

1 Analysis of the Effectiveness of the Internationalization 2 Capacity Building Framework of the Technical 3 University 4

5 *This article discusses the project on the internationalization capacity building*
6 *at the Saginov Karaganda Technical University (STU) in Kazakhstan. The*
7 *project, entitled “Capacity building for the internationalization of a technical*
8 *university by means of digital learning technologies,” was supported by the*
9 *fund “Scientific foundations “Mangilik el” (education of the 21st century,*
10 *fundamental and applied research in the humanities)” for scientists 2020–*
11 *2022. This part of the research that is presented in this article has its aim to*
12 *analyse the effectiveness of the developed framework of capacity building*
13 *for internationalization of technical university considering the national and*
14 *international contexts for enhancing the qualifications and abilities of*
15 *students and teachers to an internationally comparable level. In paper there*
16 *have been presented the methods of high efficiency that has been assessed*
17 *through the heat intensity map for practical realization of the Framework*
18 *approaches with presenting the research findings for further steps.*

19
20 **Keywords:** *internationalization, high-efficiency methods, heat intensity*
21 *map, framework for building the internationalization capacity, technical*
22 *university.*

23 24 25 Introduction 26

27 Globalization processes affect all spheres of socio-economic life of
28 society. In recent years, a lot of efforts have been made in Kazakhstan to
29 improve the quality of university education and its compliance with
30 international standards. Today, the internationalization of higher education is a
31 necessary condition for the organization of effective international cooperation,
32 ensuring the creation and support of stable ties in the field of training
33 specialists and conducting scientific research, the formation of a positive image
34 of Kazakhstani universities in the world educational space. In the context of
35 the knowledge economy formation, the creation of new technologies as a tool
36 for discovering and realizing the potential of future specialists comes to the
37 fore. Consequently, the training of technical specialists should be based on the
38 application of the best practices of the leading universities of the world, taking
39 into account the existing traditions of Kazakh education. This will contribute
40 not only to the formation of new approaches to engineering education, but also
41 to the growth of the intellectual capacity of human capital and the development
42 of the creative industry in the country.

43 The conducted research made it possible to develop a Technical
44 University Internationalization Framework, which includes a set of activities
45 based on a complex interaction of approaches and principles. The
46 implementation technology of this Framework based on a specialized tool - the
47 Go UniTech digital system - includes three main stages:

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Stage 1 – preparation for implementation

1. Determination of the efficiency level of the implementation of the model proposed components based on the heat intensity map.
2. Adding additional measures implemented within the framework of the developed tools in order to increase the intensity of internationalization processes.
3. Drawing up a map of stakeholders based on a list of internal and external actors of interaction within the framework of internationalization processes.
4. Formation of a risk portfolio in accordance with the stakeholders' map.
5. Determination of the list of measures for rapid response to potential risks.

Stage 2 – implementation and testing of the model via the developed tools

1. Preparation and filling of content for the information system.
2. Testing the functionality of the information system.
3. The appointment of section administrators and the definition of functionality.
4. Launch of the information system.

Stage 3 – monitoring the sustainability of the model mplementation

1. Analysis of the performing IC functions processes in accordance with the heat map of increased intensity.
2. Assessment of the significance and level of measures implementation by experts.
3. Preparation of an analytical report and recommendations for the further model implementation.

At the same time, stage 1 is the most difficult, requiring detailed analysis and a deliberate approach to implementation.

Methods

The internationalization of higher education institutions via digital technologies is one of the key areas aimed at promoting educational diversity and cultural practices [1-4]. The first stage components of implementing the model with the help of an information system provide a maximum understanding of user roles and a preliminary assessment of the activities intensity offered to participants. In order to develop the mechanisms of the Framework functioning on the basis of the proposed tools, internal and external subjects are identified.

1 Internal subjects: student, Kazakhstani teachers and researchers,
2 administration, Administrators of university processes.

3 External: universities, foreign scientist/teacher, foreign student, employers,
4 graduates.

5 Interaction within the framework of the model is carried out in accordance
6 with the high efficiency methods of the internationalization process formulated
7 as a result of strategic correlation decisions obtained on the basis of
8 multifactorial SWOT analysis with benchmarking factors [5]:
9

- 10 1. Organization of joint research activities with foreign partners:
11 Kazakhstani teachers and researchers – a foreign scientist/teacher.
- 12 2. Expansion of scientific research areas list, including in the field of
13 education and the university technical profile: Kazakh teachers and
14 researchers – foreign scientists/teachers.
- 15 3. Formation of the International researchers Institute: Kazakh teachers
16 and researchers – foreign scientists/teachers.
- 17 4. Development of technology transfer and patent Cooperation (Patent
18 Cooperation Treaty - PCT): Kazakhstani teachers and researchers –
19 foreign scientists/teachers.
- 20 5. Opening of the Marketing Office: Administration – university
21 processes administrators.
- 22 6. Expanding the list of academic mobility programs for students:
23 students – Kazakhstani teachers and researchers – foreign scientists/
24 teachers.
- 25 7. Formation of linguistic, cross-cultural and entrepreneurial competence
26 of teaching staff: Administration – Kazakhstani teachers and researchers
27 - foreign scientists/teachers.
- 28 8. Formation of the readiness of teaching staff for the processes of
29 globalization through the international environment: Kazakh teachers
30 and researchers – foreign scientists/teachers.
- 31 9. Formation of students "global" competencies (global issues) bank:
32 Kazakhstani teachers and researchers – students, a foreign scientist -
33 students.
- 34 10. Implementation of strategies for co-learning (co-learning) and co-
35 teaching (co-teaching) with the participation of foreign partners: student
36 - foreign student, Kazakhstani teachers and researchers - foreign
37 scientists/teachers.
- 38 11. Expanding the coverage of the language training students (international
39 certification) contingent: A foreign student - scientist.
- 40 12. Organization of soft & business skills trainings for HiPo employees
41 (employees with high potential): The administration of the university
42 processes is a foreign scientist.
- 43 13. Increasing the share of internationalization costs in the framework of
44 budget planning for the coming period, including through the
45 development of sponsorship financing: Administration – employers,
46 administration – graduates

- 1 14. Adaptation of intra–university management standards to international
2 practice through the development of an open access information
3 system for managing internationalization processes: Administration –
4 administrators of university processes - Kazakhstani teachers and
5 researchers.
- 6 15. Sustainable development of mechanisms for the formation of a
7 positive image of the university in the international arena and
8 systematic promotion of professional portfolio and expansion of
9 networking (international networking) in international electronic
10 databases: Administration – foreign scientists, Kazakh teachers and
11 researchers – foreign scientists/teachers.
- 12 16. Creation of Alumni Network Environment based on an information
13 system for the implementation of joint scientific and educational
14 projects: Administration- graduates.
- 15 17. Formation of a digital collaborative space. – administrators of
16 university processes – foreign scientists, administration – faculty of
17 the university - graduates, administration – faculty of the university –
18 student, administration – faculty of the university – foreign student.

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20 Thus, in order to conduct a comprehensive assessment of the
21 implementation of high-efficiency methods within the framework, it is
22 necessary to use several levels of assessment, including the construction of a
23 Heat intensity map, the development of a stakeholder map to assess potential
24 risks in the implementation of the framework.

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28 **Results and Discussion**

29 In order to determine the implementation effectiveness of the proposed
30 recommendations via the developed tools, it is proposed to develop a heat
31 intensity map of the internationalization capacity building implementation
32 principles of the technical university.

33 For this purpose, a correlation matrix has been developed, in which the
34 categories of the framework, the proposed approaches and the identified
35 recommendations are correlated. According to the logical structure of the
36 matrix, recommendations can be implemented in a specific approach within
37 certain categories. At the same time, it is possible to implement the
38 recommendation both within the frame of one approach, and several. To identify
39 the most intensive processes of the technical university internationalization, based
40 on the proposed recommendations, the cells of the matrix were color coded
41 according to the following parameters:

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Blue color – there is no implementation of the recommendations along the
line of the principle within the frame of a specific approach ("temperature" is
low);

1 Yellow – the recommendation is implemented within the frame of one
 2 approach based on one principle (minimum "heating");
 3 Orange color – two recommendations have been implemented ("temperature"
 4 intensity is high);
 5 Red light – recommendations are implemented intensively (maximum
 6 "temperature").
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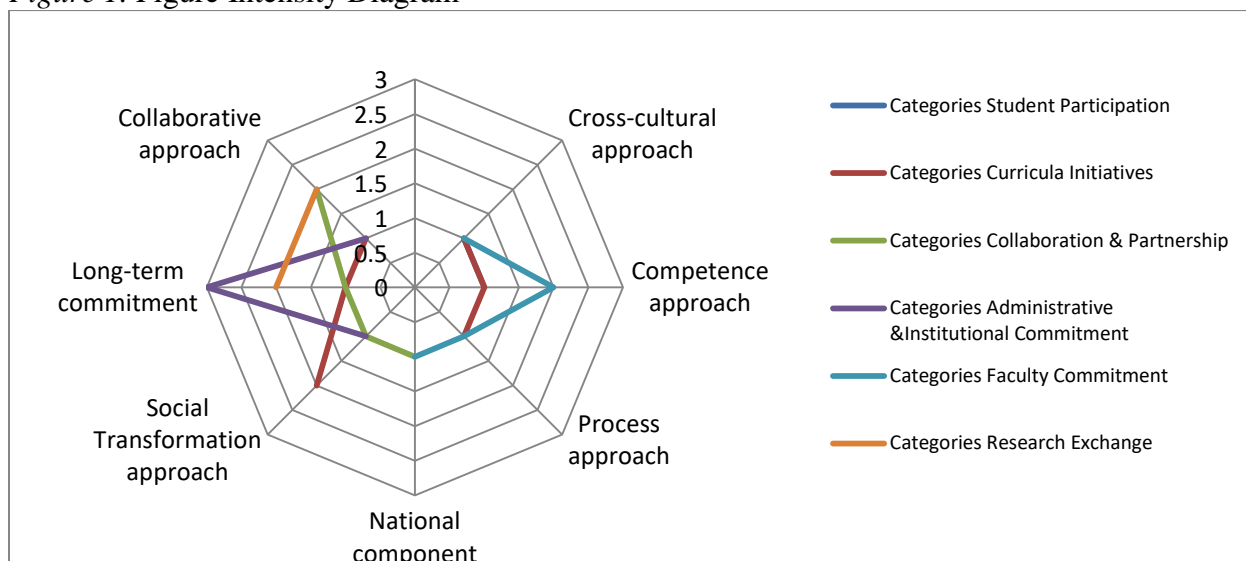
8 The resulting matrix was transformed by deleting the text into a processes
 9 intensity heat map with a quantitative designation of activities (Table 1).
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11 *Table 1.* Table Heat intensity map of the implementation of the Framework
 12 approaches within the relevant categories

Approaches	Categories					
	Student Participation	Curricula Initiatives	Collaboration & Partnership	Administrative & Institutional Commitment	Faculty Commitment	Research Exchange
Cross-cultural approach	1	1	1		1	
Competence approach	1	1			2	
Process approach		1		1	1	1
National component			1		1	
Social Transformation approach		2	1	1		
Long-term commitment		1	1	3		2
Collaborative approach		1	2	1		2

13
 14 Conditional numerical values to the cells will be assigned for assessing the
 15 intensity of recommendations on a scale from 0 to 3 in intensity, based on the
 16 data obtained, a diagram will be constructed (Fig. 1)
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1 *Figure 1. Figure Intensity Diagram*



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4 Based on the obtained map, it can be concluded that a number of
5 approaches are not implemented intensively enough within the categories. In
6 this regard, additional solutions are required within the frame of the proposed
7 information system tools.

8 Also, based on the assigned values, we determine the intensity of the
9 implementation of the principles (I) based on the total intensity coefficients
10 (K_i), provided $I = \sum K_i = 1$, where $K_i \leq 1$:

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$$12 \quad K_i = \frac{\sum P_n}{n} \times 0,01 \quad (1),$$

13

14 where K_i is the principle implementation coefficient ;

15 $\sum P_n$ is the total indicator of assigned values for the implemented
16 categories. The obtained results are presented in Table 2.

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18 *Table 2. Table Intensity coefficients of approaches implementation*

Category	Value
Student Participation	0,02
Curricula Initiatives	0,07
Collaboration & Partnership	0,06
Administrative & Institutional Commitment	0,06
Faculty Commitment	0,05
Research Exchange	0,05
Intensity of approaches implementation by category	0,31

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20 Suppose that the minimum intensity threshold should be at least 60%,
21 while the average K_i should vary from 70% to 80%, high intensity - from 80%.
22 To this end, it is necessary to develop additional solutions for coefficients with
23 a specific gravity ≤ 0.06 . Identification of "thin" places to increase the intensity
24 was carried out (Table 3).

1 *Table 3. Table Intensity Enhancement Field*

<i>Approaches</i>	<i>Inactive categories</i>	<i>Low-intensity categories requiring additional activities</i>
Cross-cultural approach	Administrative & Institutional Commitment	Student Participation
	Research Exchange	Collaboration & Partnership
Competence approach	Collaboration & Partnership	
	Research Exchange	Curricula Initiatives
	Administrative & Institutional Commitment	
Process approach	Student Participation	Research Exchange
	Collaboration & Partnership	
National component	Student Participation	-
	Collaboration & Partnership	-
	Administrative & Institutional Commitment	-
Social Transformation approach	Student Participation	Administrative & Institutional Commitment
	Faculty Commitment	
	Research Exchange	
Long-term commitment	Student Participation	-
	Faculty Commitment	-
Collaborative approach	Student Participation	-
	Faculty Commitment	-

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Based on the analysis, a number of additional measures are proposed to strengthen categories with low intensity.

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After the implementation of the proposed solutions, the heat map will look like this (Table 4).

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Table 4. Table Heat map of increased intensity

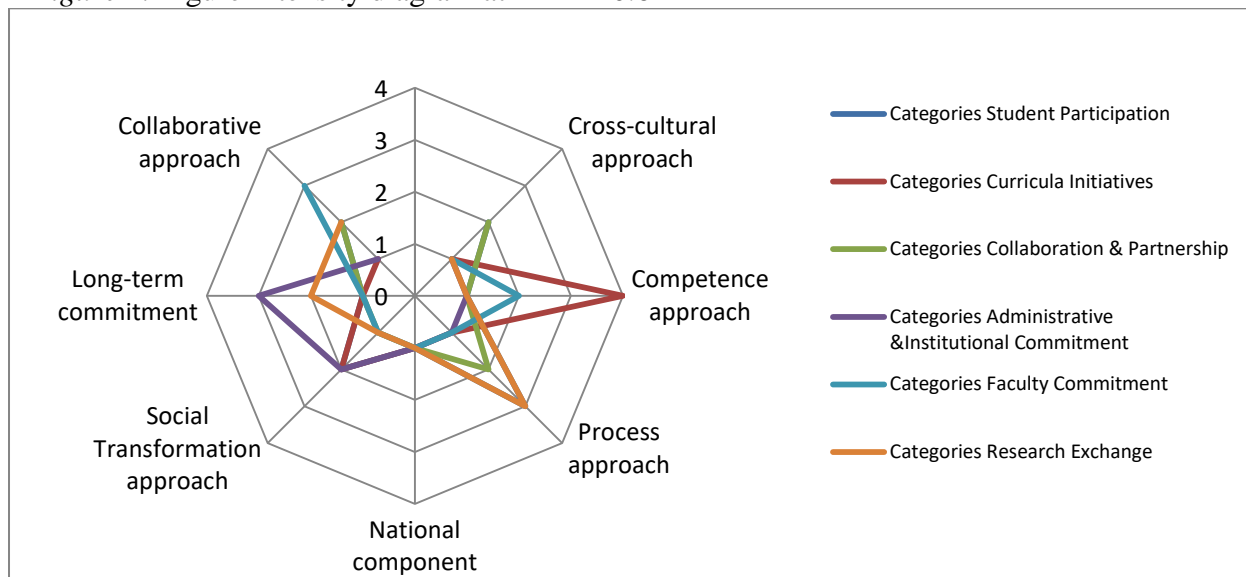
Approaches	Categories					
	Student Participation	Curricula Initiatives	Collaboration & Partnership	Administrative & Institutional Commitment	Faculty Commitment	Research Exchange
Кросс-культурный подход	2	1	2	1	1	1
Cross-cultural approach	1	4	1	1	2	1
Competence approach	3	1	2	1	1	3
Process approach	1	1	1	1	1	1
National component	2	2	1	2	1	1
Social Transformation approach	1	1	1	3	1	2
Long-term commitment	2	1	2	1	3	2
Collaborative approach	0,12	0,11	0,1	0,1	0,1	0,11

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1 At the same time, $I=\sum K_i=0.64$, which makes it possible to achieve the
2 required intensity of the processes.

3 Then the intensity diagram will look like this (Figure 2).
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5 *Figure 2. Figure Intensity diagram at $I=\sum K_i=0.61$*



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8 The implementation of a formed decision measures set was implemented
9 within the framework of the Go UniTech digital system, taking into account all
10 factors and potential risks by compiling a Stakeholder Map based on the
11 International Standards for Identifying and Interacting with Stakeholders: Standard
12 AA 1000, the standard of accountability principles (Accountability Principles
13 Standard 2008), "Stakeholder Engagement Standard 2011" (AA 2011 Stakeholder
14 Engagement Standard 2011), ISO 26000: Social Responsibility Guidelines, GRI
15 (Global Reporting Initiative) [6-9].

16 The following categories act as stakeholders:

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18 1. Investors: contribution made - financial and logistical means
19 • Ministry of Education and Science of the Republic of Kazakhstan
20 • University
21 • Enterprises and organizations
22 • Funds of various levels
23

24 At the same time, investors' expectations include the following: improving
25 the quality of educational services, the implementation of state policy in the
26 field of higher education; compliance with the quality of education with
27 international standards; increasing the place of universities in domestic and
28 international rankings; social transformation.
29

1 2. Employers: enterprises and organizations whose expectations are
2 focused on obtaining qualified specialists in accordance with the stated
3 requirements.

4 3. Administration: departments, departments and centers involved in the
5 processes of the Model:

- 6
- 7 - Top management of the university, responsible for the development of
8 the development strategy, management of internationalization
9 processes and allocation of financial resources.
 - 10 - Departments for Personnel Development (administrative issues),
11 whose activities are aimed at developing international competencies of
12 personnel.
 - 13 - Department of Academic Affairs, responsible for the management of
14 academic processes within the framework of the internationalization
15 potential development model.
 - 16 - The International Department, whose competence includes the
17 coordination and regulation of partnerships with foreign
18 representatives, as well as the promotion and representation of the
19 university at the international level.
 - 20 - The Department of Science and Innovation, responsible for
21 coordinating the scientific activities of the university with a focus on
22 the international component.

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24 Department of Innovation and Entrepreneurship providing support for
25 obtaining protection documents for intellectual property products.

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- 27 - Departments, within the framework of which, the formation of
28 linguistic, cross-cultural and entrepreneurial competence, as well as
29 the readiness of teaching staff for globalization processes through the
30 international environment is carried out.

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32 All these activities are aimed at achieving such results as: capacity building of
33 the university; improving the quality of education and research; promotion of
34 scientific developments at the international level and the formation of an
35 institution of international researchers; effective execution of decisions; obtaining
36 financial benefits, including through the commercialization of the results of
37 scientific activities and the receipt of foreign investment; increase in the
38 number of HiPo employees; increasing the international ranking of the
39 university; development of academic and scientific mobility; attraction of a
40 foreign contingent of students and development of cooperation with foreign
41 universities.

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43 4. The teaching staff interested in improving the level of well-being and
44 the formation of an inter-impact portfolio through involvement in the
45 international activities of the university.

1 5. Students who actively participate in exchange and academic mobility
2 programs in order to gain international experience and study at leading
3 universities in the world.

4 6. Foreign partners.

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6 Students interested in gaining international experience, as well as high-
7 quality and affordable education.

- 8
9 - Teachers and researchers seeking to expand their international
10 experience and ensure the promotion of their portfolio at the
11 international level, as well as in some cases the commercialization of
12 the results of joint research.
13 - Enterprises and organizations interested in attracting talented
14 graduates.

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16 The support of such interest and the university's efforts to meet the needs
17 of partners will contribute to improving the image of the university at the
18 global level.

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20 7. Service providers, including IT developers, suppliers of scientific and
21 laboratory equipment, office equipment; marketers; international centers and
22 consulting companies.

23 8. Local communities with which contacts are maintained, providing
24 support in the places of activity; loyalty and support of local authorities;
25 favorable attitude; cooperation.

26 9. Government bodies.

27
28 The activities of the university include measures to establish dialogue and
29 long-term cooperation with stakeholders. A stakeholder map is drawn up
30 taking into account risks, ranking them according to dependence (direct or
31 indirect), obligations, situation (with special attention to areas of high risk),
32 influence, different (diverse) perspectives. Methods of interaction with
33 stakeholders include the following forms, regulated by AA 2011 Stakeholder
34 Engagement Standard 2011.

35 As a result, a risk portfolio was compiled, including risks for each
36 stakeholder:

- 37
38 - Strategic risks arising at the level of making strategic decisions and
39 having a direct impact on the development of the university's
40 internationalization potential.
41 - Legal risks arising at the level of compliance with the norms and
42 requirements of the main documents regulating the activities of the
43 university.
44 - Operational risks arising in the course of daily operational activities
45 related to the implementation of the development plan of the
46 university.

- 1 - Academic risks arising in the course of educational activities.
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4 **Conclusion**

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6 The developed algorithm of step-by-step implementation of the
7 internationalization capacity building framework of the educational process in
8 a technical university, taking into account potential risks, is aimed at the
9 effective implementation of the internationalization capacity building
10 framework of a technical university. As a result of the conducted research, in
11 order to analyze the effectiveness of the implementation of the proposed
12 framework, mechanisms of interaction of subjects of the educational process
13 were developed on the basis of the information system of learning
14 internationalization, a correlation matrix was designed with the correlation of
15 the framework principles, the proposed approaches and the identified
16 recommendations. Determining the types of educational process subjects
17 interaction on the basis of the learning internationalization digital system
18 allows you to establish the relationship between internal and external subjects.
19 The next stage is the compilation of the primary matrix for the correlation of
20 the model categories, the proposed approaches and the identified
21 recommendations. Based on the revealed correlations, the intensity heat map of
22 the implementation of the principles is designed within the framework for
23 internationalization capacity building of the technical university. As part of the
24 intensity diagrams analysis of the processes of implementing the framework,
25 based on the calculation of intensity coefficients, the field of intensity increase
26 was determined, categories with low intensity were identified. To this end,
27 additional activities have been developed in the categories of Student
28 Participation, Collaboration & Partnership, Curriculum Initiatives, Research
29 Exchange and Administrative & Institutional Commitment, which made it
30 possible to design a Heat Map of increased intensity with an average threshold
31 of more than 60% for all categories of internationalization.

32 In turn, the formation of a risk portfolio based on a map of stakeholders
33 allows the most efficient implementation of the proposed activities, taking into
34 account the measures for prompt response to risks and compliance with
35 measures to prevent the occurrence of risks.
36

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