

Survey on the Status of Digitization at German HEI

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1. ABSTRACT

The results of a survey on the digitization of universities in Germany prove that digitization is of great importance for the three dimensions of research, teaching and learning and administration in general, but that the actual implementation status of digitization at German universities is much more restrained. Particularly in the area of administration, the actual level of digitization accomplished at German universities is still regarded as comparatively low. If the IT infrastructures and the systems implemented are analyzed, the status quo is characterized by a large amount of different systems, most of which do not yet allow continuous workflows and are hardly integrated. Many universities show completely different levels of maturity for different systems.

2. RESULTS

2.1. Introduction

Digitization has initiated a comprehensive process of differentiation at higher education institutions (HEI), transforming established forms of scientific and administrative work. Despite a number of studies on partial aspects, comprehensive surveys on HEI digitization have not yet been available, neither in Germany nor internationally. This is the background to the survey "Digitization of Higher Education" (Gilch et al. 2019a), conducted by the HIS Institute for Higher Education Development (HIS-HE) on behalf of the German Expert Commission for Research and Innovation (EFI 2019). The objective of the study was to analyze the process of HEI digitization, considering the dimensions of research, teaching and learning, administration and infrastructure. Methodically, the study focused on a partially standardized full survey among German university leaders, conducted in spring 2018. 119 from 395 universities (response rate: 30.1%) completed the questionnaire. The quantitative data were evaluated by means of descriptive analysis methods and multivariate analysis methods (cf. Gilch et al. 2019b).

The study focuses in particular on the importance, strategies and objectives of digitization, the embedding of digitization in IT governance, the status and framework conditions of digitization, digital infrastructure, digital research, learning and governance, and recommendations for action to policy-makers. The most important survey results with a focus on status of digitization, digital strategies and system implementation in German universities are presented and discussed in this paper.

2.2. Status of Digitization

With regard to the significance and status of digitization, a central result of the quantitative survey is that the significance of digitization at universities in Germany is generally rated as high. With regard to the whole institution, 82.6 percent of the university leaders rate the importance of digitization on

a five-point scale as high or very high (see Figure 1). In terms of individual dimensions, university leaders attribute the greatest importance to the digitization of teaching and learning (75.7%) and the digitization of administration (71.9%).

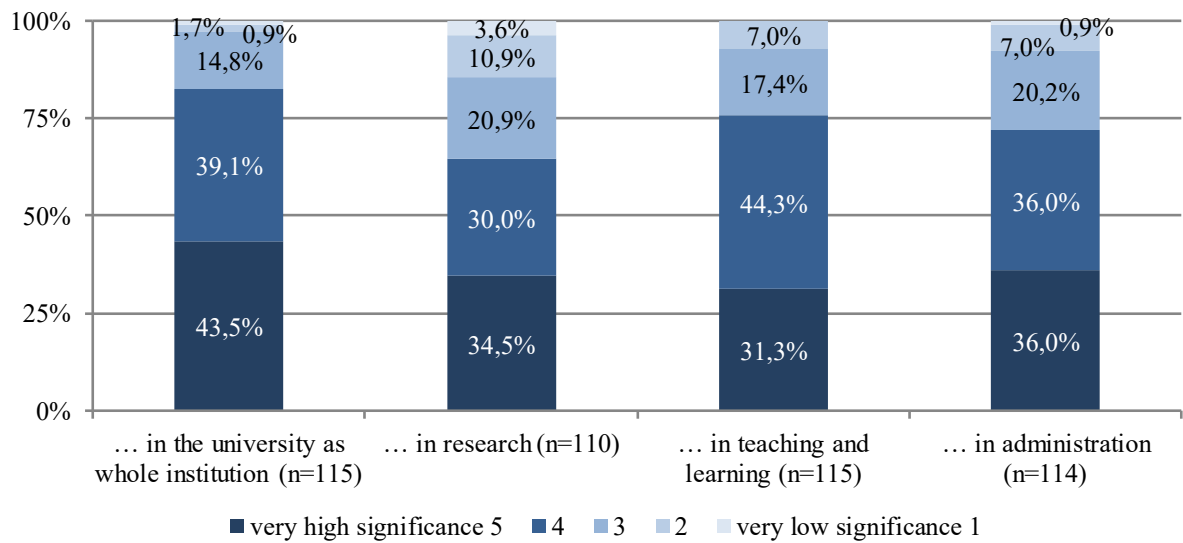


Figure 1: Significance of digitization by dimensions

"Which significance has digitisation for your university ...?"
(Gilch et al. 2019a: p. 26)

However, this high significance which is generally attributed to digitization does not correlate with the status that digitisation has actually reached at the universities according to their own assessment. Only in the areas of research and teaching the status is rated high with values of only 34.3% and 29.3% respectively. In the area of administration only 22.3% of the university leaders assess the status of digitisation as high or very high. This means, that in total, only about 20% of the universities assess the status achieved so far as high or very high. This result does not change significantly if only the universities are considered who have given high significance to digitisation (see Figure 2). For these universities, too, only 30.4% consider the overall status of digitization to be high or very high.

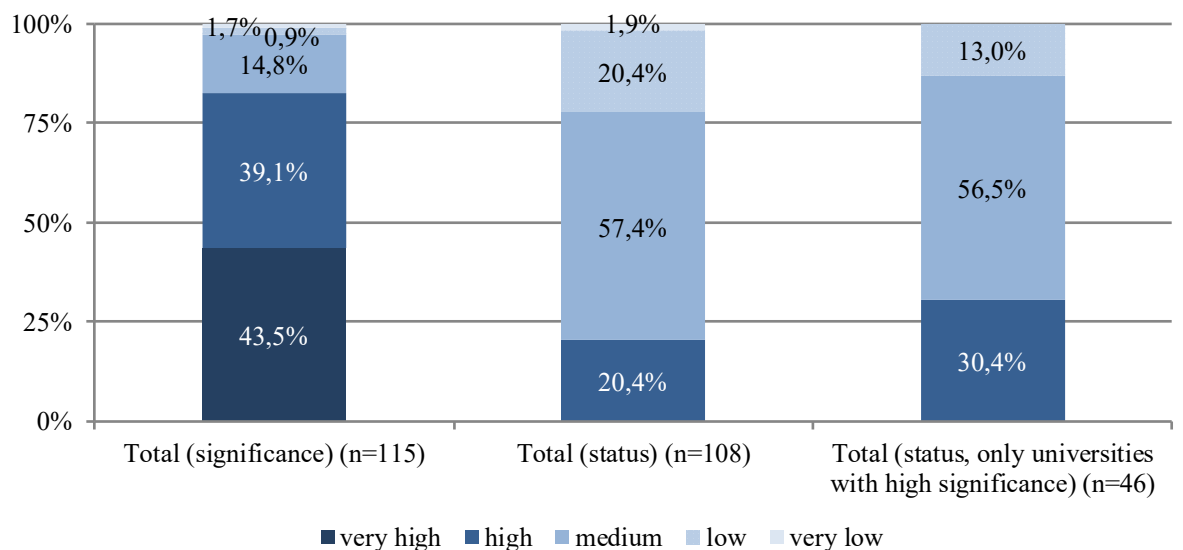


Figure 2: Significance and status of digitization

Significance of digitization, compared to "Which status has digitization at your university?"
(Gilch et al. 2019a: p. 31)

Comparing the individual university types, it can be seen that overall, both the significance and the status of digitization are slightly higher for universities than for universities of applied sciences. For the areas of research and teaching and learning, this also corresponds with the university sizes (larger universities = higher status and significance of digitization), although it should be noted that large institutions are more often universities, while the universities of applied sciences are mostly smaller. Only in the area of digital administration the medium-sized and small universities appear to be at a slightly higher level of digitization development than the large universities.

Overall it can be recognized that, according to the assessment of the university leaders, only at a few universities all three areas research, teaching and learning and administration have reached the same high level of digital development. However, both in the area of research and in the area of teaching and learning, there exist some sections within most universities that are already far advanced in digitization, while other sections are still hardly digitized at all.

- According to the results of additional interviews that were carried out in the context of case studies, this is the case in research with research groups from a wide range of disciplines that are regarded as pilots, while other research groups seem to attach less importance to digitization or consider it to be less relevant in their respective research fields.
- With regard to the area of teaching and learning, the qualitative interviews refer often to flagships and light houses that exist at many universities in a wide variety of forms, but which have so far in no way resulted in widespread dissemination. This means that within the universities, these two areas are more of a "patchwork" with different levels of digitisation, although the enormous significance of this issue has already been recognized - and thus the need to e.g. further increase the spread of more sophisticated blended learning concepts.

For the area of administration the assessment of the current status of digitization is generally lower, although university leaders tend to rate the significance of digitization in administration for their university as high.

2.3. Digitization strategies

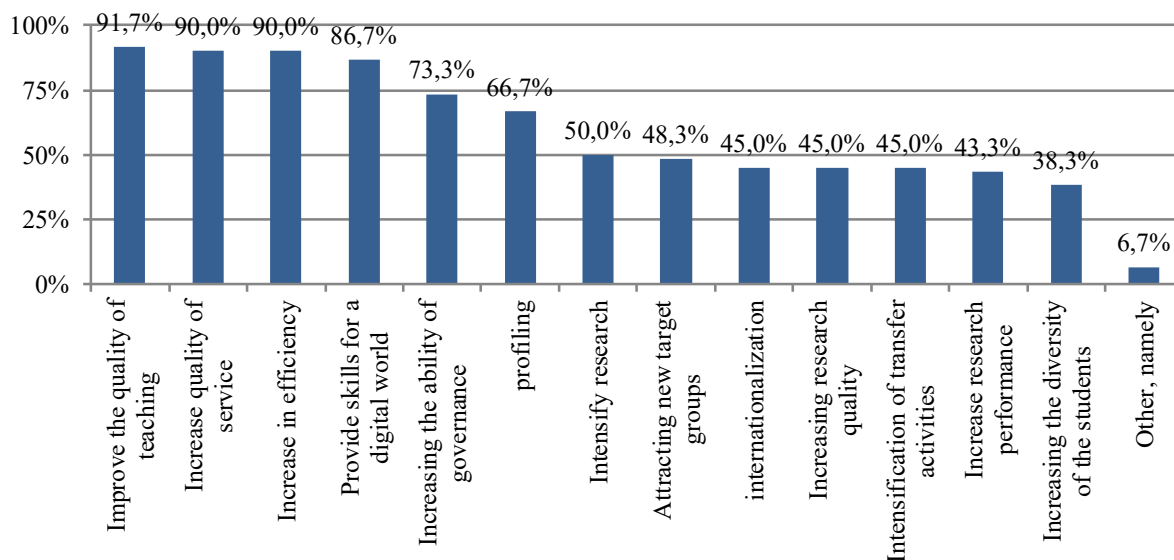


Figure 3: Objectives of digitization strategies

"Which objectives should the university's digitization strategy achieve?"
(N = 60, multiple answers possible) (Gilch et al. 2019a: p. 69)

The universities were then asked to what extent digitization is reflected in university strategies and which objectives the universities pursue with digitization. A written strategy or concept for digitizing the university as a whole is available or being developed at 54.5% of the universities. Dimension-specific (digitization) strategies are primarily available for teaching and learning (69.6%) and administration (61.8%) or are currently being developed. The objectives most frequently associated with these strategies are to improve the teaching quality (91.7%), to increase the administrative

services' quality (90.0%) and the administration's efficiency (90.0%) and the teaching of digital skills (86.7%, see Figure 3).

These objectives were then given different priorities by the universities. The results show a connection between frequently stated objectives and prioritisation. The most important objectives - improving the quality of teaching, increasing the service quality and efficiency of administration and providing skills for a digital world - also are attributed a very high priority. Conversely, a rarely mentioned objective such as increasing the diversity and heterogeneity of the students in the framework of a digitisation strategy also has a low priority.

To assess the strategic level more clearly, the study also asked the universities about their IT-governance. Concerning the question of responsibility for digitization within the university leadership, the results show that in 73.8% of the responding universities one person in the university management is in charge of digitization. The findings suggest that a basic "management attention" (Hochschulforum Digitalisierung 2016) with regard to digitization is given in three quarters of the universities.

However, this responsibility for digitisation within the university management must be differentiated through the results on the dissemination of CIO structures:

- A total of 60.2% of the institutions have a CIO or a CIO committee.
- This is true for 76.7% of the universities, compared to 55.6% for the universities of applied sciences.
- With regard to the size of the universities, 86.4% of the large, 75.8% of the medium-sized and 41.8% of the small universities have a CIO structure.

The figure determined for all universities is considerably higher than the findings of a CIO survey previously carried out in Germany in 2014 (Lang/Wimmer 2014) according to which only 14% of the universities (or 56 of a total of 391 universities) had implemented a CIO structure. The percentage of universities with CIO in Germany is now of a similar scale as in the US where, according to an EDUCAUSE study, 68% of higher education institutions have a CIO position (Pomerantz 2017).

However, it is not only the formalized IT governance, but also the informal dimension that needs to be considered if conclusions regarding the activity structure of an organization should be drawn. The survey provided information on the persons who are in fact in charge of the digitization process and the actors involved in the development of the digitization strategy. Against this background the importance of identities between formal structure (management function, CIO) and activity structure for the digitization strategy in the university can be elaborated.

With regard to the question of which actors are seen as leaders in the process of digitisation, the results are as follows (see Figure 4):

- Most often the directors of computer centres are considered to play a leading role in the digitization process (68.9%),
- followed by the Vice Presidents (62.2%),
- the Full-time Vice Presidents of Administration (58.0%),
- the Presidents or Rectors (53.8%) and
- the heads of other central institutions (e.g. Service Centre for Digital Teaching and Learning, University Didactics Centre, etc.) (47.1%)

Looking at the actors involved in the development of the digitization strategy, it appears that most frequently (in 80% of cases or more)

- Vice-Presidents,
- Computer centre directors
- Presidents or Rectors and
- Full-time Vice Presidents of Administration

are involved in the development of this strategy (for the dimension of teaching and learning, this result is confirmed by another survey of Becker and Stang 2020). In 65.0% of cases heads of university libraries are involved. In about half of the cases employees participate in technology and administration (53.3%), a CIO (50.0%) or the management of a central e-learning centre (50.0%).

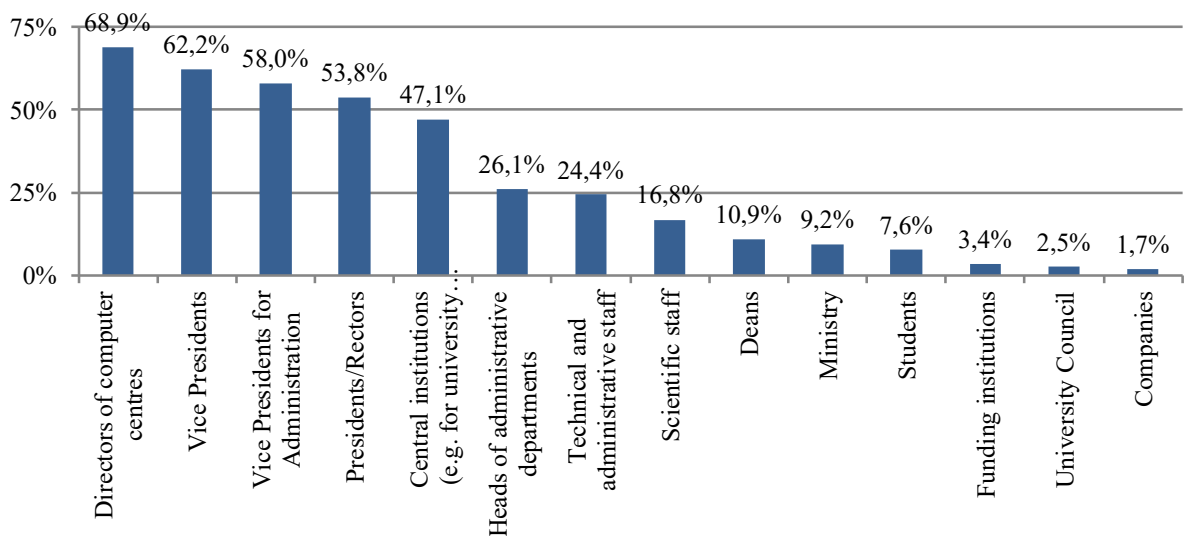


Figure 4: Leading actors in the digitization process

"Which actors take a leading role in the process of digitizing your university?"

(N = 119, multiple answers possible) (Gilch et al. 2019a: p. 85)

An interesting difference between the university types is that a more participatory approach seems to dominate at universities compared to universities of applied sciences when developing digitization strategies. For example, at universities of applied sciences the president or rector is most often directly in charge for digitization, whereas at universities this task is most often the responsibility of the responsible vice president, provost or deputy rector and the director of the computer centres.

With regard to formal and informal IT governance, the interviews conducted at the case studies showed that the university leaders, heads of computer centres and administrative managers are responsible in a top-down approach for the establishment or further development of a digital infrastructure, the optimization of the university's internal IT services and for the establishment of digital workflows in administration. Digitization strategies in research and teaching need central governance and support, but the initiative and commitment of the researchers and lecturers themselves are of great importance. Therefore, an interaction between top-down and bottom-up processes seems most promising.

With regard to the digitization of universities as a whole, the results of the survey show that a form of work-sharing exists at central level: The university leadership pushes digitization forward and makes decisions, while the central expert staff in form of CIOs and directors of computer centres coordinate the processes and activities. It seems - as further results from Gilch et. al 2019 show - that the existence of a CIO has a positive influence on the status and significance of digitization, and a digitization strategy is also more often developed at universities who have a CIO position. This is important because it increases the maturity level of IT governance of a university, which is also a key factor for successful cooperation in the field of digitization (von der Heyde 2016). But as US studies show, an even closer strategic collaboration between university leadership and CIO will be necessary in the future to meet the challenges of digitization internally and externally (Zastrocky 2019).

2.4. Status of IT infrastructure and selected IT systems

As the universities have different perceptions on both the significance and the status of digitization for the three areas of research, teaching and learning and administration, they were asked about the degree of implementation of corresponding IT infrastructures and, for example, about the digitization level of selected administrative processes.

If the IT systems that are important for the research infrastructure, such as Research Information Systems (RIS), Research Data Management (RDM) and Virtual Research Environments (VRE), are considered first, the implementation level of these systems can give at least indirect indications of the degree to which these systems are also used by researchers and are thus available to them for digitized research.

Partially or fully implemented are

- Research Information Systems (RIS) at 30.6% of universities (7.1% completely, 23.5% partially),
- Research data management systems (RDM systems) at 18.2% of the universities (3.0% completely, 15.2% partially) and
- Virtual Research Environments (VRE) at 18.8% of universities (0.0% full, 18.8% partial).

This relatively low level of implementation of university-wide digital formats and applications can be explained by the high heterogeneity of research itself (e.g. in terms of scientific diversity and sub-areas such as basic and applied research) and also by the heterogeneity of researchers' research interests and research methods. In this respect, the cautious assessments presented here, which primarily reflect the perspective of university leaders, do not allow the conclusion that digitisation of the research sector is not progressing, especially at universities. The actors themselves report very clearly that research infrastructures and practice have developed dynamically. However, this is often happening on an international level and within the internationally connected research communities themselves. The universities could only provide necessary infrastructures on site and/or provide incentives.

In the case of IT systems that are important for teaching and learning, such as Student Information Systems (SIS) and Learning Management Systems (LMS), the results show that (see Figure 5)

- Student Information Systems (SIS) to 87.7% and
- Learning Management Systems (LMS) to 85.0%

are partially or fully implemented at universities. In addition to this infrastructural framework for digitization in the field of teaching and learning, the degree of utilization of selected teaching and learning formats was also analyzed. The results show the following proportion of high or very high usage for the formats examined (only formats with more than 10% are shown):

- Mobile learning: 24.7%
- Lecture recording (i.e. live digitized lecture): 19.4%
- Social media: 19.2%
- Open Educational Resources: 18.9%
- Online peer and collaborative learning: 16.0%
- E-portfolio: 13.8%
- Inverted Classroom: 13.2%
- Simulation-supported learning: 11.6%

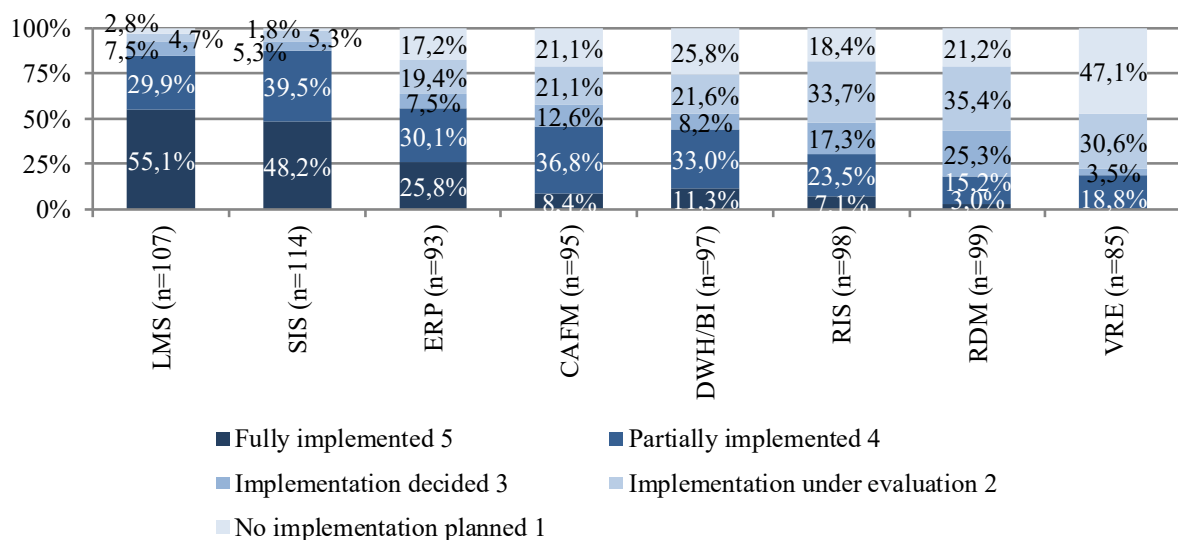


Figure 5: Implementation level of selected IT systems

"To what degree are the following IT systems implemented at your university?"
(Gilch et al. 2019a: p. 104)

As shown above, Student Information Systems and Learning Management Systems are in use practically everywhere with regard to the administrative side of digitized teaching. However, the comprehensive use of digital teaching and learning formats has not yet been realized in accordance with the self-image of most universities as “on site” institutions, as expressed in several interviews. However, it is considered a central task to further strengthen digitization in the field of teaching and learning in the future not only on a technical but also on a didactically well-founded basis.

If we take a look at the IT systems used in the area of administration with regard to their degree of implementation, the following results emerge for the three areas of administration mentioned above, which are also listed above for the area of research and for the area of teaching and learning (all figures refer to partial or full implementation, see Figure 5):

- Research Information Systems (RIS) are partially or fully implemented at 30.6% of higher education institutions.
- Student Information Systems (SIS) are partially or fully implemented at 87.7% of the universities.
- Resource management systems (enterprise resource planning (ERP) systems) are partially or fully implemented at 55.9% of the universities.
- Data warehouse or business intelligence systems (DWH/BI) are partially or fully implemented at 44.3% of the universities.
- Computer-aided facility management systems (CAFM) are partially or fully implemented at 45.3% of the universities.

This means that the level of implementation of Student Information Systems is already very high at universities in general and almost nationwide at universities (93.0%). Research Information Systems, on the other hand, have only been implemented at just slightly less than a third of the universities. Systems for resource management are partially or fully implemented at about half of the universities.

Because the level of implementation of an IT system provides an initial indication of the status of digitisation, but the use of these systems can vary widely, the digitisation levels already achieved by the universities were surveyed on the basis of specific applications. In analogy to the Capability Maturity Model (CMM, Wannemacher et al. 2008; Ebel 2008), which has been established as part of the development of various approaches to IT service management, four levels were defined:

Level 1: Information is provided online.

Level 2: The form can be downloaded.

Level 3: The form can be completed online.

Level 4: The process is completely digitized.

The results show that currently only for two of the applications listed more than half of the universities claim to have reached digitization level 4, which are both elements of the widely used Student Information Systems:

- The university application procedure is handled completely digitally at 55.8% of the universities.
- The same applies to 66.3% of the universities with regard to the notification of examinations and grades.

These figures apply practically irrespective of factors such as type of higher education institution, size of institution and location.

When the other administrative processes mentioned above are considered, the universities specify that they achieve the following percentage for digitization level 4 (the IT systems with which these applications are usually processed are listed in brackets, see Figure 6):

- Enrolment (SIS): 41.9%
- Leave of absence for students (SIS): 19.3%
- Procurement (ERP): 17.4%
- Invoice processing (ERP): 21.4%
- Application for jobs (ERP): 18.7%
- Request for leave for staff (ERP): 36.4%
- Business trip application (ERP): 16.2%
- Travel expense accounting (ERP): 9.8%

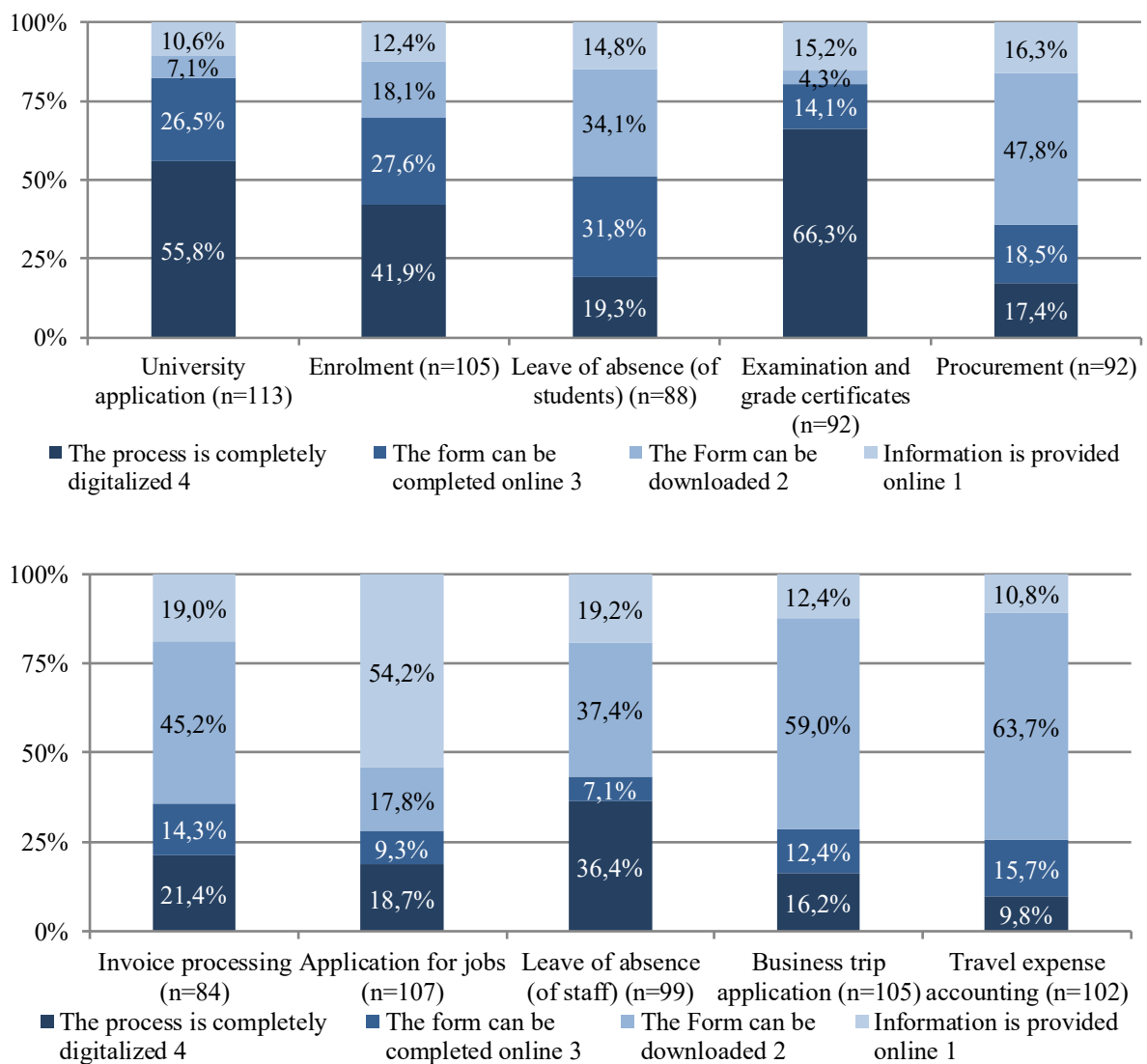


Figure 6: Digitization levels of selected administrative processes

"Which digitization level is reached by the following administrative processes?"
(Gilch et al. 2019a: p. 58)

Overall, it can be seen that study-related applications that are processed with Student Information Systems tend to have a higher level of digitization than applications that access ERP systems. As the level of implementation of these two systems also differs greatly (see above), this finding is not surprising at first, but it confirms the statements made so far on the level of digitisation in the area of administration.

3. CONCLUSION

The study on the digitization of universities, which was commissioned by the Commission of Experts for Research and Innovation and conducted in 2019 by HIS-HE, was the first comprehensive study to analyze the status of digitization at German universities for all three areas of research, teaching and learning and administration.

The study showed that the significance of digitization for universities is generally considered to be high or very high, but that the status of digitization still remains considerably behind this high significance. However, the universities have started to increase this low level of digitization. This is

reflected, for example, by the fact that digitization strategies have been developed and IT governance structures are also increasingly being improved in Germany. A lot has happened in recent years, especially with regard to the implementation of CIOs, which are now established at 60,2% of the universities, as the comparison of the new results to older studies with only 14% CIOs in 2014 shows.

With regard to the implementation status of digital infrastructures and the implementation level of selected IT systems, fully digital workflows have so far only been offered to users at few universities (9.2%). In most cases (72.3%) a large number of IT systems and applications are in use, but these are only partially, but not fully, integrated. Looking at the implementation level of selected IT systems, Student Information Systems are already in use at a well-advanced level almost everywhere, while other administrative systems are in an introduction phase for the most part (e.g. ERP, CAFM, BI). The student management area also includes those processes that are already fully digitized like university application or examination and grade notifications.

Also relating to the area of teaching and learning, university-wide Learning Management Systems are already in use at most universities. However, the use of more elaborated formats of e-learning is mostly still in the hands of a limited number of innovators and has not yet been anchored in the wide majority of teaching. That means, that often different implementation levels are existing at the same university simultaneously in the area of teaching and learning. Such a heterogeneity is apparent in the digitization of research, too. The level of digital research formats depends to a large extent on the individual research fields, but also on the researchers themselves. At university level, corresponding digital infrastructures such as research information systems and research data management are still largely under construction.

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