasises the role of these systems as comprehensive gateways to the academic ecosystem rather than mere repositories of course descriptions.

The DACEM AC extends the traditional notion of Course Catalogues (CCs) by incorporating institutional information, campuses, organisational units, resources, services, and mobility-related information in accordance with the recommendations of the ECTS Users' Guide (European Commission, 2015). This broader scope motivated the adoption of the term Academic Catalogue, which more accurately represents the nature and purpose of the platform.

- **3.2 Include institutional information, campuses, organisational units, resources, and services.** Understanding the educational context requires information beyond academic offerings. Information about campuses, facilities, accommodation, libraries, student support services, and other resources is particularly important for mobility and international students.

The DACEM AC enables the description of institutions, campuses, organisational units, and numerous resources and services, including accommodation, visa support, insurance, support for students with disabilities, and special facilities.

- **3.3 Include academic calendars and term periods as structured entities.** Academic calendars and term periods are fundamental for planning studies and mobility activities. Their structured representation improves transparency and facilitates coordination across institutions. The DACEM AC supports the representation of academic years and term periods, allowing educational offerings to be associated with specific periods.
- **3.4 Support rich and interconnected educational ecosystems.** HEIs increasingly participate in EUAs and other forms of international collaboration. Students and staff should be able to understand not only the characteristics of an individual institution, but also its relationships with partner institutions and the opportunities arising from such collaborations. Representing institutions as members of alliances and networks contributes to a more comprehensive understanding of the educational ecosystem and facilitates the discovery of shared educational offers, mobility pathways, and cross-institutional opportunities.

The DACEM AC enables institutions to describe their participation in EUA and other collaborative initiatives. Information about alliances can be associated with

institutions, providing users with additional context regarding their international partnerships and educational ecosystems.

3. The Educational and Semantics Dimension

The second layer focuses on the representation and meaning of educational information. It aims to ensure that Academic Catalogues not only provide information but also support shared understanding, trust, recognition, and cooperation across institutions and countries.

Four thematic domains are included within this dimension:

- **4 Educational Models and Learning Structures.** This domain addresses how educational offerings should be represented. It includes recommendations concerning hierarchical and modular programme structures, learning components, micro-credentials, lifelong learning opportunities, joint programmes, and European Degrees.
- **5 Semantics and Shared Understanding.** This domain focuses on the use of common vocabularies and competence frameworks that enable educational information to be interpreted consistently across institutions and systems. It encompasses recommendations concerning ELM vocabularies, ISCED-F classifications, learning outcomes, and competence frameworks such as ESCO.
- **6 Trust, Quality, and Transparency.** This domain concerns the reliability and verifiability of academic information. It includes recommendations related to provenance, integrity mechanisms, versioning, supporting documents, quality assurance information, and traceability, with the aim of strengthening trust and transparency.
- **7 Mobility and European Cooperation.** This domain recognises the central role of Academic Catalogues in supporting mobility and cross-institutional collaboration. It encompasses recommendations related to inter-institutional agreements, mobility opportunities, Blended Intensive Programmes, virtual mobility, European University Alliances, and the future European Degree.

3.1 Educational Models and Learning Structures

Higher education is undergoing profound transformations driven by increasing flexibility, internationalisation, lifelong learning, and the emergence of new forms of educational provision. As a result, ACs should evolve beyond traditional representations based on isolated courses and rigid programme structures to support richer and more flexible learning models.

Key principle: ACs should represent learning structures and learning pathways, rather than merely lists of educational offerings

Policy recommendations:

- **4.1 Support hierarchical and modular representations of educational offerings.** Educational offerings are increasingly organised in terms of programmes, specialisations, modules, and learning components. Explicitly representing these relationships improves transparency, facilitates curriculum management, and supports flexible learning pathways.

The current DACEM AC supports hierarchical relationships among institutions, organisational units, programmes, and courses. Extending this approach to modules and other learning components represents an important direction for future developments.

- **4.2 Support the representation of diverse learning opportunities.** Higher education increasingly encompasses educational opportunities beyond traditional degree programmes. ACs should be capable of representing micro-credentials, lifelong learning opportunities, Blended Intensive Programmes (BIPs), virtual mobility activities, summer schools, and other forms of learning.

The current DACEM AC focuses mainly on programmes and courses. Support for additional types of learning opportunities has been identified as an important area for future evolution.

- **4.3 Promote reusable and stackable learning components.** Educational components are increasingly reused across programmes and institutions. Supporting reusable and stackable learning components facilitates curriculum flexibility, lifelong learning, and the accumulation of learning achievements over time.

Although not currently implemented, the modular structure envisaged by the DACEM AC provides a foundation for supporting reusable and stackable educational components.

4.4 Support joint programmes, European Degrees, and cross-institutional educational offerings. Educational offerings increasingly involve collaboration among institutions. Academic Catalogues should support the representation of joint programmes, European Degrees, and other educational opportunities delivered across institutional boundaries.

The DACEM AC already incorporates information about mobility agreements, joint educational offerings and alliances.

3.2 Semantics and Shared Understanding

Transparency, interoperability, and cooperation within the European Higher Education Area depend not only on the availability of information, but also on its consistent interpretation. Educational information should therefore be described using shared concepts, classifications, vocabularies, and competence frameworks that enable institutions, learners, and digital systems to understand and exchange information in a meaningful way.

However, differences in terminology, educational traditions, and institutional practices may hinder comparability and interoperability. Similar educational concepts may be described using different terms, while identical terms may carry different meanings in different contexts. Such ambiguities can create barriers to mobility, recognition, and the effective reuse of information.

ACs should therefore rely on common semantic foundations that promote a shared understanding of educational entities and their characteristics. These foundations should support both human and machine interpretation, facilitate multilingualism, and remain sufficiently flexible to accommodate the diversity and continuous evolution of higher education systems.

Key principle: ACs should not only provide information but also promote a shared understanding of educational concepts across institutions, countries, languages, and systems.

Policy recommendations:

- **5.1 Promote the adoption of shared information models and vocabularies.** Common information models and vocabularies provide a common language for describing educational entities and their relationships. Their adoption facilitates interoperability, comparability, and information exchange across institutions and systems.

In addition, a complementary policy recommendation is to promote the extension of these shared information models and vocabularies to include all required terms and languages.

The DACEM AC has adopted the European Learning Model (ELM) as the conceptual basis for representing educational entities and their relationships.

- **5.2 Promote the use of internationally recognised classifications.** Common classifications facilitate comparability and discovery across institutions and countries. Standard classifications such as ISCED-F contribute to a shared understanding of disciplines and educational fields.

The DACEM AC supports the classification of programmes and courses according to ISCED-F.

- **5.3 Promote shared frameworks for learning outcomes and competencies.** Learning outcomes and competencies provide a learner-centred perspective on educational offerings. Shared frameworks such as ESCO can improve transparency, comparability, and interoperability while supporting recognition and employability.

The current DACEM AC supports textual descriptions of learning outcomes. Future developments should explore the use of shared competence frameworks and semantic representations.

3.3 Trust, Quality, and Transparency

Trust constitutes a fundamental requirement for ACs and the digital ecosystems in which they operate. Students, institutions, mobility coordinators, recognition authorities, and digital services increasingly rely on ACs to access information that supports important decisions related to mobility, admissions, curriculum planning, recognition, and quality assurance. Consequently, the information provided through ACs should not only be accessible and comprehensive but also reliable, transparent, and verifiable.

Key principle: **ACs should not only provide information, but also provide confidence in that information**

Policy recommendations:

- **6.1 Include supporting documents and references to authoritative information.** Educational information should be complemented by access to supporting documents and authoritative sources. Providing links to regulations, accreditation reports, quality assessments, and other relevant documentation enhances transparency and facilitates verification.

The DACEM AC enables institutions to associate documents and external references with different entities, providing users with access to supporting information.

- **6.2 Promote the integration of quality assurance information.** Quality assurance plays a central role in building trust and facilitating recognition. ACs should provide access to relevant quality assurance information and support initiatives aimed at connecting quality-related data across institutions.

The DACEM project has explored the integration of quality assurance information through the QualityLink approach, enabling the association of institutions and programmes with quality-related information.

- **6.3 Support provenance and accountability.** Users should be able to identify the source and ownership of information. Information provenance and clear responsibilities contribute to accountability and strengthen confidence in the reliability of ACs.

The DACEM AC includes information about the authorship and date of the last update.

- **6.4 Support versioning and the preservation of historical information.** Educational information evolves over time. Preserving historical versions enables users to verify the information that was valid at a specific point in time and supports recognition, auditing, and transparency.

Although not currently implemented, the preservation of historical information has been identified as an important requirement for future developments of the DACEM AC.

- **6.5 Promote integrity mechanisms and information traceability.** Mechanisms allowing users and systems to verify whether information has changed contribute to transparency and trust. Integrity and traceability are particularly relevant for mobility, recognition, and quality assurance processes.

Integrity mechanisms are not currently supported by the DACEM AC. Nevertheless, they represent an important area for future developments aimed at strengthening trust and authenticity.

3.4 Mobility and European Cooperation

While the previous dimensions have focused on information, educational models, semantics, and trust, this dimension emphasises one of the original and most important purposes of ACs: enabling mobility and facilitating cooperation among institutions. However, the scope of mobility has expanded considerably, encompassing not only traditional Erasmus exchanges but also Blended Intensive Programmes, virtual mobility, European University Alliances, joint programmes, and the emerging European Degree.

Key principle: **ACs should enable learners to discover and access educational opportunities beyond the boundaries of their home institutions**

Policy recommendations:

- **7.1 Include information about mobility agreements and international cooperation opportunities.** Mobility opportunities constitute an essential component of the EHEA. Making agreements and related opportunities visible enhances transparency and facilitates mobility planning and recognition.

The DACEM AC supports the representation of mobility agreements and enables users to identify opportunities associated with specific home programmes.

- **7.2 Provide mobility-oriented information and contact points.** Mobility students often have specific information needs concerning visas, accommodation, insurance, student support services, and institutional procedures. Providing dedicated information and contact points facilitates mobility and improves the student experience.

The DACEM AC enables institutions to provide mobility-related information and dedicated contacts for areas such as visas, accommodation, insurance, and support services.

- **7.3 Incorporate experience-based recommendations from mobility coordinators.** Mobility coordinators accumulate valuable practical knowledge regarding institutions, programmes, and mobility pathways. Capturing and sharing this experience can improve student guidance, preserve institutional memory, and contribute to more successful mobility experiences.

The current DACEM AC only allows institutions to manage their own information. Nevertheless, the incorporation of experience-based recommendations from

mobility coordinators of other institutions targeted at their students has been identified as a valuable feature for future developments.

- **7.4 Support the representation of institutions as members of EUAs and collaborative networks.** Institutions increasingly participate in alliances and strategic networks that create new educational opportunities and pathways. Making these affiliations visible helps students understand the broader educational ecosystem and facilitates the discovery of shared initiatives and cross-institutional opportunities.

The DACEM AC enables institutions to describe their participation in alliances and collaborative initiatives, thereby providing additional context regarding their international ecosystems.

4. The Digital Infrastructure Dimension

The third layer focuses on the technological foundations that enable Academic Catalogues to interoperate and evolve into components of a broader European Academic Information Space.

Two thematic domains are included within this dimension:

- **8. Interoperability and Technical Standards.** This domain addresses the mechanisms required to exchange and reuse academic information in a machine-readable manner. It includes recommendations concerning persistent identifiers, APIs, exchange formats, and interoperability with European infrastructures and services.
- **9. Federated Academic Catalogue Ecosystems.** This domain represents the most advanced level of integration. It includes recommendations to promote ecosystems of interoperable catalogue instances, authoritative sources, catalogue registries, federated search mechanisms, cross-catalogue relationships, and alliance-wide educational ecosystems.

4.1 Interoperability and Technical Standards

The increasing digitalisation and internationalisation of higher education require ACs not only to provide information for human users, but also to support the automated exchange and reuse of information across systems and organisations. Academic information is increasingly consumed by digital services supporting mobility, admissions, curriculum management, recognition, quality assurance, and lifelong learning. Consequently, interoperability has become a fundamental requirement for ACs.

Achieving interoperability requires more than the availability of information. It depends on the adoption of common technical standards, persistent identifiers, exchange formats, and well-defined interfaces that enable systems to communicate and cooperate effectively. Such standards facilitate the integration of ACs with institutional information systems and European digital infrastructures, while reducing duplication and promoting consistency.

Key principle: ACs should not only be readable by humans, but also understandable and reusable by machines

Policy recommendations:

- **8.1 Promote the use of persistent and globally unique identifiers.** Persistent and globally unique identifiers facilitate the unambiguous identification of institutions, programmes, courses, and other educational entities. They improve interoperability, support recognition processes, and enable stable references to information over time. Examples:

The DACEM AC assigns identifiers to all entities and recognises the importance of adopting persistent and externally recognised identifiers. SCHAC codes are used for institutions.

- **8.2 Support standardised APIs for Academic Catalogues.** Standardized APIs enable the automated exchange and reuse of academic information among systems and organisations. They constitute the foundation for interoperability and facilitate the development of value-added services.

The DACEM project has strongly influenced the development of the OCCAPI v2 specification and provides API support to facilitate interoperability among catalogue instances and external systems.

- **8.3 Promote interoperability with European digital infrastructures and services.** ACs should be able to interact with the digital infrastructures supporting mobility and cooperation within the EHEA. Interoperability with these services contributes to reducing administrative burdens and enhancing the learner experience.

The DACEM AC has been designed with interoperability in mind and builds upon experiences gained within the Erasmus Without Paper (EWP) ecosystem.

- **8.4 Support standardised import and export formats.** Standardised exchange formats facilitate the migration, reuse, and synchronisation of information among systems. They also lower barriers to adoption and promote the participation of institutions with different levels of digital maturity.

The DACEM AC supports CSV-based import mechanisms and recognises the importance of providing standardised formats for data exchange.

4.2 Federated Academic Catalogue Ecosystems

ACs should not be regarded as isolated institutional systems. As higher education becomes increasingly interconnected, ACs are expected to operate as components of broader ecosystems that support the discovery, exchange, and reuse of information across institutions, countries, and digital infrastructures.

Such ecosystems should preserve institutional autonomy and the principle of authoritative information while enabling new capabilities, including federated search, cross-catalogue relationships, and the discovery of educational opportunities across institutional and national boundaries. Rather than promoting centralised databases, this approach advocates collaboration among distributed catalogue instances based on common standards and interoperable interfaces.

Key principle: **ACs should cooperate as a network of authoritative information sources rather than operate as isolated repositories**

Policy recommendations:

- **9.1 Promote ecosystems of interoperable ACs instances.** ACs should evolve from isolated institutional systems into interconnected ecosystems. Such ecosystems preserve institutional autonomy while enabling the exchange and reuse of information across institutions and services.

The DACEM architecture has been conceived as a distributed ecosystem of catalogue instances rather than as a centralised platform, enabling institutions to maintain their own authoritative information. For example, agreements could be established between institutions available in different instances.

- **9.2 Establish a registry of authoritative ACs.** Users and systems should be able to identify the authoritative source of information for each institution. Catalogue registries facilitate discoverability, interoperability, and trust by enabling the identification of official catalogue instances.

The DACEM project has recognised the importance of identifying authoritative catalogue sources and foresees establishing mechanisms to support catalogue discovery.

- **9.3 Support federated search and discovery services.** Learners increasingly need to explore opportunities beyond their home institutions. Federated search capabilities can facilitate the discovery and comparison of educational opportunities distributed across multiple catalogue instances.

The current DACEM AC provides search capabilities within individual instances. Federated search functionalities represent a natural evolution of the ecosystem.

5. Policy Recommendations for Stakeholders

The development of an interoperable AC ecosystem involves a broad range of actors operating at different levels. Eight categories of stakeholders have been identified:

- Users and communities of practices
- Higher Education Institutions (HEIs)
- European University Alliances (EUAs)
- National authorities and ministries
- European institutions and policy makers
- Quality Assurance (QA) agencies and recognition bodies
- European technical infrastructures and standardisation communities
- HEIs and mobility software providers

The next sections show how the recommendations are applied to these stakeholders. Table 2 provides a summary of the matching.

Table 2. Matching between the recommendations and stakeholders

Recommendations	Users & Comms	HEIs	EUAs	Nat. Author.	Eur. Institut.	QA & Rec. B.	Techn. Infrastr.	Softw. Provid.
1.1 Identify target users and support role-specific information		✓						
1.2 Provide clear and student-oriented information		✓						
1.3 Ensure the availability of appropriate contact information		✓						
1.4 Support multilingualism and establish English as the default fallback language		✓						
1.5 Adopt mobile-first approaches and responsive design								✓
1.6 Ensure accessibility and inclusiveness		✓						
1.7 Include meaningful and representative visual elements		✓						
1.8 Provide advanced search, browsing, and discovery functionalities		✓						✓
1.9 Support personalised recommendations and intelligent exploration		✓						✓
1.10 Support user feedback and issue reporting mechanisms	✓	✓						✓
2.1 Establish content governance and quality principles		✓						
2.2 Promote the single source of truth		✓						✓
2.3 Define multi-level responsibilities and role-based permissions		✓						✓
2.4 Establish editing, validation, and approval workflows		✓						✓

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2.5 Promote distributed ownership and coordinated governance		✓						
2.6 Promote incremental development and maturity-based approaches		✓		✓				✓
2.7 Establish recognition mechanisms and awards for excellence		✓		✓				
3.1 Adopt the concept of the Academic Catalogue and broaden its scope beyond programmes and courses		✓						✓
3.2 Include information about campuses and organisational units		✓						✓
3.3 Provide academic calendars and term periods		✓						✓
4.4 Support joint programmes, European Degrees, and cross-institutional educational offerings			✓	✓	✓			
5.1 Promote the adoption of shared information models and vocabularies					✓	✓	✓	✓
5.2 Promote the use of internationally recognised classifications					✓	✓	✓	✓
5.3 Promote shared frameworks for learning outcomes and competencies					✓	✓	✓	✓
6.1 Include supporting documents and references to authoritative information		✓		✓	✓	✓		✓
6.2 Promote the integration of quality assurance information		✓		✓	✓	✓		✓
6.3 Support provenance and accountability		✓		✓	✓	✓		✓
6.4 Support versioning and preservation of historical information		✓		✓	✓	✓		✓
6.5 Promote integrity mechanisms and information traceability		✓		✓	✓	✓		✓
7.1 Include information about mobility agreements and cooperation opportunities		✓	✓	✓				✓
7.2 Provide mobility-oriented information and contact points		✓						✓
7.3 Incorporate experience-based recommendations from mobility coordinators	✓	✓	✓					✓
7.4 Support the representation of institutions as members of EUAs and collaborative networks			✓		✓			✓
8.1 Persistent identifiers		✓		✓	✓	✓	✓	✓
8.2 Standardized APIs		✓		✓	✓	✓	✓	✓
8.3 Promote interoperability with European digital infrastructures and services				✓	✓		✓	✓
8.4 Standardised import/export formats		✓		✓	✓	✓	✓	✓
9.1 Promote ecosystems of interoperable AC instances			✓	✓	✓		✓	✓
9.2 Establish a registry of authoritative ACs				✓	✓		✓	✓
9.3 Support federated search and discovery services			✓	✓	✓		✓	✓

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5.1 Users and Communities of Practice

Users constitute the primary beneficiaries of AC and represent the main target group of the DACEM initiative. Communities of practice also play an important role in sharing experiences, identifying requirements, and promoting good practices.

Representative actors include:

- Students;
- Mobility coordinators;
- Programme coordinators;
- Catalogue administrators;
- International offices;
- Communities of practice and professional networks.

Key recommendations:

- Student Experience and Accessibility:
 - 1.10 Support user feedback and issue reporting mechanisms.
- Mobility and European Cooperation:
 - 7.3 Incorporate experience-based recommendations from mobility coordinators.

5.2 Higher Education Institutions (HEIs)

HEIs are responsible for the governance, maintenance, and continuous improvement of their Academic Catalogues. They also provide the organisational structures, policies, and resources required for their implementation and sustainability.

Relevant stakeholders include institutional leaders, academic units, administrative services, and associations of universities. Examples include:

- European University Association (EUA);
- Conferencia de Rectores de las Universidades Españolas (CRUE), Spain;
- Consorzio Interuniversitario per il Calcolo Automatico dell'Italia Nord Orientale (CINECA), Italy;
- Czech Universities initiative (<https://www.czechuniversities.com/>) Czech Republic.

Key recommendations:

- Student Experience and Accessibility:
 - 1.1 Identify target users and support role-specific information.
 - 1.2 Provide clear and student-oriented information.
 - 1.3 Ensure the availability of appropriate contact information.
 - 1.4 Support multilingualism and establish English as the default fallback language.
 - 1.6 Ensure accessibility and inclusiveness.
 - 1.7 Include meaningful and representative visual elements.
 - 1.8 Provide advanced search, browsing, and discovery functionalities.
 - 1.9 Support personalised recommendations and intelligent exploration.
 - 1.10 Support user feedback and issue reporting mechanisms.
- Governance, Collaboration and Continuous Improvement
 - 2.1 Establish content governance and quality principles.
 - 2.2 Promote the single source of truth.
 - 2.3 Define multi-level responsibilities and role-based permissions.
 - 2.4 Establish editing, validation, and approval workflows.
 - 2.5 Promote distributed ownership and coordinated governance.
 - 2.6 Promote incremental development and maturity-based approaches.
 - 2.7 Establish recognition mechanisms and awards for excellence.
- Academic Information and Educational Ecosystems
 - 3.1 Adopt the concept of the Academic Catalogue (AC) and broaden its scope beyond programmes and courses.
 - 3.2 Include information about campuses and organisational units.
 - 3.3 Provide academic calendars and term periods.
- Trust, Quality and Transparency
 - 6.1 Include supporting documents and references to authoritative information.
 - 6.2 Promote the integration of quality assurance information.
 - 6.3 Support provenance and accountability.
 - 6.4 Support versioning and the preservation of historical information
 - 6.5 Promote integrity mechanisms and information traceability.
- Mobility and European Cooperation
 - 7.1 Include information about mobility agreements and cooperation opportunities.
 - 7.2 Provide mobility-oriented information and contact points.

- 7.3 Incorporate experience-based recommendations from mobility coordinators.
- Interoperability and Technical Standards
 - 8.1 Persistent identifiers.
 - 8.2 Standardized APIs.
 - 8.4 Standardised import/export formats.

5.3 European University Alliances (EUAs)

EUAs are important drivers for the development of shared educational offers, European Degrees, and cross-institutional learning pathways. They constitute natural environments for experimenting with interoperable and federated Academic Catalogue ecosystems.

Relevant actors include:

- Existing European University Alliances, particularly those already providing shared catalogues or common educational offers, such as EPICUR, UNITA, INGENIUM, and EUPeace;
- The FOREU4ALL initiative supports cooperation among the 73 alliances.

Key recommendations:

- Educational Models and Learning Structures
 - 4.4 Support joint programmes, European Degrees, and cross-institutional educational offerings.
- Mobility and European Cooperation
 - 7.1 Include information about mobility agreements and cooperation opportunities.
 - 7.3 Incorporate experience-based recommendations from mobility coordinators.
 - 7.4 Support the representation of institutions as members of EUAs and collaborative networks.
- Federated Academic Catalogue Ecosystems
 - 9.1 Promote ecosystems of interoperable AC instances.
 - 9.3 Support federated search and discovery services.

5.4 National Authorities and Ministries

National authorities are responsible for higher education policies, regulatory frameworks, digitalisation strategies, and quality assurance systems. They can play a key role in promoting interoperability and supporting national Academic Catalogue initiatives.

Representative actors include:

- Ministries of Education;
- National agencies for higher education;
- National digitalisation authorities;
- Bodies responsible for vocational higher education and tertiary education systems.

Key recommendations:

- Governance, Collaboration and Continuous Improvement
 - 2.6 Promote incremental development and maturity-based approaches.
 - 2.7 Establish recognition mechanisms and awards for excellence.
- Educational Models and Learning Structures
 - 4.4 Support joint programmes, European Degrees, and cross-institutional educational offerings.
- Trust, Quality and Transparency
 - 6.1 Include supporting documents and references to authoritative information.
 - 6.2 Promote the integration of quality assurance information.
 - 6.3 Support provenance and accountability.
 - 6.4 Support versioning and the preservation of historical information
 - 6.5 Promote integrity mechanisms and information traceability.
- Mobility and European Cooperation
 - 7.1 Include information about mobility agreements and cooperation opportunities.
- Interoperability and Technical Standards
 - 8.1 Persistent identifiers.
 - 8.2 Standardized APIs.
 - 8.3 Promote interoperability with European digital infrastructures and services.
 - 8.4 Standardised import/export formats.
- Federated Academic Catalogue Ecosystems
 - 9.1 Promote ecosystems of interoperable AC instances.
 - 9.2 Establish a registry of authoritative ACs.
 - 9.3 Support federated search and discovery services.

5.5 European Institutions and Policymakers

European institutions provide the policy frameworks and funding instruments that shape the evolution of Academic Catalogues within the European Higher Education Area. Their

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responsibilities include initiatives related to the European Degree, the European Student Card Initiative, interoperability frameworks, and revisions of the ECTS Users' Guide.

Relevant actors include:

- European Commission;
- European Education and Culture Executive Agency (EACEA);
- European Parliament;
- Council of the European Union;
- Bologna Follow-Up Group (BFUG).

Key recommendations:

- Educational Models and Learning Structures
 - 4.4 Support joint programmes, European Degrees, and cross-institutional educational offerings.
- Semantics and shared understanding
 - 5.1 Promote the adoption of shared information models and vocabularies.
 - 5.2 Promote the use of internationally recognised classifications.
 - 5.3 Promote shared frameworks for learning outcomes and competencies.
- Trust, Quality and Transparency
 - 6.1 Include supporting documents and references to authoritative information.
 - 6.2 Promote the integration of quality assurance information.
 - 6.3 Support provenance and accountability.
 - 6.4 Support versioning and the preservation of historical information
 - 6.5 Promote integrity mechanisms and information traceability.
- Mobility and European Cooperation
 - 7.4 Support the representation of institutions as members of EUAs and collaborative
- Interoperability and Technical Standards
 - 8.1 Persistent identifiers.
 - 8.2 Standardized APIs.
 - 8.3 Promote interoperability with European digital infrastructures and services.
 - 8.4 Standardised import/export formats.
- Federated Academic Catalogue Ecosystems
 - 9.1 Promote ecosystems of interoperable AC instances.
 - 9.2 Establish a registry of authoritative ACs.

- 9.3 Support federated search and discovery services.

5.6 Quality Assurance Agencies and Recognition Bodies

Quality assurance (QA) agencies and recognition bodies contribute to transparency, accreditation, and trust in higher education systems. They are important stakeholders in the provision and use of quality-related information within Academic Catalogues.

Representative actors include:

- European Association for Quality Assurance in Higher Education (ENQA);
- European Quality Assurance Register for Higher Education (EQAR);
- National quality assurance agencies;
- Recognition authorities and ENIC-NARIC centres.

Key recommendations:

- Semantics and shared understanding
 - 5.1 Promote the adoption of shared information models and vocabularies.
 - 5.2 Promote the use of internationally recognised classifications.
 - 5.3 Promote shared frameworks for learning outcomes and competencies.
- Trust, Quality and Transparency
 - 6.1 Include supporting documents and references to authoritative information.
 - 6.2 Promote the integration of quality assurance information.
 - 6.3 Support provenance and accountability.
 - 6.4 Support versioning and the preservation of historical information
 - 6.5 Promote integrity mechanisms and information traceability.
- Interoperability and Technical Standards
 - 8.1 Persistent identifiers.
 - 8.2 Standardised APIs.
 - 8.4 Standardised import/export formats.

5.7 European Technical Infrastructures and Standardisation Communities

Technical infrastructures and standardisation communities are responsible for developing and maintaining the standards, vocabularies, APIs, and registries that enable interoperability among Academic Catalogues and related systems.

Relevant actors include:

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- Erasmus Without Paper (EWP) Consortium;
- European University Foundation (EUF);
- European Learning Model (ELM) governance groups;
- OCCAPI and OEAPI communities;
- Communities involved in the European Student Card Initiative and related infrastructures.

Key recommendations:

- Semantics and shared understanding
 - 5.1 Promote the adoption of shared information models and vocabularies.
 - 5.2 Promote the use of internationally recognised classifications.
 - 5.3 Promote shared frameworks for learning outcomes and competencies.
- Interoperability and Technical Standards
 - 8.1 Persistent identifiers.
 - 8.2 Standardised APIs.
 - 8.3 Promote interoperability with European digital infrastructures and services.
 - 8.4 Standardised import/export formats.
- Federated Academic Catalogue Ecosystems
 - 9.1 Promote ecosystems of interoperable AC instances.
 - 9.2 Establish a registry of authoritative ACs.
 - 9.3 Support federated search and discovery services.

5.8 HEIs and mobility software providers

Software providers are a strategic stakeholder group, as many higher education institutions rely on commercial or open-source platforms to manage academic information. The widespread adoption of DACEM recommendations will largely depend on the incorporation of interoperability standards and good practices into these systems.

Examples include:

- Ametys¹ (France)
- SIGMA Gestión Universitaria² (Spain)
- CINECA's ESSE3³ (Italy)

¹ Ametys website <https://www.ametys.org/community/en/index.html>

² SIGMA website <https://www.sigmaaie.org/es>

³ ESSE3 website <https://corsi.cineca.it/en/solutions/esse3-student-management-system>

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- MUCI's USOS⁴ (Poland)
- MoveOn⁵ by QS unisolution
- Mobility-Online⁶ by SOP
- Other EWP 3rd party providers⁷

Key recommendations:

- Student Experience and Accessibility:
 - 1.5 Adopt mobile-first approaches and responsive design.
 - 1.8 Provide advanced search, browsing, and discovery functionalities.
 - 1.9 Support personalised recommendations and intelligent exploration.
 - 1.10 Support user feedback and issue reporting mechanisms.
- Governance, Collaboration and Continuous Improvement
 - 2.2 Promote the single source of truth.
 - 2.3 Define multi-level responsibilities and role-based permissions.
 - 2.4 Establish editing, validation, and approval workflows.
 - 2.6 Promote incremental development and maturity-based approaches.
- Academic Information and Educational Ecosystems
 - 3.1 Adopt the concept of the Academic Catalogue (AC) and broaden its scope beyond programmes and courses.
 - 3.2 Include information about campuses and organisational units.
 - 3.3 Provide academic calendars and term periods.
- Semantics and shared understanding
 - 5.1 Promote the adoption of shared information models and vocabularies.
 - 5.2 Promote the use of internationally recognised classifications.
 - 5.3 Promote shared frameworks for learning outcomes and competencies.
- Trust, Quality and Transparency
 - 6.1 Include supporting documents and references to authoritative information.
 - 6.2 Promote the integration of quality assurance information.
 - 6.3 Support provenance and accountability.
 - 6.4 Support versioning and the preservation of historical information
 - 6.5 Promote integrity mechanisms and information traceability.
- Mobility and European Cooperation

⁴ USOS website <https://www.usos.edu.pl/>

⁵ MoveON website <https://moveonhub.qs.com/>

⁶ Mobility-Online website <https://www.sop.co.at/en/higher-education/mobility-online>

⁷ Web page for the EWP 3rd party providers <https://wiki.uni-foundation.eu/spaces/EWP/pages/1149169/3rd+party+software>

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- 7.1 Include information about mobility agreements and cooperation opportunities.
 - 7.2 Provide mobility-oriented information and contact points.
 - 7.3 Incorporate experience-based recommendations from mobility coordinators.
 - 7.4 Support the representation of institutions as members of EUAs and collaborative
- Interoperability and Technical Standards
 - 8.1 Persistent identifiers.
 - 8.2 Standardized APIs.
 - 8.3 Promote interoperability with European digital infrastructures and services.
 - 8.4 Standardised import/export formats.
- Federated Academic Catalogue Ecosystems
 - 9.1 Promote ecosystems of interoperable AC instances.
 - 9.2 Establish a registry of authoritative ACs.
 - 9.3 Support federated search and discovery services.

6. New emerging use-cases, the future of DACEM

What is the future of DACEM AC? In this section we consider emerging use cases that further demonstrate the strategic value of ACs beyond their traditional role as repositories of educational information. As HEIs become increasingly data-driven, interconnected, and learner-centred, ACs can support new services and ecosystems, including AI-powered guidance, cross-institutional collaboration, etc. Anticipating these developments is essential to ensure that AC remain useful, interoperable, and capable of supporting future educational and technological innovation.

6.1 Further adoption of the DACEM platform and the OCCAPI standard

In the future, DACEM should remain flexible and interoperable, enabling integration with additional external APIs and institutional infrastructures. Large institutions often already have their own internal systems, regardless of whether they function effectively. DACEM should support these institutions without requiring them to completely replace their existing infrastructure.

For institutions wishing to implement the OCCAPI v2 standard directly into their internal systems, substantial effort may be required. Full implementation may involve adapting existing data models, integrating heterogeneous information sources, revising internal workflows and ensuring that all the internal systems are well-organized. A lighter and more practical approach would be to apply the standard only to mobility-related courses and information (e.g., English courses). In any case, from a technical point of view, the effort required to develop the export mechanisms, APIs, and mapping processes may not differ substantially. Therefore, limiting the initial scope should be regarded mainly as an organizational and governance strategy to facilitate adoption.

The DACEM's bulk import functionality (based on CSV files) may also play an important feature as an accessible entry point for institutions. If institutions can export data from their existing systems, they can upload or synchronise it annually into the DACEM environment without disrupting their established workflows. In this sense, DACEM can serve as middleware or a "signal repeater" layer between institutional systems and mobility infrastructures, reducing complexity and improving interoperability.

6.2 Further adoption by European University Alliances (DACEM as a middleware)

This middleware approach could be particularly valuable for European university alliances and new cross-institutional collaborations, which require shared mobility infrastructures

without forcing institutions to abandon their local systems. The role of DACEM as middleware has not yet been fully explored and represents a promising direction for future use.

6.3 AI-supported study and mobility assistants

A possible future development for the DACEM platform is to leverage structured course data and semantic metadata to recommend courses, support credit recognition, and assist administrative processes such as applications and equivalence checks. In this context, such assistants would rely on high-quality, machine-readable catalogue data and evolve ACs from static information systems into proactive, personalised guidance tools.

6.4 Cross-institutional and alliance-wide curricula

Cross-institutional and alliance-wide curricula reflect the growing integration of EUAs and collaborative programmes. This would enable students to follow coherent learning pathways across multiple institutions while ensuring credit portability and recognition. ACs are essential to make these distributed curricula visible and structured, allowing users to understand how courses contribute to joint programmes or degrees. The DACEM can support the transition from isolated course listings to networked educational offerings within the EHEA.

6.5 Lifelong learning and micro-credential ecosystems

Lifelong learning and micro-credential ecosystems extend ACs beyond traditional degree programmes to include flexible, modular learning opportunities. These allow learners to build targeted competencies over time and combine formal, non-formal, and continuing education into personalised pathways. Micro-credentials require structured and interoperable descriptions to ensure transparency, recognition, and portability. DACEM, could in the future provide the infrastructure to make these opportunities visible and comparable, supporting a shift toward more flexible, learner-centred education systems.

6.6 Competence- and skills-based discovery

Competence- and skills-based discovery would enable learners to find educational opportunities based on skills and competencies rather than institutions or disciplines. Using shared vocabularies and classification systems, ACs could better match learners' prior knowledge and learning goals with relevant offerings. This improves transparency, personalisation, and recognition across institutions. DACEM could in the future support a shift from catalogue-centric navigation to learner-centric exploration of educational ecosystems.

7. Conclusion

ACs are evolving from traditional repositories of course descriptions into strategic digital infrastructures supporting mobility, lifelong learning, recognition, quality assurance, and cooperation across the EHEA. Their transformation is essential to enable emerging initiatives such as EUAs, the European Degree, and the development of a European Academic Information Space.

The recommendations presented in this document provide a shared framework to guide this evolution. They address human and organisational aspects, educational and semantic considerations, and the technical foundations required to achieve interoperability and trust. Together, these recommendations advocate a learner-centred approach in which ACs become comprehensive, authoritative, multilingual, and machine-readable sources of academic information.

The recommendations recognise that no single actor can achieve this transformation alone. Their successful implementation requires collaboration among users, higher education institutions, alliances, national authorities, European policymakers, quality assurance bodies, technical communities, and software providers. Each stakeholder group has distinct responsibilities and complementary roles in creating and sustaining an interconnected ecosystem of ACs.

Rather than prescribing a single model, the DACEM initiative promotes a progressive and inclusive approach that accommodates the diversity of institutional contexts and levels of digital maturity across Europe. Incremental development, shared standards, distributed governance, and continuous improvement are key principles for ensuring long-term sustainability and broad adoption.

Ultimately, the vision underpinning these recommendations is that ACs should become trusted and interoperable knowledge infrastructures capable of supporting not only the information needs of today's learners and institutions, but also the future evolution of higher education in Europe. By fostering openness, semantic consistency, transparency, and cooperation, ACs can contribute significantly to the realisation of a federated European Academic Information Space and strengthen the foundations for a more connected, flexible, and learner-centred EHEA.

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