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# Perception of agro-industrial engineering students on global innovation indices

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## Abstract

The objective was to evaluate the level of conceptual perception of higher education students regarding the Global Innovation Indices. The sample consisted of 77 agro-industrial engineering students from UNIA, divided into three groups: Group I, students of Cycle III; Group II, Cycle VI; and Group III, Cycles VII and X, which were selected through intentional non-probabilistic sampling. The Kruskal-Wallis non-parametric test was conducted, which showed the non-significance of the differences between groups and within each group. 57.4% of students presented a perception of the values that they do not understand and do not give importance to the Global Innovation Indices, compared to 42.7% who indicated that they do understand and give importance to it. No significant statistical difference was demonstrated between the groups and within each reference group at the levels of perception of the Global Innovation Indices.

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## 1. Introduction

Innovation implies a change procedure [1]. This means products and services available to users. OECD and Eurostat [2] define innovation in this way "a new or improved product or process (or a combination of both) that differs significantly from the previous products or processes of the unit and that has been made available to potential users (product) or put into use by the unit (process)" this precision is standardized globally and is the basis for establishing innovation indicators [3].

Innovation has a very broad conceptual spectrum and significance that can refer, among other dimensions: organizational innovation, for example: modernizing quality management, updating administrative management, etc. [4-8] technological

innovation which requires technology to innovate the product or process [1, 3, 9-14] innovation in marketing reduces the loss of a new product in the market [15, 16] the social innovation that has do with the standard of living, social insertion, adhesion, the educational level of a community, etc. [17-21] therefore, innovation is not only developed in science and technology (R&D) but also in other areas such as organizational innovation, marketing innovation, social innovation, unquantified innovations, etc., thus recognizing the role of innovation for society [22].

The good effectiveness of an innovation is related to its management [5, 10] it also brings economic growth and well-being of the communities [23].

In this sense, a series of indicators have been developed as tools for evaluating the progress of conditions and processes of innovation in different degrees, from the total to the particular, including institutional. For example, Cornell University INSEAD [24] as well as OMPI [25] present the so-called "Global Innovation Indices", which involve the innovation variable or component in institutions as an instrument to assess the state of development of the Nations, in innovative terms.

On the other hand, Peru is one of the countries that intends to be part of the Organization for Economic Cooperation and Development (OECD). To be part of said organization, Peru must carry out and demonstrate compliance with conditions ranging from political, economic, educational to environmental, measurable through established indicators or indices [26].

In a national context, it is necessary to strengthen innovation in the National System of Science, Technology and Innovation [27] as well as improve capacities that contribute to achieving the country's competitiveness based, among other factors, in innovation, the quality of education, etc. [28].

For this, it has become necessary to "develop policies on competitiveness embodied in a National Competitiveness and Productivity Policy", which guide practices linked between the public and private sectors through a National Competitiveness and Productivity Plan. Precisely, within the framework of national competitiveness, the "development of capacities for innovation, adoption and transfer of technological improvements" are contained in priority objective 3 of the National Competitiveness and Productivity Plan [29].

Also, in a university context, it is important to know if the national policy on innovation is being considered in the development of innovation capacities given the role of the university system. Therefore, it is necessary to know the degree of knowledge of university students on these emerging issues, their importance in the development agenda of Research in Science and Technology of the university and also by the result that it could contribute in the development and would make it effective. of all the functions that correspond to the university, for the benefit of the quality and continuous improvement of the educational service that it offers.

Therefore, it is necessary to explore the perception of the student body of the Agroindustrial Engineering program in order to know, identify, and analyze the achievement of understanding of the components or variables of the Global Innovation Index, as well as its importance in academic development through the approach of the following question: What is the differentiated conceptual perception of the students of the School of Agroindustrial Engineering of the UNIA regarding the Global Innovation Indices?

## 2. Method

The perception of students from the Professional Academic School (EAP) of Agroindustrial Engineering (IAI) of the National Intercultural University of the Amazon (UNIA) on the factors or variables that constitute the Global Innovation Index was investigated. The type of research was non-experimental, cross-sectional descriptive. For the purpose of this experience, the perception of the assessment of content, concepts, thought, etc. is considered. about innovation. The evaluation of the perception of the students was grouped by levels: the percentage value of the low level plus the value of the medium level is expressed in a unique value called "does not understand and does not give importance to it, and the high and very high levels are expressed as "understands and considers it important"

The population consisted of 328 students from the Agroindustrial Engineering Program (IAI) enrolled in the 2023-II academic semester, according to the UNIA Academic Management System (SIGA) database. The sample comprised 77 students divided into three groups: Group I included students from Cycle III; Group II included students from Cycle VI; and the third group included students from Cycles VII and X. The students were selected using intentional non-probabilistic sampling.

The survey strategy was considered strange and a questionnaire designed and based on the conceptual framework of the Global Innovation Indices of 2019 [25] was administered, whose articles were subjected to the Cronbach's Alpha test, resulting in a high reliability of 0.98. The application of the instrument was carried out in September 2021 remotely (in consideration of the health emergency and related provisions established by the government), for which the instrument was prepared using the "form" tool of the Google system. The data was transferred via MS Excel 2016 to the SPSS v.24.0 Software for processing and non-parametric statistical analysis. Finally, to determine the existence of significance between the groups and within the group, in terms of their differentiated conceptual perception; that is, their assessment of content or of the variables, the data were processed with the Kruskal Wallis non-parametric test statistic for independent samples.

## 3. Results

For the analysis of results, the recategorization or grouping and the arithmetic sum of percentage values of the respective levels of perception will be desired; that is, the percentage value of the low level plus the value of the medium level is expressed in a unique value called "does not understand and does not give importance to it, and the high and very high levels are expressed as "understands and gives importance to it". Look at: Table 1 and Table 2.

**Table 1.**

Perception levels of agroindustrial engineering students on global innovation indices.

| Levels | Institutional environment (%) | Human capital and research (%) | Infrastructure (%) | Market sophistication (%) | Business sophistication (%) | Knowledge and technology outlets (%) | Creativity outlets (%) |
|---|---|---|---|---|---|---|---|
| Low | 35.1 | 39.0 | 5.2 | 40.3 | 39.0 | 39.0 | 3.9 |
| Half | 16.9 | 19.5 | 44.2 | 26.0 | 22.1 | 26.0 | 45.5 |
| High | 24.7 | 27.3 | 29.9 | 23.4 | 27.3 | 19.5 | 33.8 |
| Very high | 23.4 | 14.3 | 20.8 | 10.4 | 11.7 | 15.6 | 16.9 |
| Total: | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |

**Table 2.**
Recategorization of levels of perception of Agroindustrial Engineering students on Global Innovation Indices.

| Recategorized levels | Institutional environment (%) | Human capital and research (%) | Infrastructure (%) | Market sophistication (%) | Business sophistication (%) | Knowledge and technology outlets (%) | Creativity outlets (%) |
|---|---|---|---|---|---|---|---|
| Low-Medium (Does not understand and does not care) | 52 | 58.5 | 49.4 | 66.3 | 61.1 | 65 | 49.4 |
| High-Very High (Understands and attaches importance) | 48 | 41.6 | 50.7 | 33.8 | 39 | 35.1 | 50.7 |
| Total: | 100 | 100 | 100 | 100 | 100 | 100 | 100 |

Note. Conceptual analogy in levels: Low-Medium (Does not understand and does not care); High -Very High (They understand and give importance to it).

The 66.3% of the students surveyed do not understand and do not give importance to the variable "market sophistication". Both the "infrastructure" variable and the "products of creativity" present equal percentage values for both "does not understand and does not care" (LOW-MEDIUM) and for their corresponding levels "understands and cares". 65% of the students "Do not understand and do not give importance (LOW-MEDIUM)" to the variable "knowledge and technology products" and 35.1% understand it and give it importance. 52% "Do not understand and do not give importance" to the institutional environment as a variable of innovation rates and 48% do understand it and give it importance. Finally, 58.5% "do not understand and do not give importance" to "Human capital and research" as a variable of innovation rates and 41.6% do understand it and give it importance.

**Table 3.**
Test statistics [a,b]

| | Institutional environment (%) | Human capital and research (%) | Infrastructure (%) | Market sophistication (%) | Business sophistication (%) | Knowledge and technology outlets (%) | Creativity outlets (%) |
|---|---|---|---|---|---|---|---|
| H de Kruskal-Wallis | 5.084 | 0.659 | 1.650 | 2.744 | 4.030 | 4.141 | 3.258 |
| gl | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| Sig. asymptotic | 0.079 | 0.719 | 0.438 | 0.254 | 0.133 | 0.126 | 0.196 |

a. Kruskal-Wallis test.
b. Grouping variable: GROUPS.

Regarding its importance and understanding to the institutional environment related to: the environment policy, regularization and business, the level of perception of the students was: low with 35.1%, medium with 16.9%, high with 24, 7% and very high with 23.4%. Table 1. It was also observed that there is no dissimilarity between the groups since $p = 0.079$ is greater than $\alpha = 0.05$. Table 3. The median difference between Group I and Groups II and III is 1.0. Symmetry is also observed in group II and not in groups I and III. Figure 2.

Concerning its importance and understanding in relation to the human capital that implies: basic education, postgraduate education and research and development, the level of perception of the students was: low with 39.0%, medium with 19.5%, high with 27.3% and very high with 14.3% Figure 1. It is observed, similarly, that there is no dissimilarity between the groups since $p = 0.719$ is greater than $\alpha = 0.05$. Table 3. The median difference between Group I and Groups II and III is 1.0. Likewise, symmetry is observed in group II and not in groups I and III. Figure 2.

In relation to its importance and understanding regarding the infrastructure that includes: ICTs, infrastructure in general and ecological sustainability, the level of perception of the students was: low with 5.2%, medium with 44.2%, high with 29 .9% and very high with 20.8% Figure 1. In the same way, it is shown that there is no difference between the groups since p = 0.438 is greater than α = 0.05. Table 3. The median difference between Group I and Groups II and III is 1.0. Likewise, symmetry is observed in group II and not in groups I and III. Figure 2.

With respect to its importance and understanding in relation to the sophistication of the market that considers: the credit system, investment and trade and competitiveness, the level of perception of the students was: low with 40.3%, medium with 26.0%, high with 23.4% and very high with 10.4%.

Figure 1. Likewise, it is verified that the groups do not differ since p = 0.254 is greater than α = 0.05. Table 3. The median difference between Group I and Groups II and III is 1.0. Likewise, symmetry is observed in group II and not in groups I and III. Figure 2.

Regarding its importance and understanding in relation to the sophistication of business that includes: workers with knowledge, innovation networks and knowledge incorporation, the level of perception of the students was: low with 39.0%, medium with 22, 1%, high with 27.3% and very high with 11.7%. Figure 1. It is also evident that the groups are not far apart, since p = 0.133 greater than α = 0.05. Table 3. The difference in medians between Groups I, II and III is 1.0. Likewise, symmetry is observed in group II and not in groups I and III. Figure 2.

In consideration of its importance and understanding regarding technological products and knowledge that is related to: knowledge creation, importance and dissemination of knowledge, the level of perception of the students was: low with 39.0%, medium with 26.0 %, high with 19.5% and very high with 15.6% Figure 1. It is also shown that the groups do not diverge from each other because p = 0.126 is greater than α = 0.05. Table 3. The median difference between Group I and Groups II and III is 1.0. Likewise, symmetry is observed in group II and not in groups I and III. Figure 2.

With respect to their importance and understanding of creativity related to intangible products or goods, creative goods or services and online creativity, the level of perception of the students was: low with 3.9%, medium with 45.5%, high with 33.8% and very high with 16.9%. Figure 1. It is also evident that there is no difference between the groups, since p = 0.196 greater than α = 0.05. Table 3. The median difference between Group I and Groups II and III is 1.0. Likewise, symmetry is observed in group II and not in groups I and III. Figure 2.

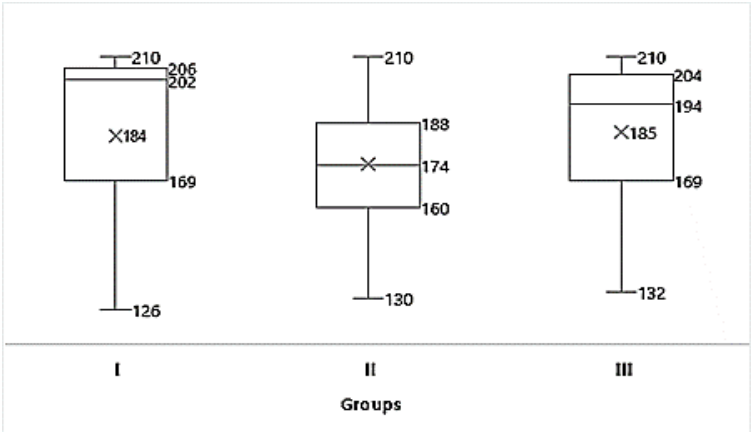


**Figure 1.**
Results of 3 attribute selection methods.

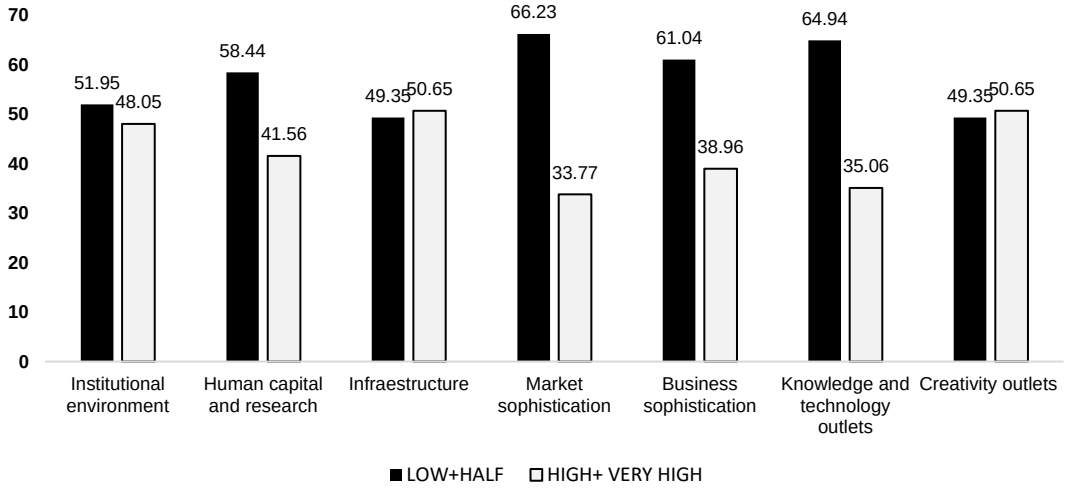


**Figure 2.**
Perception and importance of the innovation index.

The distribution of the weighting values regarding the perception of innovation indices is better observed in group II (students of cycles VI), than in Group I and III (students of cycles III, VII and X).

## 4. Discussion

The level and standard of quality of education, as well as the development of research in a country, are the main determinants of its capacity for innovation [30]. The level and standard of educational quality in our country is expressed in the Quality Assurance Policy of Higher University Education [31] and other policy and regulatory instruments. These aspects are implemented -with certain dynamics-, in the university system, through teaching-learning processes, research, university extension, etc. These functions are developed, based and oriented, within the framework of a student graduation profile that results, at the same time, from curricular development; Said academic work should not be assumed as static but dynamic, a character that is regulated by law "according to scientific and technological advances" [27]. On the other hand, it is assumed that, if such curricular dynamics are not carried out, according to scientific and technological advances, then a routine academic training could be presented. In this regard, according to Hölzl and Janger [32] the organizational routine can become a parapet for the development of innovation. In this case, in the university context, the "academic activity" not developed within the framework of Law 30220 is considered as "organizational routine". In this sense, knowing the perception of students about innovation rates would allow recognizing the need to include, more explicitly, the Innovation variable in the aforementioned processes. Said inclusion, in the relevant university spaces and with sufficient academic-scientific weighting, would facilitate the development of innovation capacities as stated [30]; In addition, it would imply innovation in the management of organizational processes [5] especially academic-scientists.

On the other hand, innovation has an important role in food security [33] the importance includes the generation of innovative services and products [3] consequently, in the formation of students of the Professional School of Agroindustrial Engineering of the UNIA, food safety is not only considered as an academic and research task, but also, due to the results obtained, it is observed that the subject of innovation must be incorporated to strengthen the graduation competences of students and also consolidate the institution in these issues given the substantial innovation for organizations [7] and contribute to the innovation and competitiveness of the country. Likewise, assuming that innovation guarantees the achievement of country objectives that are set out in Sustainable Development policies and, that in achieving them, universities have a determining role [30] mainly in higher education, it was proposed to find out the level of perception of its understanding and importance, by the students of the aforementioned Professional School, regarding the Global Innovation indices, which include the following variables : Institutional Environment, Human Capital and Research, Infrastructure, Market Sophistication, Business Sophistication, Knowledge and Technology Outputs and Creativity Outputs [34].

With respect to results, the institutional environment variable, 51.9% do not understand and do not attach importance to it and 48.1% understand and attach importance to it. Thus, we have that the perception of the students is similar since they do not present a significant difference. In relation to human capital, there are 58.5% who do not understand and do not give it importance and 41.6% understand it and give it importance. In this case, the student perception is also similar on the two aspects since they do not present a significant difference. In consideration of the infrastructure, 49.4% do not understand and do not give it importance and 50.7% understand it and give it importance. On this aspect, the perception of the students is also similar. Regarding the sophistication of the market, 66.3% do not understand and do not give it importance and 33.8% understand it and give it importance. However, the perception of the students is similar because there is no significant difference.

Due to the sophistication of business, 61.1% do not understand and do not give it importance and 39.0% understand it and give it importance. Similarly, in the business sophistication dimension, the students' perception does not present a significant difference. In relation to technological products and knowledge, 65.0% do not understand and do not care and 35.1% understand and care. Even so, the perception of the students does not present a significant difference. Regarding creativity, 49.4% do not understand and do not give importance to it and 50.7% understand it and give it importance. However, the perception of the students does not present a significant difference either.

Since innovation not only refers to technology but also includes services and organizational aspects [18] the proposal of this study was to assess the level of conceptual perception of students regarding the Global Innovation Indices made up of seven variables. or dimensions [34] raised in this study. In general terms, it is observed that the perception of students who do not understand and do not give importance on average was 57.4%, compared to 42.7% who understand and give importance to these innovation indices. However, the results did not show significant differences considering a general comparison of all the variables or dimensions of innovation carried out between groups and within each group. These results coincide with what was found by Vázquez-Parra, et al. [35] when studying the perception of complex knowledge of Mexican undergraduate university students.

These results would be due to several factors and conditions, among them the content of the Study Plan that is not making an impact on the knowledge and development of topics related to innovation, a curricular oversight of teachers who are not promoting the development of knowledge in Concordance with the new trends in science and technology [27] especially innovation regarding Agroindustries. This confirms that there is no statistically significant difference on the perception regarding the Global Innovation Indices, as observed in the results between groups I, II and III that correspond to the lower, intermediate and upper cycle, respectively. Contrasting with the Null Hypothesis; that is to say, that the students of superior cycles perceived better and therefore understood and gave importance to the raised dimensions; At the same time, it was expected that those in the intermediate cycle perceived better than those in the lower cycle.

However, it is shown that the assessment of the perception of the indices is similar in all students regardless of the cycles they attended, which is contradictory to the logic and achievement of competencies, abilities throughout the academic training

and their relevance. with the new currents of scientific and technological knowledge [36] the basis for achieving innovation, and could be considered as a barrier [32, 37] which should be addressed and overcome, especially with regard to knowledge. In this sense, it is observed that the university has to improve its policies, models, instruments, academic and research processes due to the results and the scientific and technical tendencies required, as stated [38, 39].

Therefore, the inclusion of the Innovation variable is justified and necessary, so that the university develops and maintains leadership in innovation [40]. This would consist of an instrumental inclusion such as in the educational model, the strategic direction, the curriculum of the career (in which the weighting in terms of credit would be considered, the enforceability, that is, the curricular obligatory nature, the level within the curricular system, thematic inclusion within the research lines of the program, etc.

## 5. Conclusions

Since it is shown that there is no statistically significant dissimilarity between the groups of students regarding the levels of perception, the Global Innovation Indices and the variables they comprise were perceived in a similar way both between the groups and within the same group. The assessment of the perception of the indices is similar in all students regardless of the cycles they completed, which is contradictory to the logic of achievement of competencies and abilities throughout the training. The distribution of the weighting values regarding the perception of innovation indices is better observed in Group II (students of cycles VI) than in Groups I and III (students of cycles III, VII, and X) due to its lowest interquartile interval value. The inclusion of the innovation variable in the academic function (the teaching-learning and research processes, mainly of the IAI program) and in the management of the UNIA is necessary.

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