

# An Exploratory Factor Analysis Approach in Empirical Study of the DigIn.Net 2 Project

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**Abstract:** The main purpose of the current DigIn.Net 2 project (supported by DAAD, BMBF) is to promote the digital internationalization of partner universities in Germany and Ukraine. The study focuses on the effective practical application of the project of the Anhalt University of Applied Sciences in cooperation with four Ukrainian universities. Based on the exploratory factor analysis of empirical survey data from 1063 respondents who participated in international internships “Digital Future: Blended Learning” during 2022-2023, an original compilation of key factors for successful internationalization of universities in the digital space was formulated. As the international internship was launched during the pandemic and then continued uninterrupted in the post-pandemic period and during the war, the authors had to collect and analyze valuable data from respondents in difficult times for the first time. In addition, some researchers have been involved in surveys and data processing on internationalization, but they have not applied factor analysis to this type of data. Factor analysis was conducted to reduce the sample size of the variables, group them based on correlations, and interpret the resulting factors. The principal components method was used as the extraction method, and Varimax with Kaiser normalization was used as the rotation method. Thus, a modern model of a successful internationalization strategy for each university should take into account the following factors: Global cooperation and networking, Competences and globalization of standards, Digital evolution, Funding and policy dynamics, Int’l research initiatives.

## 1 INTRODUCTION

In the dynamic landscape of higher education, the process of internationalization has emerged as a crucial paradigm for universities aiming to foster global competencies and collaborations. With the advent of the digital era, this imperative has been further underscored, propelling institutions to adapt and evolve within an increasingly interconnected and technology-driven milieu.

Aligned with this progressive vision, the DigIn.Net 2 project [1], spearheaded by the German Academic Exchange Service (DAAD), has been instrumental in promoting internationalization endeavors in digital space between partner universities in Germany and Ukraine [2]. This initiative has served as a catalyst for collaborative efforts, particularly exemplified by the Anhalt

University of Applied Sciences (HSA) and its joint projects with several prominent Ukrainian universities [3].

This study delves into the critical components and attributes that drive the success of university internationalization in the digital space [4]. Using the method of Exploratory Factor Analysis (EFA), the most probable number and composition of objective factors were obtained, which meaningfully cover the entire complex set of data obtained from participants of the international internships "Digital Future: Blended Learning" internships in 2022 and 2023.

The analytical methodology encompassed the application of the principal components extraction method, complemented by the Varimax technique with Kaiser normalization as the rotation method [5, 6]. This paper highlights a nuanced model for devising and implementing successful

internationalization strategies tailored to the specific needs of each university. The identified factors in the analysis will serve as pivotal cornerstones in shaping an effective and sustainable internationalization trajectory within the contemporary digital landscape. By embracing these multifaceted dimensions, universities can proactively navigate the complexities of globalization and digital transformation, thus fortifying their global presence and impact.

## 2 INTERNATIONALIZATION OF PARTNER UNIVERSITIES

Research on various dimensions of internationalization is actively conducted worldwide, involving professional organizations, universities, and individual researchers. Notable organizations in this field include the European Association of Universities (EAU), the International Association of Universities (UIA), the British Council (UK), the Institute for International Education (USA), the Center for International Higher Education at Boston College (USA), the Association for Academic Cooperation (USA), the German Academic Exchange Service (Germany), among others.

As per J. Knight's definition, internationalization is the process of incorporating international, intercultural, and global elements into the educational, academic, and administrative functions of an individual institution [7].

Presently, global collaboration stands as a key metric for assessing the caliber of education and scientific pursuits worldwide, serving as a crucial means for their assurance and enhancement. As a result, nearly all higher education institutions globally are actively engaged in international endeavors, striving to broaden their scope, albeit with variations in their interpretation of its principles, aims, objectives, and methodologies.

The German-Ukrainian educational partnership stands out as a promising avenue in this trajectory, particularly in light of the escalating demand for online education and the ongoing large-scale war. This conflict precipitated a significant influx of Ukrainian refugees into Europe, with Germany being a notable destination, rendering the German-Ukrainian partnership increasingly pertinent. As of August 2023, Germany is home to 1 175 695 Ukrainian residents [8], comprising a considerable segment of students and prospective students, whose presence serves as a key metric for measuring the internationalization of universities. In particular,

since the beginning of the war, the HSA has hosted more than 220 Ukrainian students, faculty of partner universities, and their families.

### 2.1 Anhalt University of Applied Sciences

Anhalt University of Applied Sciences (HSA) is a key participant in the dynamic process of internationalization, catering to a diverse cohort of 2 700 students from 110 nations and offering 12 English-language study programs. With international students comprising 35% of the student body, the current internationalization strategy (2018-2024) [9] places emphasis on pivotal areas including fostering innovation, advancing teaching and research, cultivating student competencies, and augmenting external funding.

HSA operationalizes its global focus through five core areas, playing a pivotal role in its continual evolution as a prominent center for education and research. These areas encompass strategic internationalization management, global networking initiatives, the cultivation of an inclusive and welcoming culture, enhancements in learning and teaching, and the promotion of research activities [9].

Expanding participation in various programs and projects serves as a catalyst for supporting innovation, developing research, facilitating the integration of excellent scientists, stimulating student mobility, and significantly increasing external funding.

### 2.2 HSA-Ukraine Cooperation

HSA maintains robust ties with Ukrainian universities, fostering regular student and academic exchanges. These initiatives are primarily facilitated through programs such as ERASMUS+ (KA 107), the Eastern Partnership, professional international internship programs [10].

The University has 12 English-language programs and has established English-language master's double degree programs such as DDP Communication and Embedded Systems, DDP Data Science, as well as German-language bachelor's programs in Electrical and Information Engineering and Computer Systems and Networks/ Internet of Things (IoT) with the following leading universities:

- National Technical University of Ukraine "Igor Sikorsky Kyiv Polytechnic Institute" (KPI, Kyiv);
- Odessa Polytechnic National University (OPNU, Odesa);

- State University of Intelligent Technologies and Telecommunications (SUITT, Odesa);
- Ternopil Volodymyr Hnatiuk National Pedagogical University (TNPU, Ternopil);
- Kharkiv National University of Radio Electronics (NURE, Kharkiv).

More than 70 students have successfully completed these programs and are currently employed by German and Ukrainian companies. Additionally, more than 40 professors and associate professors have participated in internships at HSA, and over 1100 faculty undertook international online internships in the years 2022-2023.

Through collaborations with Ukrainian universities, especially within the framework of programs administered by the German Academic Exchange Service (DAAD) and funded by the Federal Ministry of Education and Research (BMBF), HSA has accumulated initial and favorable experiences. Various ongoing projects such as the IDEA-East Hub, Digin.Net, Digin.Net 2, DigiJED, DigiJED 2, Study Visits, FIT4Ukraine, GLS Computer Systems and Networks/ Internet of Things (IoT), CaESaR and INTEGRA projects serve to expand and strengthen promising cooperation in the academic field.

### 2.2.1 DigIn.Net 2 Project

The DigIn.Net Project was initiated shortly before the outbreak of the COVID-19 pandemic, serves as a pivotal testament to HSA's unwavering dedication to international collaboration in higher education and the global orientation of its faculties. It underscores the institution's resolute focus on establishing transnational higher education through the seamless integration of digital technologies and innovations, propelling an accelerated transition towards the future of education.

Building upon the positive momentum garnered during the project's initial phase from 2019 to 2021, the second phase spanning 2021 to 2023 prioritizes the consolidation and expansion of collaborative efforts, accompanied by a steadfast commitment to enhancing the core activities of the project. A notable emphasis is placed on the elevation of digital competencies among the teaching staff.

### 2.2.2 Project Highlights

Annual *Contests of Innovative Ideas* for students and young scientists in the domains of ICT, energy technologies, and mechanical engineering have been pivotal in showcasing HSA's robust laboratory infrastructure and equipment. This has particularly

attracted talented engineering students from Ukraine, presenting them with a platform to actualize their ideas within the laboratory setting, subsequently influencing decisions concerning further study or research endeavors in Germany.

The pivotal highlight of the DigIn.Net 2 project was the introduction of the "*Digital Future: Blended Learning*" *International Internship* in May 2022, catering to participants from partner universities. A total of 186 participants successfully completed the internship, receiving certificates of completion and enriching their digital competencies through immersive learning experiences. Subsequent iterations of the internship took place in October 2022, April 2023, and October 2023, with a growing number of participants from diverse universities. The internship program served as an enriching platform for comprehending, analyzing, and exploring global facets of internationalization within the digital realm, providing invaluable insights into key factors and perspectives driving this transformative process.

## 3 EMPIRICAL RESEARCH

The main purpose of this research was to make sure that the fundamental factors that are crucial for the successful internationalization in a digital space of universities are understood. It aimed to explore the significance, challenges, prospects and impact of digital internationalization on learning, as well as on individual actors in the educational process and the nature of inter-institutional relations. Leveraging data from four surveys conducted within the framework of the DigiNet 2 project [2], the study applied exploratory factor analysis to identify key factors. The surveys involved researchers, professors, lecturers, associate professors, and staff of more than 150 higher education institutions.

### 3.1 Methodology and Respondents

The surveys "Key Factors of Internationalization of Higher Education" were conducted between May 4<sup>th</sup> and May 28<sup>th</sup>, 2022, then from October 10<sup>th</sup> to October 28<sup>th</sup>, 2022, and then from April 4<sup>th</sup> to April 22<sup>th</sup>, 2023, and then from October 2<sup>nd</sup> to October 20<sup>th</sup>, 2023. The participants were carefully selected to form a statistically representative sample. Prior to participating in the survey, respondents were provided with an information booklet and a consent form. They were informed that their involvement was entirely voluntary and anonymous, and they had the option to withdraw their consent at any time without

having to provide a reason. It was assured that the collected data would remain confidential and solely be used for research and statistical analysis purposes.

To validate the research tools, a pilot study was conducted on April 4, 2022, involving the participation of 45 teachers and 15 students. Based on the results of the pilot study, adjustments and minor changes were made to the questionnaire items. The decision was made to carry out the survey during online sessions of international internships, utilizing digital tools for data storage, analysis, and presentation.

The first survey was conducted from May 4<sup>th</sup> to May 31<sup>st</sup>, 2022, and gathered responses from 186 participants representing 15 universities in Ukraine, 3 in Germany, and 5 from other European countries. The second survey took place from October 10<sup>th</sup> to October 31<sup>st</sup>, 2022, with 192 respondents from 27 universities. The third survey took place from April 4<sup>th</sup> to April 22<sup>th</sup>, 2023, with 261 respondents from more than 100 universities. The fourth survey took place from October 2<sup>nd</sup> to October 20<sup>th</sup>, 2023, with 424 respondents from more than 120 universities. The majority of higher education respondents had a public institutional profile, with a dual emphasis on both teaching and research and offering programs at all degree levels.

Questionnaires and a glossary of terms and definitions were made available in both English and Ukrainian. Digital tools, such as Mentimeter, Google Forms, and Slido, were employed for questionnaire creation, design, and result presentation. The findings from the four research rounds are structured into two main segments: an empirical aggregate analysis,

comprising the outcomes of the first part of the surveys, and a factor analysis of the empirical data from the second part of the survey.

### 3.2 Aggregated Results Overview

Aggregated results:

- According to the surveys, an average of 68% of respondents have an institutional policy/strategy, and 8,4% reported that such a policy/strategy is being developed; 23,1% said they had no information about it. A comparison over time indicates a notable rise in the percentage of respondents who reported the implementation of the internationalization policy in a digital space. Specifically, 71,6% of participants reported such a policy in the fourth survey, whereas 64% did so in the first survey. This increase can be interpreted as an objective improvement in the awareness of participants within the educational process.
- Furthermore, the study revealed that the most frequently assessed areas of internationalization are focused on cultivating partnerships, including research collaboration, grant programs, and knowledge sharing/transfer, ranking first. The second most evaluated aspects include the facilitation of faculty mobility, enrollment of foreign students, and promotion of student mobility abroad. Lastly, the development of programs aimed at enhancing national capacity occupies the third position in terms of evaluation priority. Refer to Figure 1 for detailed results.

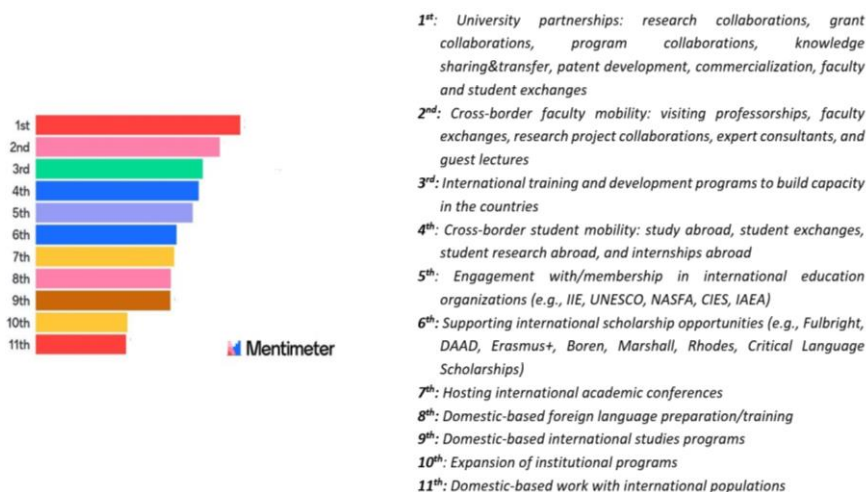


Figure 1: Survey results: Areas of internationalization.

The results of this survey closely correlate with the data of the latest DAAD study on the areas of internationalization in higher education through the lens of digitalization, where the following are [11]:

- 1) Cooperation, collaboration and partnerships – CCP.
- 2) Mobility and Exchange – ME (Physical – Blended – Virtual).
- 3) Administrating Internationalization Digitally – AID.
- 4) Attractiveness of Universities in a Global Knowledge Society – GKS.
- 5) Knowledge Transfer and Open Education – KTOE.

Following the identification of the main areas of internationalization, it was imperative to assess the extent of the respondents' involvement in these areas. The findings revealed the following trends:

- The percentage of respondents engaged in international activities, particularly project-related activities, exhibited a substantial increase from 55,5% in 2022 to 68% in October 2023, and this is most likely to be distance work or blended learning activities;
- In terms of experiences abroad for the purpose of exchange or mobility, the results displayed a slight regression. In October 2022, 49,7% of respondents indicated no experience in this regard, while 38,1% reported internship experiences lasting up to 3 months. Additionally, 7,1% of respondents had experiences spanning from 3 to 6 months, 2,6% had work experiences abroad lasting up to one year, and 2,5% had experiences exceeding one year. In October 2023, these figures changed slightly, with 56% of respondents indicating no experience, 33% reporting internship experiences of up to 3 months, 4% with experiences lasting from 3 to 6 months, 3% having work experiences abroad for up to one year, and 4% having experiences exceeding one year (Figure 2).

### 3.3 Factor Analysis

Factor analysis compresses information in a correlation matrix, revealing hidden factors that explain relationships among observed features (variables). By identifying a small set of factors, it simplifies complex relationships among numerous variables. These factors group related variables for meaningful interpretation, combining strongly correlated variables while maintaining weak correlations between different factors.

There are two primary classifications of factor analysis: Exploratory Factor Analysis (EFA) and Confirmatory Factor Analysis (CFA) [12]. EFA is particularly beneficial when the researcher lacks a clear understanding of the specific number of factors at play [13].

The mathematical model of factor analysis assumes changes in observed variables stem from underlying latent properties known as *general factors*, with each common factor having varying degrees of influence denoted by *factor loadings*. Additionally, it acknowledges that variations can also arise from independent sources, termed *specific factors*, such as random errors and measurement inaccuracies. Let  $X_i$  represent the  $i$ -th observed variable. We can denote  $U_i$  as the general component of this variable, which comprises the changes influenced by common factors. Additionally,  $\epsilon_i$  represents the specific factors, which entail changes that are independent of one another and not contingent on alterations in other variables. Consequently, the change in variable  $X_i$  can be dissected into the sum of the general component, representing overall changes influenced by common factors, and the specific component, indicating changes induced by specific factors:

$$X_i = U_i + \epsilon_i \tag{1}$$

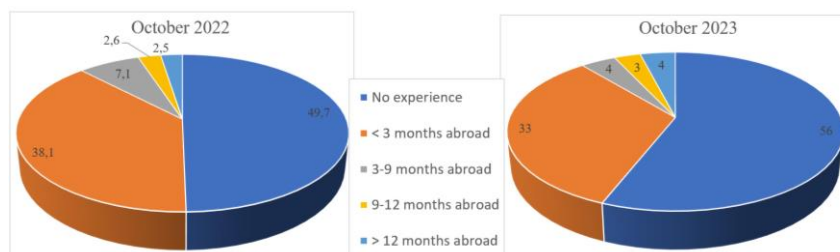


Figure 2: Survey results: International experience and mobility of the respondents in 2022 and 2023.

The further improvement of the idea of factor analysis is based on the assumption that the data of  $n$  variables  $U_i$  are linear combinations of a smaller number of other variables  $F_j$  called factors, i.e.

$$U_i = \omega_{1i}F_1 + \omega_{2i}F_2 + \dots + \omega_{ki}F_k, \quad (2)$$

where  $i = \overline{1, n}$ .

$\omega_{ji}$  - are factor loadings of the  $F_j$  factors, which characterize the degree of influence of the  $j$ -th common factor on the  $i$ -th empirical variable. Combining the above (1) and (2), we obtain the following, which is expressed through general and specific factors as follows:

$$X_i = \omega_{1i}F_1 + \omega_{2i}F_2 + \dots + \omega_{ki}F_k + \varepsilon_i, \quad (3)$$

where  $i = \overline{1, n}$ .

Where:

- General factors  $F_j$  are either uncorrelated random variables with variance equal to 1 or unknown non-random parameters.
- The specific factors  $\varepsilon_i$  have a normal distribution, are uncorrelated and independent of the general factors.

The primary method for directly estimating the relationship between variables (3) typically assumes equal relationship scores of 1. In this approach, the relationship scores are equivalent to the diagonal elements of the correlation matrix, resulting in specific factor variances of 0. This concept forms the foundation of one of the most renowned models of factor analysis, known as the principal components method [5]. Under this method, a transition to a new coordinate system occurs, constituting a set of orthonormalized linear combinations. These linear combinations are specifically the eigenvectors of a correlation matrix. The first principal component is the linear combination exhibiting the highest variance. Subsequently, the second component embodies the largest variance among all other linear combinations that exhibit no correlation with the first principal component.

The next stage of factor analysis is factor rotation, i.e. rotation of the coordinate axes corresponding to the factors, which is carried out not in the space of the original variables, but in the space of the factors found. The essence of the process of rotation of any pair of vectors is to find an angle between the new and old direction of the factors that would give the greatest increase in the selected criterion. Rotation of

factors in space allows to characterize each attribute by the predominant influence of one factor. In modern statistical data processing packages, the most common rotation methods are varimax, quartimax, and equimax. Varimax rotation simplifies the values of the columns of the factor matrix by reducing them to 1 or 0. Having obtained the factor solution (factor matrix) after the rotation procedure, you can proceed to the interpretation and naming of the factors.

### 3.3.1 EFA Methodology

Factor analysis was conducted to reduce the size of the sample of features (answers to the questionnaire) and group them based on correlations. The principal components method was used as a selection method, and Varimax with Kaiser normalization was used as a rotation method [6]. To optimize the calculations, the statistical software package SPSS was used [14], the results of which are presented in the following Tables 1 and 2.

The survey was conducted in four rounds, which were combined into two blocks and compared over time: in 2022 with 378 respondents and in 2023 with 685 respondents, respectively. Respondents were asked to express their opinion on the following items:

- 1) Areas of digital internationalization development:
  - *AD1*. Academic partnerships and collaboration;
  - *AD2*. Mobility and exchange programs;
  - *AD3*. Digital transformation;
  - *AD4*. Global standards implementation;
  - *AD5*. International research initiatives.
- 2) External factors of internationalization development:
  - *EF1*. Public policy (national, state/provincial, municipal);
  - *EF2*. Ranking of the country's universities;
  - *EF3*. Business and industry;
  - *EF4*. International rankings;
  - *EF 5*. International partner universities.
- 3) Internal factors of internationalization development:
  - *IF1*. Head of the institution;
  - *IF2*. International *department or person responsible for internationalization*;
  - *IF3*. Teaching staff;
  - *IF4*. University ranking;
  - *IF5*. Personally.
- 4) Internal and external challenges in the development of internationalization:
  - *CH1*. Insufficient financial resources;
  - *CH2*. Restricted government funding;

- *CH3*. Limited awareness among educational stakeholders;
  - *CH4*. Faculty and staff's limited experience and knowledge;
  - *CH5*. Language barrier.
- 5) Challenges and solutions of the digital internationalization:
- *CD1*. Overcoming the consequences of the COVID-19 pandemic and global conflicts;
  - *CD2*. Rethinking education at all stages of learning;
  - *CD3*. Implementation of hybrid learning models (face-to-face, blended, virtual);
  - *CD4*. Promoting e-internationalization and mixed virtual mobility;
  - *CD5*. Promoting digital collaboration and virtual partnerships.
- 6) Implementation and expansion of external activities:
- *EA1*. Cultivate international networks;
  - *EA2*. Cultivate intercultural and global competencies through knowledge exchange;
  - *EA3*. Facilitate joint research endeavors;
  - *EA4*. Collaborate with international associations and institutions;
  - *EA5*. Establish international or double degree programs;
  - *EA6*. Develop cross-border academic programs;
  - *EA7*. Engage in joint projects.
- 7) Preparation and bridging gaps in the path of digitalization:
- *GD1*. Creating an innovative digital environment;
  - *GD2*. Digitization of educational and research processes;
  - *GD3*. Enhancing digital competencies;
  - *GD4*. Acquiring practical experience in digital technologies;
  - *GD5*. Augmenting the amount of external funding.

The respondents have ranked the proposed answers in descending order of importance, i.e. from the complete preference of one answer over another. After that, each of the proposed answers to each question was evaluated on a five-point (seven-point) scale: from strongly agree (2/3) to strongly disagree (-2/-3).

### 3.3.2 Implementation

Based on the results of the factor analysis, Table 2 indicates the total explained variance, revealing that five Eigen factors have values exceeding one, leading

to the selection of only five factors for analysis. The first factor explains 27,113% of the total variance, the second one explains 7,174%, the third explains 7,033%, the fourth one explains 6,121%, and the fifth – 4,424%. Following the extraction phase, the Kaiser's method, also known as K1 - Kaiser's method [6], was employed to determine the number of constructs to retain for rotation. As shown in Table 1, the analysis revealed that these five factors should be retained for further study.

Table 1: Total explained variance.

	Initial Eigenvalues			Extraction Sums of Squared Loading		
	Total	% of Variance	Cumulative % of Var.	Total	% of Variance	Cumulative % of Var.
1	6,158	27,113	27,113	6,158	27,113	27,113
2	1,629	7,174	34,287	1,629	7,174	34,287
3	1,597	7,033	41,32	1,597	7,033	41,32
4	1,390	6,121	47,441	1,390	6,121	47,441
5	1,005	4,424	51,865	1,005	4,424	51,865
6	0,934	4,113	55,978			
7	0,913	4,021	59,999			
8	0,814	3,584	63,583			
9	0,692	3,045	66,628			
10	0,549	2,417	69,045			
11	0,525	2,311	71,356			
12	0,500	2,202	73,558			
13	0,497	2,187	75,745			
...	...	...	...			
36	0,073	0,321	99,802			
37	0,045	0,198	100			
Extraction Method: Principal Component Analysis						

In the next step, the factor loadings with the highest absolute values were identified and recorded in each row of the rotated component matrix (Table 2). These factor loadings should be interpreted as correlation coefficients between the variable and the factors. For example, variable *AD1* has the strongest correlation with factor 1 (correlation coefficient 0,616), variable *AD2* has the strongest correlation with factor 1 (0,543), while variable *AD3* is mainly related to factor 2 (0,828), etc. In most



cases, the assignment of a variable to a particular factor based on correlation coefficients is unambiguous.

Table 2: Rotated component matrix.

	Components				
	1	2	3	4	5
AD1	0,616	0,208	0,066	0,323	-0,191
AD2	0,543	0,004	0,231	0,127	0,044
AD3	0,111	0,828	0,205	-3,8E-02	0,067
AD4	0,004	0,031	0,735	0,302	0,167
AD5	0,031	-0,097	0,333	0,602	0,042
EF1	0,200	0,118	0,015	0,123	0,622
EF2	0,279	0,007	-4,2E-02	0,322	0,054
EF3	0,083	0,022	0,103	0,118	0,761
EF4	0,172	0,066	0,557	0,082	0,244
EF5	0,602	-0,033	0,228	0,174	0,321
IF1	0,592	0,006	0,301	0,202	0,043
IF2	0,870	0,045	0,098	0,124	0,322
IF3	0,233	0,082	0,612	0,202	0,337
IF4	0,613	0,233	0,095	0,118	0,089
IF5	-3,2E-02	0,063	0,204	0,704	0,103
CH1	0,201	0,442	0,205	0,082	0,777
CH2	0,099	0,034	-2,3E-02	0,176	0,811
CH3	0,102	0,087	0,605	0,320	0,166
CH4	0,089	0,201	0,553	0,118	0,088
CH5	0,222	0,096	0,751	0,044	0,117
CD1	0,081	0,238	0,113	-0,282	0,644
CD2	0,054	0,007	0,665	0,062	0,224
CD3	0,073	0,911	-0,202	0,163	0,314
CD4	0,300	0,628	0,105	0,062	0,105
CD5	-0,104	0,823	0,114	-0,112	0,088
EA1	0,733	0,211	0,073	0,332	0,094
EA2	0,211	0,074	0,704	0,134	-0,072
EA3	0,210	0,081	-0,005	0,814	0,088
EA4	0,769	0,122	0,204	0,311	0,099
EA5	0,821	0,008	0,213	0,092	0,104
EA6	0,014	0,172	0,666	0,200	0,116
EA7	0,092	0,019	0,301	0,812	0,099
GD1	0,222	0,628	0,104	0,088	-0,207
GD2	0,172	0,691	0,076	-0,107	0,205
GD3	0,098	0,028	0,752	0,189	0,169
GD4	0,186	0,567	0,123	0,302	0,088
GD5	0,077	0,028	0,201	-0,201	0,607

Extraction Method: Principal Component Analysis  
 Rotation Method: Varimax with Kaiser Normalization  
 a. Rotation converged in 8 iterations

### 3.3.3 Results Interpretation

Based on the results, one variable (EF2) should be eliminated as its loadings are below 0,5.

The factor matrix data (rotated component matrix) indicate 5 key factors for successful internationalization of the university in an innovative digital environment. To interpret each factor, the analysis of the variables included in it should be

conducted to identify common characteristics. The more variables with high loadings in a factor, the easier it is to discern its nature. While there are no standardized methods for selecting factor names, a preliminary approach could involve using the name of the variable with the highest loadings within the factor.

Therefore, based on the above, the variables can be attributed in the following order to the factors:

- **Factor 1 – Global Cooperation and Network (GCN), 27,03%** consists of: AD1, AD2, EF 5, IF1, IF2, IF4, EA1, EA4, EA5.
- **Factor 2 (18,92%) – Digital Evolution (DEv)** includes variables AD3, CD3, CD4, CD5, GD1, GD2, GD4.
- **Factor 3 (24,32%) – Competencies and Globalization of Standards (CGS)** includes variables GD3, CD2, EA2, EA6, AD4, IF3, CH3, CH4, CH5.
- **Factor 4 (10,81%) – Int'l Research Initiatives (IRI)** includes variables AD5, EA3, EA7, IF5.
- **Factor 5 (16,22%) – Funding and Policy Dynamics (FPD)** includes variables EF1, EF3, CH1, CH2, CD1, GD5.

Thus, it is possible to outline and demonstrate a model of key factors for successful internationalization of a university in an innovative digital environment from the perspective of active participants in the educational process (Figure 3).

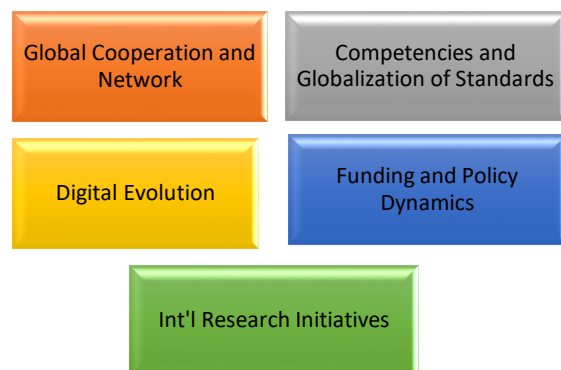


Figure 3: Key factors of university internationalization in the digital space.

## 4 CONCLUSIONS

The study, which focused on the practical implementation of the DigIn.Net 2 project of the HSA in cooperation with four Ukrainian universities, conducted an exploratory factor analysis of empirical



survey data from 1063 respondents who participated in the international internships "Digital Future: Blended Learning" in 2022-2023. This study faced the unprecedented challenge of collecting and analyzing data during the pandemic and wartime conditions, highlighting the resilience of the research process. Additionally, the application of factor analysis to the dataset, a novel approach in this context, enabled the researchers to condense variables, identify correlations, and interpret key factors efficiently.

As a result, a comprehensive set of key factors for the successful internationalization of universities in the digital sphere was identified. These factors include the need to actively develop (1) global cooperation and network, (2) competencies and globalization of standards, (3) digital evolution, (4) funding and policy dynamics, and (5) international research initiatives. These insights offer an innovative framework that can guide the development and implementation of effective internationalization strategies for universities, emphasizing the significance of adapting to the evolving digital landscape while also fostering global collaboration and maintaining a strong emphasis on research initiatives. By acknowledging these key factors, institutions can fortify their position in the international academic community, nurturing a dynamic environment that promotes growth, excellence, and sustainable global engagement.

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