Digitalization of the Student Life Cycle: Challenge and Opportunity for Universities

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Abstract

The digitalization of higher education services along the student life cycle is a central task that must be tackled by considering both internal aspects of higher education as well as those of digital networking and the law. This topic is explained in more detail using the concrete process "Recognition of academic achievements". This process is currently supported in digital form, but - not only in Germany, but also in many European countries – it is not mapped in digital workflows. In order to implement this successfully, it is not only necessary to harmonize the diverse federal, national and international projects and initiatives. The academic sector within universities must be willing to consider the mutual recognition of achievements and acquired competencies as the normality, and to ensure that the recognition process is transparent. Only if recognition decisions are made on the basis of clearly defined criteria can they be mapped well in digital workflows and thus effectively support the stakeholders involved. And policymakers must keep pushing this as a priority at universities if they want to achieve a high rate of international student mobility as one of their goals.

1 Introduction

In comparison to other European countries, digitalization has been implemented to varying degrees in university administrations. In some countries the processes in financial administration and human resources management are already characterized by end-to-end digital workflows, and the support processes for the student-life cycle have been digitally supported by IT systems for a long time. However, they still often feature a large number of manual process steps. A comparative analysis of digitalization at universities in various countries with a high e-government index, such as Estonia, Finland, Sweden and the Netherlands, compared to universities in Germany, has shown that the digital transformation in universities is already very advanced in those areas where public administration

generally has a high level of digitalization. If electronic authentication processes or digital registers for certificates and attestations are generally available and used, the universities also use them. This means that procurement processes, accounting, personnel recruiting and also application, admission and enrollment can be handled in complete digital workflows. However, it becomes more difficult when university-specific processes that affect the academic area are to be digitally supported. The diversity of degree programs, the great heterogeneity of the modules and also of the understanding of the modules, and the high degree of freedom that is used by the teachers in designing degree programs to create excellent subject-specific offerings for the students, means that all attempts and approaches to map processes such as the mutual recognition of study and examination achievements in digital workflows have come up against their limits, at least so far.

Simultaneously, the processes of the student-life cycle in the student and examination administrations have long been (partially) automated, and written communication with the "administrative clients" has almost completely shifted to using e-mails. With the Bologna reform in the years after 2000 and the modularization of study programs, module examinations replaced the previously obligatory intermediate and final examinations. As a result, studying with the acquisition of certificates that had to be presented for examination registration was no longer possible, making the introduction of digital systems to cope with the exploding number of examinations, especially at universities, indispensable. Special Student Information Systems (SIS) had been providing customized IT solutions to support universities since the 1980s. With implementation of the Bologna reform and modularization of study programs, these SIS had to be adapted to meet the new requirements. A large number of providers on the market also expanded the range of IT solutions available to universities which triggered greater competition for the best software. This competition greatly accelerated the development of IT solutions, which initially consisted only of individual, more or less strongly linked modules, into integrated SIS. A study on the digitalization of universities (Gilch et. al. 2020) showed that the interface between university administration and students as users in particular has largely shifted to online tools. This includes functions such as registering for exams, viewing grades, creating administrative notices or even changing addresses. Additionally, numerous IT systems have been developed to manage student mobility and support greater permeability of degree programs across universities, which aligns with the goals of the Bologna reform. These IT systems are primarily used in the international offices to provide digital support.

Using the example of international student mobility within the framework of the largest European exchange program, Erasmus+, the aim is to demonstrate how the process of recognizing academic achievements can be implemented in digital workflows and what challenges still need to be overcome both at the technical level and in the legal, organizational and cultural framework. As demonstrated by a study conducted in Germany in 2021 (cf. Gilch et al. 2022), the results can also be applied to other European countries. This is because, particularly in the administration of the student life cycle, digitalization often still involves a simple transfer of analog action routines to a new recording medium (Henke & Pasternack 2020, p. 17), while a real paradigm shift in the direction of automating complete review and decision-making processes, paperless exchange of documents, workflows without media discontinuity, use of Big Data and AI, and digital networking among universities is yet to come.

2 Digitalization of the student life cycle

While the focus of digitalization in campus management was primarily on student administration and examination management, the entire student-life-cycle – from the orientation phase and the provision of information for prospective students, to the university access phase with the application, admission, and enrollment procedures, and the organization of the actual study program with student administration, examination and class management, and the graduation phase with the issuing of

certificates and the transcript of records, to an open post-study phase that includes the career entry, alumni management, and lifelong learning – has been the focus of digitalization efforts at the latest since the introduction of integrated SIS (see Figure 1).
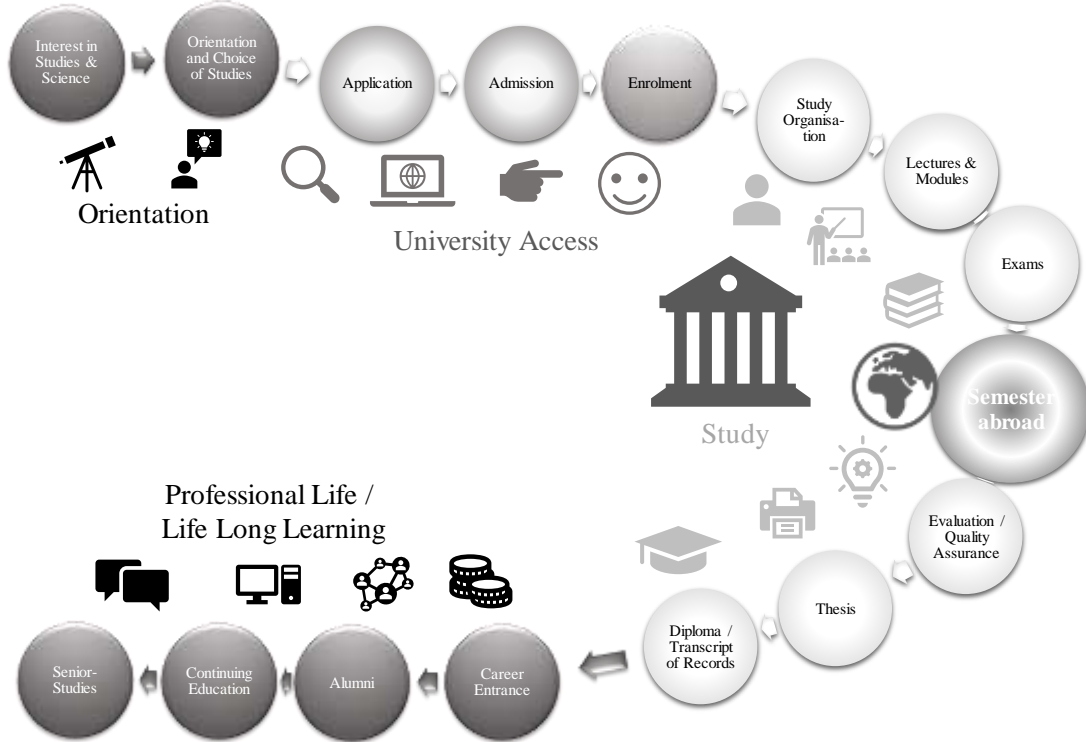

Figure 1: Student life cycle or Student Journey with focus International Exchange

In Germany, the development of digital workflows in the student-life cycle has received an external boost, not least from the Online Access Act (OZG), which came into force in August 2017 (Gilch et. al. 2021). The OZG had obligated administrative authorities at the federal, state, and local levels to (also) offer all administrative services to citizens and businesses completely digitally by the end of 2022, with universities directly included in the "Life situation: studies". However, it was not possible to meet the content and time requirements overall, and even in the area of the "Life situation: studies" only a few processes could be implemented as originally planned. An amendment to the OZG 2.0 is planned and a draft version is now available, although the above obligation is to be replaced in the future by a more voluntary commitment on the part of the authorities in the area of digitalization. In the higher education sector, therefore, it is probably the cross-university projects that have already been initiated, such as the PIM project (Platform for Inter*national Student Mobility, PIM 2023) for the development of digitalized recognition procedures, or the XHochschule project (XHEIE 2023), which is working together with the providers of SIS on the development of uniform standards for the digital exchange of data between higher education institutions, that will provide the momentum for digitalization.

In addition, activities will be continued at German universities to introduce digital enrollment, which has already been implemented in many other European countries, such as the Netherlands, with the help of uniform personal identification numbers and central digital certificate registers. In Germany, however, digital enrollment can so far only be realized with the help of pdf uploads and manual

authentication, partly due to federal structures and to national user accounts and digital school reports that are still being set up; a digital transfer of authenticated reports from schools to universities is also not yet possible.

In the international context, the new program generation (2021-2027) of the Erasmus+ program has triggered a further push to digitalize the student-life-cycle holistically and, in particular, to focus on student mobility and the associated administrative processes. With Erasmus+, the European Commission is one of the largest providers of third-party funding for the internationalization of universities and can thus provide many impetus in the universities. In the new program generation, the focus is on four transversal topics, including digitalization. The universities already commit themselves in the European Charter for Higher Education (ECHE, European Commission 2023a) to implement the technical standards of the European Student Card Initiative (ECSI, European Commission 2020) , i.e. to connect in the future to a European Identity Management for the European higher education landscape as well as to realize the technical infrastructure for the digital data exchange between the European partner universities with Erasmus without Paper (EWP, European Commission 2023a). EWP comprises:

- Conclusion of Inter-Institutional Agreements (IIA) between the home and host universities involved in the mobility.

- Conclusion of Learning Agreements (LA) in preparation for and as a prerequisite for the stay of the student at the host universities.

- Nomination (NOM) of the student for the mobility at the host university by the home university

- Transfer of the Transcript of Records (ToR) with the academic achievements at the host university for posting the achievements in the student record of the home university after the mobility.

With the Dashboard[*] provided as part of the EWP projects (https://erasmus-plus.ec.europa.eu/European-student-card-initiative/ewp/dashboard), the digital conclusion of both IIAs and LAs is already possible in principle. A range of Mobility Management Systems (MMS, in Europe more than 30 software solutions, in Germany mainly Mobility-Online and MoveOn) support universities in the implementation of digital workflows in student mobility management, for example for the application and selection of students for a stay abroad, in addition to the implementation of the EWP application interfaces (APIs). However, student mobility processes are not yet digitally connected to the student-life-cycle processes implemented within SIS, at least at German universities; in other European countries, too, the digital interfaces required between the systems involved still pose a challenge. The standards and protocols currently in use, such as EMREX (https://emrex.eu/), can be used to digitally exchange certificates and the results of entire study programs (i.e., graduation grades) between universities. For the exchange of achievement data at module and course level and the mutual recognition of competencies acquired by students during stays abroad, not only are the necessary standards lacking, but also models of categorization of the competencies to be acquired, according to which these could be cataloged in the future, are still being developed.

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[*] Free software solution, which only realizes the minimum standard to be able to implement the required digital standards in the Erasmus+ program. However, it should be noted that data exchange from dashboard to dashboard is done internally in the database and only through the EWP network when exchanging data dashboard to other software solutions and vice versa (QUELLE)

3 Digitalization of recognition processes

To be able to discuss the challenges associated with the introduction of a digital workflow for recognition processes, it is first necessary to break the process down to the procedural level. Only then can it be determined in detail where which digitalization elements take effect and where, if applicable, which organizational, legal and technical constraints lead to specific limitations. In a study for the German Rectors' Conference (HRK, Gilch et al. 2022), HIS-HE identified and mapped the digitalization of recognition of academic achievements (credit transfer) and recognition of non-academic achievements[†] in German universities and assessed the state of development. Of the different entry points into the process such as

- Recognition of acquired credits when changing programs within the university

- Recognition of acquired credits when changing universities (and degree programs)

- Recognition of competencies acquired outside of the university for a degree program at a university and

- Recognition of credits acquired during a stay abroad at a host university

this article will take a closer look at the last example, whereby a distinction must be made here as to whether the stay abroad is self-organized as a so-called "Free Mover" or whether the stay abroad is carried out within the framework of an exchange program, for example Erasmus+. The actual "recognition workflow" (see Figure 2) is basically similar in both cases and corresponds to a classic (administrative) application procedure in which the result is communicated to the student as either a positive or negative notice.

The application procedure itself is preceded by the provision of information about the procedure itself via the Internet or often also via personal consultation. In the Erasmus+ program, a learning agreement, which in principle can be described as a kind of "preliminary recognition", is concluded prior to the stay abroad. The application for recognition is usually checked by the university administration on the basis of formal criteria (e.g. completeness of documents); the recognition decision is then made by representatives of the academic self-administration (e.g. examination committees, module officers) on the basis of content-related criteria.

The digitalization can then be initiated at different levels: Digital provision of information, digital documentation of recognition history and reference cases, interoperability of a digital data exchange between home and host university, automation of decision preparation, automation of the examination of formal criteria, automation of the examination of content criteria as a computable procedure based on decision premises. Some points of the procedure are described in more detail below:

[†] Competences acquired outside higher education institutions in formal, non-formal and informal contexts.
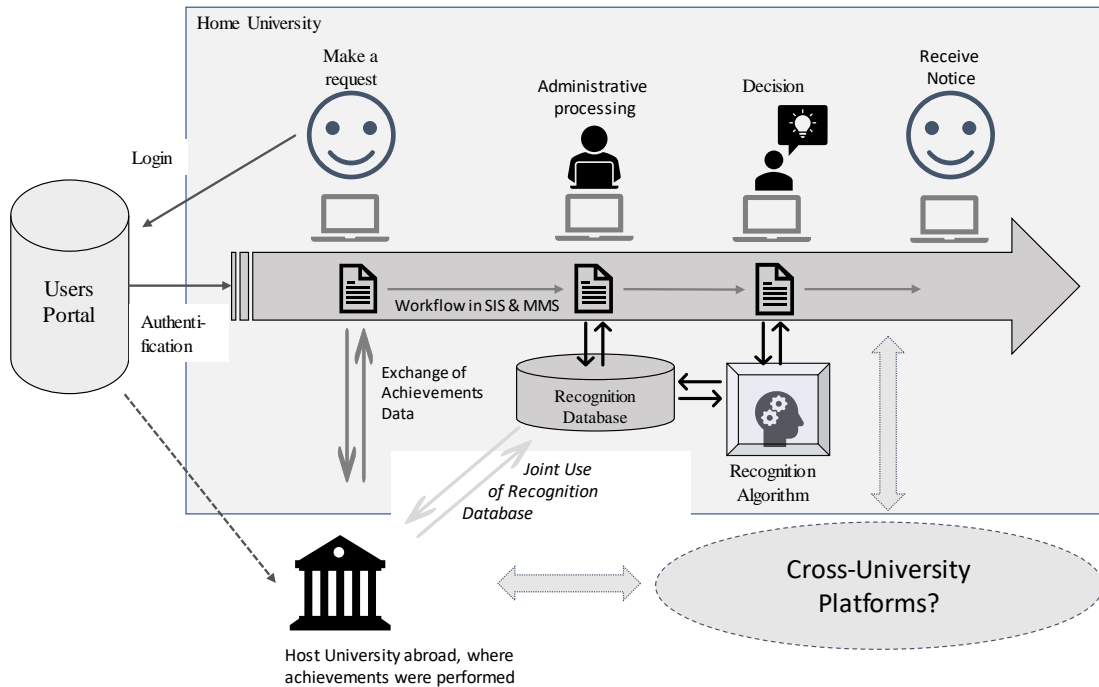
Figure 2: Digital recognition workflow (modified from Gilch et. al. 2022).

- **Provision of digital information on recognition options:** The prerequisite here is that both the home university and the host university provide students interested in studying abroad with digital access to study program content, i.e., the modules and courses offered in each case, as well as the module content and the competences taught in the modules. This enables those interested in a semester abroad to get information in advance about which modules are eligible for study at the host university and whether or how they are recognized at their home university. Databases in which information about already recognized academic achievements is stored can be available as further digital sources of information in addition to the course catalogs and offer additional procedural transparency. It is important that all participating universities make their course catalogs available well in advance of the semester start, which is actually what the universities have committed themselves to within the framework of the ECHE.

- **Registration of the student in the IT systems as a prerequisite for digital interoperability and the once-only principle:** In order to be able to use the IT systems (= SIS) of the home and host universities, the students each need an account with which they can ideally login once in single sign-on and then use all the applications in the system that have been activated for them. The EU project MyAcademicID (https://myacademic-id.eu/) introduced the European Student Identifier (ESI), a unique European student identity that can be linked to the national identity as a natural person The ESI is intended to enable students to authenticate themselves for their international mobility with their academic student identity of their home university via eduGAIN and to enable the exchange of data between the home and host university according to the once-only principle. The goal of the OZG in Germany is to make the login process at the university redundant if students are already logged in and authenticated as

citizens in the state's user portal. The authentication from the user portals is forwarded to the universities so that students can use the universities' systems (also in a European context) without re-authentication. Appropriately secure digital solutions for European identities and signatures in accordance with the eIDAS regulation are currently being developed. In Germany, the development and connection of state and federal portals and the subsequent connection of universities to this portal network are in progress.

- **Procedure of "preliminary recognition" via learning agreements** (not included as a separate process step in Figure 2): In case stays abroad are carried out within the framework of the Erasmus+ program, the conclusion of a Learning Agreement between the student and the home and host university is obligatory. In this agreement, the modules to be studied at the host university are specified and their subsequent recognition after achievement is firmly assured by the home university. For the 2023/24 cohorts, this learning agreement is to be concluded between all three parties in digital format according to EWP standards - except universities are not yet able to do so for technical reasons. The EWP format of the Learning Agreement enables digital access by responsible persons at both universities as well as by the students. For the digital data exchange between host and home university, the "EWP network" offers appropriate application programming interfaces (APIs). The implementation of the EWP-APIs in the SIS is currently being discussed, at least in Germany. At the moment, the universities are using their MMS for this purpose, whose integration into the SIS is still in its initial stages. In this respect, the processes for concluding learning agreements, which are handled via the MMS by the international offices at the universities usually, are in a parallel structure to the recognition processes, which are handled by the examination administrations with the SIS. Digital integration can help to link the processes in terms of content and organization as well. In the PIM project, a link between MMS, SIS and EWP is already being considered.

- **Application for recognition of the academic achievements acquired abroad by the student:** After returning from abroad, the student applies at the home university for recognition of the academic achievements acquired at the host university with reference to the learning agreement - in the case of so-called free movers, without the agreement. Even if, in principle, the recognition of the acquired achievements is already firmly agreed in the learning agreement, this is often not the case in practice, because either the achievements acquired at the host university differ from the learning agreement and/or the learning agreement is not always regarded as a legally binding agreement in the universities due to the parallel structure of the processes with different responsibilities. In this respect, the formal recognition procedure is started by submitting a digital application and uploading the relevant proof of achievement and further documents (ToR as pdf files, scans of certified copies, module descriptions, etc.) into the IT system - provided that digital workflows have been set up. In compliance with the once-only principle, the uploads will no longer be necessary in the future if the data on the acquired achievements can be transferred digitally either directly between the SIS of the home and host universities or via additional digital platforms with the consent of the students. There are initial pilot projects for this in Germany (cf. PIM 2021), which show that such data exchange is possible in principle, e.g. via EMREX, even if this format has so far only been used in Scandinavian countries or the Netherlands for certificates and not for individual module and course achievements.

- **Review and decision on the recognition application by the university (university administration, self-administration):** While the formal review of recognition applications is mostly carried out at the processing level in the university administration and can be well supported digitally, the examination of the content and the decision on recognition is the

responsibility of the academic body (examination board, module supervisors ...). The recognition decision is subject to the legal framework established by the Lisbon Convention, which provides for the possibility of refusing recognition only in cases where significant differences between the courses taken at the host institution and the courses of the home university for which recognition is sought are identified. Moreover, the rejection of recognition requires the university to meet a burden of proof and to provide explicit justification. However, the decision is still subject to legal review by the academic body. The academic body can base its decisions on previous decisions, which are documented in recognition databases (at various levels) within universities or across universities, as well as established recognition agreements between universities, and thereby forego a renewed examination of the content. Further developments in decision support or computable recognition procedures may involve digital algorithms and artificial intelligence, for the purpose of comparing module contents and in particular competences acquired through the modules to identify significant differences. To achieve this goal, it would be necessary to develop data standards both at the national level in Germany and other countries, as well as at the European level, to enable digital mapping of the diverse range of modules and the competences they impart. Furthermore, binding conversion algorithms would need to be established for the various grading systems, since grade conversion is still frequently carried out manually and individually within universities.

- **Book recognized achievements in the student record and inform the student of the result:** In the final procedural step, the recognized achievements are entered into the student's examination file in the SIS of the home university and the applicant is informed that the achievements have been added to file (in rare cases issued as a notice). If the decision is positive, the student may cross-check through the SIS. However, in the case of a negative result, a formal notice cannot be waived, since the legally effective delivery of the decision is associated with the appeal deadlines.

The recognition process serves as an example of the sub-processes that make up the entire Student Life Cycle, demonstrating that:

- extensive digitalization of workflows is already possible using existing IT systems such as SIS and MMS;

- internal university process steps can be mapped as digital workflows in existing SIS and MMS systems, or through the use of digital document management systems (DMS);

- a large number of digital tools, often used locally, already exist and are utilized in various ways (e.g., recognition databases in a variety of forms), but have rarely been integrated into digital workflows to date.

4 Conclusion: Challenges and opportunities of digitalization of administrative processes at the university

The further development of digitized administrative services at universities faces significant challenges, as discussed previously. While internal factors such as technology, infrastructure, and IT readiness play a vital role, universities face additional obstacles that cannot be entirely overcome independently. These challenges include:

- **Organizational structure of universities with regard to digitalization and digitalization skills:** The organizational structures of universities often lead to decentralized digitalization efforts in the departments without the necessary digitalization expertise (digitalization competence) which can create or reinforce already existing parallel structures and result in isolated solutions that are difficult to integrate. There is often a lack of understanding of digitalization (digitalization awareness) at the management level in higher education, which hinders the development of a central process management approach, viewing the university as a holistic system and forming a basic prerequisite for a meaningful digitalization of the entire university administration (non-academic and self-administrative). Furthermore, organizational units (centralized or decentralized) that are responsible for digitalization require sufficient authority within the university to manage digitalization and implement appropriate change management. Digitalization must not only be understood, but must also be wanted and integrated at all levels of management to serve as a role model. This means that investments must be made in digitalization, not only in information technology (IT), but also in the digitalization organization and implementation (strategy, process management, change management, digital and digitalization awareness, digital and digitalization competences, capacities, etc.). In particular, cross-cutting issues such as recognition, involving numerous stakeholders within the university, highlight the importance of these fundamental organizational aspects of digitalization.

- **Europe-wide and worldwide standards:** The definition and establishment of the necessary cross-university and cross-national data standards and transfer protocols for digital data exchange between institutions have already taken place in many countries. However, individual performance data or competencies acquired during stays abroad cannot yet be exchanged digitally. Even if non-university achievements are to be credited to studies, the involvement of a variety of stakeholders and the diversity of the different systems will increase further and the existing standards will reach their limits. The complexity of defining and establishing such standards is reflected in standardization and exchange projects such as EWP, EMREX, XHEIE, PIM, etc., which must be continued and provided with appropriate resources, but also require a high political priority. In this context, it is important to advance diverse initiatives that exist in many countries at the federal (e.g. Germany), national (including Germany, Norway, the Netherlands, Finland) and European (EU Commission) levels, ensuring that they are oriented towards a common framework. Ultimately a mutually compatible system of standards and protocols should be created that can be used throughout Europe and, if possible, also worldwide.

- **Europe-wide identity management:** The establishment and networking of state, national and Europe-wide user portals is essential so users can move around the IT systems of the affiliated universities and other institutions with their respective roles and authorized access rights that once authenticated. So, users can use and transfer their personal data (such as acquired academic achievements at a host university) specifically for their respective needs (such as recognition at the home university) without having to log on and authenticate repeatedly in different systems. In higher education, initial structures are in place at the European level with eduGAIN and the introduction of the European Student Identifier through the MyAcademicID project, but these are not yet in use across the board. As with data standards and transfer protocols, these European structures must be combined with the various national portals and made mutually compatible.

- **Legal security of digital processes:** It is important to ensure that digital procedures, authentication steps, and verification routines are legally secure and recognized as complete, correct, and authentic in national and international legal transactions; and that no additional

manual steps are required either from a procedural or higher education law perspective. For a completely digital recognition procedure, the required proof of achievements acquired at the host university (ToR) must be provided by the issuing institution according to a technically secure digital standard; this also means that the legal security of the exchange procedures of the required data (data formats), in the different legal cultures in Europe, must be guaranteed.

- **Legal framework:** Higher education laws, ordinances, university regulations (e.g., admission and examination regulations), and administrative practices should be revied in the sense of a "digital check." It is often the case that supposed legal and administrative obstacles to greater implementation and use of digital workflows are "quasi homemade" by the various university regulations and practices. For example, regulations may be either unclear or overly complex in their wording, making them exceedingly difficult to implement in digital workflows or only with AI in "LegalTech" services (Advotisement 2023). Also, key terms used, such as - in the case of the recognition workflow - "significant difference" or "competence check" may be legally indeterminate, and therefore not easily mappable in digital logics, requiring machine-learning algorithms. The legal admissibility of these algorithms (AI) must be examined from the point of view of "automated decisions". In the context of recognition processes, personal data must be exchanged digitally - if digital workflows are to be established - so a common understanding of the legal permissibility of the associated procedures is a basic prerequisite for their establishment. The practice of data protection at universities in different countries still differs despite the common European General Data Protection Regulation (Regulation (EU) 2016/679), so it is important to consider the different legal cultures. A completely digital recognition procedure is also only possible if the required digital "proofs" can be transmitted at all under data protection law, possibly with the student's consent.

- **Self-conception of the Academic Sector:** The variety of courses, modules, classes, examinations and the content and competencies conveyed to students through these elements is virtually infinite and is highly individually determined by professors and lecturers as well as academic committees and faculties. This academic freedom is intentional and a central feature of higher education in Europe and the free world. However, it is becoming apparent that this academic freedom is not only defined by the content and competences taught in the classroom, but that the procedural design of examination regulations and written descriptions of modules are also highly individual and diverse. Therefore, it must not only be possible to develop national, Europe-wide, and perhaps even worldwide standards to reflect the immense diversity of modules and the associated achievements and competencies, but professors and lecturers must also be prepared to accept these standards at least as a framework for their teaching. They need to develop an overall awareness that professors at other universities also adhere to these frameworks and that, from this point of view, mutual recognition of the competences acquired in the various courses is fundamentally correct and compatible with their respective academic uniqueness and excellence. At present, at least at German universities, a skepticism among individual professors towards the equivalence of achievements and competences acquired by students at other universities and with other professors, not only abroad, is evident repeatedly. Furthermore, the description of study contents and modules is often so individual and different that it is hardly comprehensible for outsiders what has been taught or imparted in which form. The creation of framework conditions (standards), for example in the representation of modules (content and competencies), as well as the establishment of transparency in recognition decisions, for example through recognition databases, are aspects that the digitalization of recognition procedures brings with it. However, in the academic sphere, these are often not seen as opportunities and necessities, but rather as a fundamental interference of university administration in academic freedom; digitalization is rejected here due to its potentialities.

These challenges are counterbalanced by the opportunities that higher education institutions have. Higher education institutions can

- as part of the necessary review of existing regulations and redesign of processes, initiate a broad internal discussion that can help to modernize internally and simultaneously develop a new university recognition culture, as is demanded by a wide range of political actors at all levels; for instance, so-called "mobility windows" in the curriculum can already simplify recognition in general, since only the recognition of elective courses/modules needs be decided.

- utilize digitalization to not only streamline their internal processes and procedures (more efficiency and saving recourses) but also in particular to improve their quality enhancing transparency, reliability, and stability for students. For instance, implementing recognition databases (databases with recognition decisions that have already been made) that provide access to recognition decisions can increase the efficiency of the administrative decision-making process and transparency for the students, if these are also made accessible to the students.

- further increase their digital readiness in international comparison to remain internationally competitive. For example, without digitalization of the student mobility management including recognition, participation in the Erasmus+ program will no longer be possible in the medium term - almost no university will be able to afford this in the competition for students; Digitalization can also prepare institution for future developments, such as the use of new formats like micro-degrees (certified study content in small units, which are acquired at different institutions and used in the study) and badges (certificates of competence in diverse variants and sizes) (HRK 2020). Additionally, universities must prepare for the dissolution the classical study at one single university, as it is currently already being tested in 41 European University Alliances within the framework of the European University Initiative (EUI, European Commission 2023c). Students within these networks will be able to move freely back and forth between the participating universities in the future.

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