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Collaborative research culture from the perspective of higher technological education in Ecuador

La cultura investigativa colaborativa desde la perspectiva de la formación superior tecnológica en el ecuador

厄瓜多尔高技术培训视角下的合作研究文化

Культура совместных исследований с точки зрения высшего технологического образования в Эквадоре

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Abstract

At the Admiral Illingworth Higher Technological Institute (AITEC), technological higher education in student training has insufficient understanding of collaborative research culture, insufficient methodological resources, weak research institutions in training processes, and limited responses to the needs of the environment due to the failure to use the student potential to produce knowledge. Therefore, it is proposed to design a heuristic model for the development of collaborative research culture through the diagnosis of the state of research that allows feedback to a consequent response to the needs of the environment with actions that promote participation in projects, the identification of problems, possible solutions and their transfer.

The heuristic model is developed through the Governance Cube that articulates the current state with the strategic deployment for the improvement of that state, whose application demonstrates in the first phase an institutionality of collaborative research that begins to manifest itself due to the behavior of the influential factors of the resource endowment dimension, although, the second phase demonstrates the improvement in resource endowment due to the feasibility of inclusion. Thus, the heuristic model is viable for its dimensions as an effective tool for diagnosis and feedback of the state of research, also encourages participation in research of the higher education institution's own identity in the contribution to the problems of the globalized world.

Keywords: collaborative research culture, technological community, educational technology.

Resumen

En la comunidad tecnológica ecuatoriana, específicamente en el Instituto Superior Tecnológico Almirante Illingworth (AITEC), se aprecia insuficiente comprensión de cultura investigativa colaborativa en la formación de los estudiantes de la enseñanza superior tecnológica, insuficientes recursos metodológicos, débil institucionalidad de la investigación en los procesos formativos, y limitadas respuestas a las necesidades del entorno por el desaprovechamiento del potencial estudiantil para producir conocimiento; para darle solución a esta situación problemática, se propone diseñar un modelo heurístico orientado al desarrollo de la cultura investigativa colaborativa en la formación de los estudiantes mediante el diagnóstico del estado de la investigación que permita la retroalimentación conducentes a acciones que impulsen la participación en proyectos, la identificación de la problematización, posibles soluciones y su transferencia como respuesta a las necesidades del entorno. El modelo heurístico se desarrolla a través del Cubo de Gobernabilidad que articula el estado actual con el despliegue estratégico para la mejora de dicho estado. La aplicación del modelo demuestra en la primera fase, una incipiente institucionalidad de la investigación colaborativa, dada fundamentalmente por el comportamiento de los factores influyentes de la dimensión dotación de recursos, mientras que, en la segunda fase, se demuestra la factibilidad de la inclusión para su contribución a la mejora de la dotación de recursos. Se concluye que el modelo heurístico, es viable en sus dimensiones como una herramienta eficaz de diagnóstico y retroalimentación del estado de la investigación para el desarrollo de la cultura investigativa colaborativa, en el contexto de una institución de educación superior, pues auspicia la participación en Investigación desde la propia identidad en la contribución a los problemas del mundo globalizado.

Palabras clave: Cultura Investigativa Colaborativa, Comunidad Tecnológica, Tecnología Educativa.

摘要

在厄瓜多尔的技术界，特别是在Almirante Illingworth高级技术学院（AITEC）中我们发现在高等技术教育学生进行培训时对协作研究文化理解的不足，方法资源不足，在培训过程中研究制度化薄弱，并且由于没有对学生创造知识潜力充分利用而导致其缺乏对环境需求的反应；为了解决这个问题，我们建议设计一种启发式模型来以在学生教育上发展合作研究文化，通过对研究状态进行诊断来反馈可以促进项目参与，识别问题，可能性解决方案及其根据环境需求的转移的行动。启发式模型是通过治理多维数据集开发的，该多维数据集阐明了当前状态，并通过战略部署来改善该状态。该模型的应用在第一阶段显示了协作研究的初期制度性，与受资源维度因素影响的行为紧密相关，而在第二阶段，则证明了资金增加的贡献的可行性。结论是，在高等教育机构的背景下，启发式模型可以作为一种对研究状态进行有效诊断和反馈的工具，促进合作研究文化的发展。

关键词: 合作研究文化, 技术界, 教育技术。

Аннотация

В технологическом сообществе Эквадора, в частности в Высшем техническом институте Адмирала Иллингворта (AITEC), наблюдается недостаточное понимание культуры совместных исследований при подготовке студентов технологических вузов, недостаток методологических ресурсов, слабая институционализация исследований в учебных процессах и ограниченные ответы на потребности среды за счет растраты студенческого потенциала для производства знаний; Для решения этой проблемной ситуации предлагается разработать эвристическую модель, ориентированную на развитие культуры совместного исследования в процессе обучения студентов посредством диагностики состояния исследования, которая позволяет обратную связь, ведущую к действиям, побуждающим к участию в проектах, идентификации проблематизации, возможных решений и ее переноса как ответа на потребности среды. Эвристическая модель разрабатывается с помощью Куба Управления, который формулирует текущее состояние со стратегическим развертыванием для улучшения этого состояния. Применение модели демонстрирует на первом этапе зарождающуюся институционализацию совместных исследований, основой которой является поведение влияющих факторов аспекта ресурсного обеспечения, а на втором этапе демонстрируется целесообразность включения, поскольку это способствует улучшению ресурсного обеспечения. Сделан вывод, что эвристическая модель жизнеспособна в своих измерениях как эффективный инструмент диагностики и обратной связи состояния исследований для развития культуры совместных исследований в контексте высшего учебного заведения, поскольку она поощряет участие в исследованиях от собственной идентичности во вкладе в решение проблем глобализированного мира.

Ключевые слова: Культура совместных исследований, технологическое сообщество, образовательные технологии.

Introduction

The Higher Technological Education has been characterized by a great diversity of criteria, purposes and foundations not only between different countries, but also within each one; based on the relationship between a country's knowledge and economic development due to the ability to produce high value-added goods and services (Alvarez Flores et al., 2006). According to a research conducted by (Cea et al., 2018) and others, globally the characteristics of Higher Technology Education are diverse, Aus-

tralia has a system with high coordination between the needs of the labor market with the training that guarantees its incursion while the United States has technical training in Community College, each state of the union has its own characteristics in technical training therefore they represent barriers to transfer effective system.

Furthermore, companies in Switzerland and Germany are organized by category and propose specialties with the purpose of providing dual training quotas, in which learning agreements are signed, information is published on platforms thus generates high levels of youth employment, relevant skills and reduces costs to the state. In Singapore, there are few institutions of this type of training, they have high technological levels, oriented to technological technical training that forms highly specialized human capital; These experiences raise pertinent elements on higher technical education for research and access to information as a critical issue that impacts the quality and visibility of the system. (Tolozano Benites et al., 2014). In addition, consider the case of the history of technological development in Japan, in which learning stages were established for the society, then to another of continuous innovations, and to enter the field of originality later (Zalduendo, 1994).

The aforementioned allow us to identify that the divergences of modes of action with respect to technological training are within the context of each country; and that the coincidence lies in the close relationship that exists between open knowledge, research and the economic and social development of the country; therefore, its implementation will depend to a great extent on the public policy of the technological training that is offered.

Higher technological training in Ecuador has had a pilgrimage of changes through history; the most recent change is Article 14 of the Regulation of the Academic Regime of the Council of Higher Education (CES, 2019), that organizes two (2) levels of academic training, the third level, which corresponds to technical, technological and undergraduate training, and the fourth or postgraduate level; these bring about to the generation of a change in content and significance due to the fact that the previous regulations focused on *"the development of basic operations, the application of specialized techniques and the execution of functions related to labor contexts related to specific trades of units of Production of goods and services"* (CES, 2010); However, the current focus is on *"the application, coordination and adaptation of specialized techniques and the design, execution and evaluation of functions and processes related to the production of goods and services";* this represents a transformation of the technological students to the results of learning and graduation profile.

The challenge facing the Almirante Illingworth Higher Technological Institute, AITEC, is to satisfy the guidelines of public policy related to the training process developed at the higher level. Consequently, the cultural transformation of research and access to information is required, which allows the generation of goods and services by technological students to respond to the needs and problems of the environment, as a result of learning and the graduation profile so that the demands and requirements of the higher education system are met and particularly with the objectives of the economic and social development of the country.

Therefore, the analysis and understanding of what is linked to the research culture in the bibliography consulted is considered a relevant aspect of institutional policy, which is based on three pillars: Cultural Heritage, Cultural Identity, and Local Development; (UNESCO, 2012). The pillar of Cultural Heritage refers to a set of all material or non-material goods considered of relevant interest for the permanence of the identity and cul-

ture of a people. The pillar of Cultural Identity considers all those elements that allow to identify, characterize, and show the similarity and the difference between peoples. And the pillar of Local Development is based on a model of participatory democracy of concerted agents and subjects articulated in a common project whose purpose is to raise the quality of individual and collective life and therefore improve and satisfy the needs detected.

In this sense, the investigative culture is expressed as a set of norms and practices that make the difference in its development potentialities of a higher education institution, it supports the participation from the own identity in the contribution to the problems of the globalized world. In addition, it means providing teachers and students with suitable instruments to promote values, understand, take charge and transform the environment where they live (Tamayo & Tamayo, 2012).

Equally, the potentialities of collaborative research are highlighted because they determine the saving of time and money of a considerable amount, given by access to experienced collaborators, external and internal financial and material resources. (National Healthcare Group, 2013). In fact, the potentialities specify the nuclei of collaborative research that are the research groups which do not remove the scientific communities that play an essential role in the management of the epistemic quality of science (Wilholt, 2011).

In the situational analysis of the Instituto Superior technological Almirante Illingworth (AITEC), contained in the Improvement Plan 2019, what refers to the weaknesses of the research indicates the scarce student participation in the research assistantships, as well as that the scientific production by teachers and students still does not reach the required level, which results in a little understanding regarding the collaborative research culture in the training of students of technological higher education, together with the scarce methodological resources, the weak institutional framework of research in the formative processes of research that leads to limited responses to the needs of the environment due to neglecting the student potential to produce knowledge. As a solution, it is proposed the fulfillment of the objective that corresponds to designing a heuristic model oriented to the development of collaborative research culture in the training of students through a diagnosis of the current situation that allows feedback from the institutional planning system.

Methodology

The study of various models linked to research culture (Tolozano Benites et al., 2014) recognizes the deficiency of a collaborative approach, that contribute to the training of students from the professional as well as the inquiry, analysis and production of knowledge as a resource for the development of the life project. For this reason, a heuristic model is proposed that characterizes, symbolizes and represents the fundamental relationships for the institutionalization of collaborative research culture in students of Technological Institutes in Ecuador.

Especially, AITEC has a Research and Innovation System (González et al., 2020) which develops an open, evolutionary and complex system that is differentiated by collaborative relationships that involve learning processes based on science and experience so to achieve in the higher technological training of the student, the development of design competencies , execution and evaluation of functions and processes related to the production of goods and services.

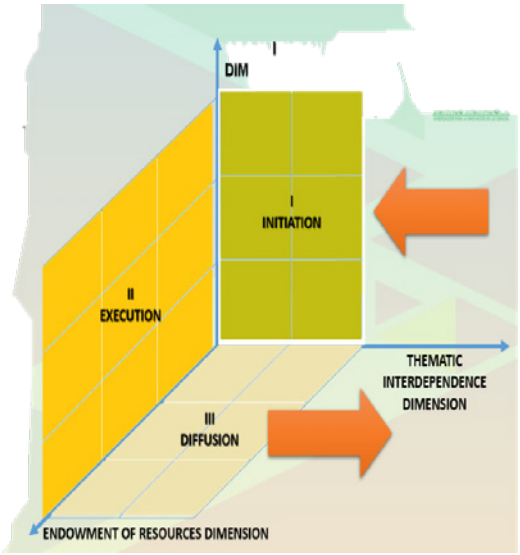
In this sense, the process of higher technological training occurs through the execution of academic programs or careers offered by the institution, which are presented based on the demand for tensions, problems and situations of the local reality that it hopes to solve. The approval by the control agents leads to the development of knowledge and investigative skills aimed at scientific innovation through the mastery of exploratory investigative techniques tied to the creation, adaptation and technological innovation, it is developed in the teacher-student interaction through of all career. The transversal axis is carried out for the transmission and production of knowledge in learning contexts, opening the way to the development of collaborative research culture by students along with the innovation of the pedagogical practice of teachers.

From this outlook, the demand for institutional transformations requires a tool that converts the organization's strategy into operational objectives in order to enhance the achievement of results. (Neely et al., 2001). For Instituto Superior technological Almirante Illingworth, the tool is the heuristic model that is developed through the cube of governance allowing to articulate the current state with the strategic deployment to improve that state. It is instrumentalized through the collaborative research governance cube, proposed by (Heinze & Kuhlmann, 2008) which is structured in three dimensions: (1) thematic interdependence, (2) organizational and (3) resource allocation, as shown in figure 1.

The dimension of thematic interdependence linked to research progressively contributes to the multi, inter and transdisciplinary work of the training processes of institutional scope. The organizational dimension refers to the structural aspects of the research system that organize the higher technological institutions that define the style of operation for collaboration. Finally, the dimension of endowment of resources is useful to designate the human, material, financial and knowledge contributions with access for teachers and students in collaborative research.

Figure 1

The cube for diagnosis and feedback



Within each dimension, shown in figure 1, the key success factors linked to the key outcome areas are formed, so that they integrate the efforts and results of the different substantive functions (González González et al., 2018) for the effect, the four key outcome areas are:

1. Collaborative Spaces for research,
2. Research project,
3. Spread of research and
4. Knowledge transfer.

Respectively, each of the key result areas has key success factors which are weighted in order to determine to some degree the status or progress of the collaborative research culture in the higher educational institution. Thus, it is important to determine the criteria on which the relationships between the key success factors of the dimensions are evaluated qualitatively in intervals ranging from inappropriate to very appropriate, which are expressed on a Likert scale from 1 to 5, described as follows:

(5) Very appropriate, the optimal value for AITEC is considered, in which the essential requirements for determining the influence being evaluated are expressed.

(4) Quite appropriate, it is considered to express in almost all its generality the essential qualities being evaluated, being able to represent with a fairly high degree the fundamental requirements which typify its influence.

(3) Appropriate, it is considered that the mark takes into account an important part of the qualities to be evaluated, which express elements of value with a certain level of influence, although it can be improved in less significant situations.

(2) Inappropriate is considered to expresses a low level of adequacy in relation to the desired state which is assessed by expressing deficiencies in certain components considered essential to determine their influence.

(1) Inappropriate is considered that expresses marked limitations and contradictions that do not allow it to adapt to the essential qualities that determine the quality of the object being evaluated for what is not proceeding.

The model design is based on the influence caused by the relationship of the key success factors between two dimensions of the governance cube. Each factor can reach a value between 1 and 5; Therefore, the cell configured by the relation with the other factor will be multiplicative and may reach an amount equal to but not greater than 25. Then, the intervention of both will be measured from a coefficient that expresses the real with respect to the desired. Correspondingly, these results from each cell facilitate a diagnosis of collaborative research in the institution.

The articulation of the dimensions of the governance cube and the key success factors, configure a set of cells, which makes it possible to structure three stages through a dynamic and procedural process, called initiation, execution, and dissemination; these are not rigid, they can vary according to the needs, behaviors, scope and volume of the technological community, as shown in Figure 1. The influence of the stage is measured by the multiplicative ratio of the coefficients of each cell of the quadrant under study. The closer it is to its maximum value, 1, the greater the influence of the success factors.

The first quadrant of the governance cube is the initiation given by the relationship between the thematic interdependence dimension with the organizational dimension that motivates collaborative research spaces through actions leading to shared work by teachers and students. Therefore, communication and information exchange, data sharing, brainstorming and spontaneous interaction in different environments are facilitated. The first stage is characterized by the dynamism and flexibility of the collaborative spaces in which the actions that are carried out imply the individual commitment that with the changes that are expected to be obtained in their involvement with the research topics, they intend to sensitize all the participants from of the demands of the environment. In addition, this stage aims to familiarize the student with the investigative work in collaborative relationships within the classroom, leaving their comfort zone towards institutional and inter-institutional relations with open approaches to inclusion and diversity based on the principles of collaboration.

The execution is configured by the second quadrant of the cube of governance through the organizational dimension with the provision of resources in which is formalized through research projects the process of search, collection, creation, and systematic analysis of a set of data and background involving the use and application of organized human talent, research seedbeds, ensuring student participation (Quintero Corzo et al., 2008) using technical, technological and material resources in order to achieve scientific results. This stage applies what was learned in the previous stage, involves the interaction of collaborative spaces effectively where changes of direction are made and are executed towards the execution of their own research projects. This stage is dynamic even so it responds to the connotations, monitoring and results expressed in the institution in accordance with the established norms.

Finally, the third quadrant of the governance cube is formed by the third stage of dissemination in which the allocation of resources is related to the thematic interdependence dimension. It refers to the output documents expressed in technical and scientific publications generated from the results of the research work, with scientific production being the result of the research disseminated through publications: Books, book chapters and technical brochures, book chapters, technical brochures, published articles, lectures, as results of human, material, financial and knowledge contributions that have access to teachers and students for collaborative research.

The heuristic model is the bedrock of the proposed design for decision-making based on a diagnosis and feedback on the state of collaborative research in a continuous and dynamic way. However, its operation is in the synchronization of the components of the model in stages. In fact, to make decisions about the reliability of a stage, a coefficient that meets the necessary assumptions must be considered, since not doing so can lead to erroneous conclusions and significantly affect the development of the research model.

Analysis and results

The components of the heuristic model for decision-making are the dimensions and key success factors. The latter are grouped into domains and associated with key outcome areas, particular aspect, given the context in which creativity, adaptability and divergent thinking must be expressed, according to psychologist (Pratkanis, 2011). In this context, through strategic work teams, a qualitative assessment is made for the assignment of key success factors to the corresponding dimension of the model (Bukvova, 2010).

The first key outcome area is called collaborative research spaces (García-Valcárcel et al., 2018) and (Dumrauf et al., 2009), corresponding to group work spaces in which teachers and students with a profile according to the academic domain coexist, managing to facilitate communication and information exchange, data sharing, brainstorming and spontaneous interaction in different environments. The group work spaces show the different areas of collaborative research which are: internal, institutional and inter-institutional. Therefore, the coincidence of criteria establishes the existence of a direct relationship between the areas and dimensions for the assignment of critical success factors, detailed below in Table 1.

Table 1

Assignment of the factors of the area collaborative spaces of research to the dimensions of the governance cube

Collaborative Spaces	Key Success Factors	Dimensions		
Fields		Thematic interdependence	Organizational	Endowment of resources
Internal research collaboration	Approach to scientific research methodology as a transversal knowledge discipline	X		
	Report on integration projects knowledge	X		
	The experimental learning component of vocational subjects	X		
	The report on the work of curricular integration	X		
Institutional research collaboration	Research assistantship		X	
	Research seed		X	
	Research groups		X	
	Student scientific conferences		X	
	Training in research		X	
Interinstitutional research collaboration	Involvement in national and international events			X
	Involvement in research networks			X

Note. It establishes the existence of a direct relationship between the scopes and dimensions for the assignment of the critical success factors.

The second key outcome area is the research project (Abello Llanos & Pardo Sánchez, 2014; OECD, 2018), comprising the systematic search, collection, creation, and analysis of a set of data and background involving the use and application of human talent organized into research assistants, research seed companies, and research groups, employing technical, technological, and material resources so as to generate a large part of the ideas that will subsequently be applied to the development of new products and services, scientific results from the performance of a set of actions and activities. Likewise, the work team agrees with the assignment of the critical success factors to the dimensions according to their scope, as reflected in Table 2.

Table 2

Assignment of the factors of the research projects area to the dimensions of the governance cube

Research projects	Key Success Factors	Dimensions		
Fields		Thematic interdependence	Organizational	Endowment of resources
Planning	Solicitation for projects	X		
Implementation	Project monitoring		X	
Results	The impacts of the results			X

Note. It establishes the existence of a direct relationship between the scopes and dimensions for the assignment of the critical success factors.

The third key outcome area is the dissemination of research (CACES, 2020), which describes research output documents manifested in technical and scientific publications produced through the results of the research work, thereby multiplying the visibility, which open rifts for new investigative processes based on what has been published. The third area is managed by the following key success factors, particularly there is a unique area, the coincidence of criteria in the assessment focuses on the allocation to the resource dimension, as shown in Table 3.

Table 3

Assignment of area factors dissemination of research results to the dimensions of the governance cube

Dissemination of research results	Key Success Factors	Dimensions		
Fields		Thematic interdependence	Organizational	Endowment of resources
Scientific production	Books and book chapters			X
	Article			X
	Papers			X

Note. It establishes the existence of a direct relationship between the scopes and dimensions for the assignment of the critical success factors.

The fourth and final key output area is knowledge transfer (OMPI, 2020) and innovation (OECD, 2006), which covers several fields of research, including the social sciences, as well as less formal transfer mechanisms. However, existing facilities or limitations may inhibit its development by making it a provider of human resources rather than a provider of knowledge (Trigo & Elverdin, 2019). This area manifests an ordinal way for the Transfer of Knowledge and Innovation through two levels: Institutional and inter-institutional generalization. Accordingly, the members of the working group coincide in assigning a key factor for each dimension that expresses the interface of said activity with the research itself, as detailed in Table 4:

Table 4

Assignment of the factors of the knowledge transfer and innovation area to the dimensions of the governance cube

Knowledge transfer and innovation	Key Success Factors	Dimensions		
Fields		Thematic interdependence	Organizational	Endowment of resources
Institutional	Centre for management of scientific and technical information		X	
Interinstitutional generalization	Community service projects	X		
	Observatories			X

Note. It establishes the existence of a direct relationship between the scopes and dimensions for the assignment of the critical success factors.

The methodology of the heuristic model for decision making is adjusted to the context of each higher education institution, therefore the diagnosis and feedback of the state of collaborative research will be appropriate; However, its application contributes significantly to the articulation of the three substantive functions of technological education and makes it possible to know about those actions that should be enhanced or reinforced, of which there is not enough information.

The heuristic model application for decision making was carried out in AITEC, which has institutionally academic domains and/or research lines and the educational pedagogical model of the institute that focuses on the student, as the basis of the model. It developed through the deployment of the three planned stages of initiation, implementation, and finally dissemination; where the coefficient of each cell was calculated from the weighting of key factors, the assigned values correspond to the data provided by the institutional planning system.

In the stage I initiation, the cube quadrant depends on the relationship between the key success factors of the thematic interdependence dimension and the organizational dimension, in which the given score is observed, the result of which is the coefficient, the same that establishes the level of the least and most influential, as can be seen in Table 5. At this stage, the cells with the greatest influence correspond to the relationship between Research training and community service projects, in addition, the cell between the Center for the Management of Technical Scientific Information

and community service; while the cell with the least influence refers to the Scientific Research Methodology Approach, as a transversal knowledge discipline in relation to the research assistantships and Research Seedbeds respectively.

Table 5

The coefficients of the initiation stage

Thematic interdependence dimension	Organizational dimension						
Key Success Factors	Research assistantship	Research seed	Research groups	Student scientific conferences	Training in research	Project monitoring	Centre for management of scientific and technical information
Approach to scientific research methodology as a transversal knowledge discipline	.120	.120	.480	.360	.600	.480	.600
Knowledge Integration Projects Report	.160	.160	.640	.480	.800	.640	.800
Experimental learning component of vocational subjects	.160	.160	.640	.480	.800	.640	.800
Report of the curricular integration work	.160	.160	.640	.480	.800	.640	.800
Solicitation for projects	.160	.160	.640	.480	.800	.640	.800
Community service projects	.200	.200	.800	.600	1.000	.800	1.000

Note. The result is the coefficient, the same that establishes the level of the least and most influence.

The stage II of the execution corresponds to the quadrant of the cube depends on the relationship between the key success factors of the organizational dimension and the dimension of resource endowment, in which the given score is observed, the result of which is the coefficient, the same that establishes the level of the least and most influential, as can be seen in table 6. At this stage the most influential cells correspond to the relationship between research training and participation in research networks and presentations respectively; in addition, the cell between the center for manage-

ment of scientific and technical information with participation in research networks and presentations respectively, while the least influential cells refer to the relationship between research assistantship with books and book chapters and observatories respectively, as well as the cells in which research seedbeds are related to books and book chapters and observatories respectively.

Table 6

The coefficients of the execution stage

Endowment of resources dimension	Organizational dimension						
Key Success Factors	Research assistantship	Research seed	Research groups	Student scientific conferences	Training in research	Project monitoring	Centre for management of scientific and technical information
Involvement in national and international events	.160	.160	.640	.480	.800	.640	.800
Involvement in research networks	.200	.200	.800	.600	1.000	.800	1.000
Books and book chapters	.120	.120	.480	.360	.600	.480	.600
Article	.160	.160	.640	.480	.800	.640	.800
Papers	.200	.200	.800	.600	1.000	.800	1.000
Observatories	.080	.080	.320	.240	.400	.320	.400

Note. The result is the coefficient, the same that establishes the level of the least and most influence.

The stage III of diffusion corresponds to the quadrant of the cube depends on the relationship between the key success factors of the resource endowment dimension and thematic interdependence dimension, in which the given score is observed, the result of which is the coefficient, the same that establishes the level of the least and most influential, as can be seen in table 7. In this stage, the most influential cells correspond to the relationship between the participation in research networks with community service projects, as well as the cell between presentations and community service projects, while the less influential cells refer to the relationship between scientific research methodology approach, as a transversal knowledge discipline and observatories respectively.

Table 7

The coefficients of the diffusion stage

Thematic interdependence dimension	Endowment of resources dimension					
Key Success Factors	Involvement in national and international events	Involvement in research networks	Books and book chapters	Article	Papers	Observatories
Approach to scientific research methodology as a transversal knowledge discipline	.480	.600	.360	.480	.600	.01
Knowledge Integration Projects Report	.640	.800	.480	.640	.800	.04
Experimental learning component of vocational subjects	.640	.800	.480	.640	.800	.04
Report of the curricular integration work	.640	.800	.480	.640	.800	.04
Solicitation for projects	.640	.800	.480	.640	.800	.04
Community service projects	.800	1.000	.600	.800	1.000	.15

Note. The result is the coefficient, the same that establishes the level of the least and most influence.

With the coefficients of each cell of the determined heuristic model stages, the state of the cell with the greatest and least influence is reflected respectively, as well as those that are in the intermediate process. The result provides a diagnosis of the state of collaborative research and the feedback that serves to support preventive and/or corrective actions in favor of the planning system of the Almirante Illingworth Higher Technological Institute (AITEC).

Discussion and conclusions

From the point of view of higher technological training, the development of collaborative research culture must be based on the set of material and immaterial distinctive features that characterize the Ecuadorian higher education institution, such as respect for creativity, adaptability and thought. divergent that institutionalizes and singles out the proposed model, without leaving out the contributions of others that tend to emphasize the globalization and standardization of processes.

Once the study and the applicability of the proposed heuristic model for decision making is completed, the necessary and sufficient information is obtained to allow the following conclusions to be reached:

- • The model through cube of governance is viable in its dimensions as an effective tool for diagnosis and feedback of the state of research for the development of collaborative research culture in the context of a higher education institution.
- • The configuration of the model by key areas of results, areas, as well as key success factors and their relationship with the dimensions express creativity, adaptability and divergent thinking through strategic work teams that institutionalizes and singularizes the articulation of substantive functions from the perspectives of collaborative research.
- • In the application of the model, the weighted data to the key success factors correspond to the scope of the institutional planning system, as the foundation for collaborative research feedback.
- • The applied model develops the collaborative research culture in the education of students, which encourages participation in research from their own identity in contributing to the problems of the globalized world.

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