

Impact of the Improvement Program on Innovation Management of an Academic Center

Impactos del Programa de Mejoras en la gestión de innovación de un Centro de Estudios

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ABSTRACT

Aim: to explain the evolution of indicators of innovation management at the Research Center for Exploitation, Manufacturing, and Recovery of Parts and Equipment, Faculty of Electromechanics, Ignacio Agramonte Loynaz University of Camagüey, Cuba, five years after progressive implementation of a program to strengthen its capacity for innovation, as part of previous research follow up.

Methods: logical-historical analysis, and analysis and synthesis.

Results: The results of measures implemented were positive in terms of science and innovation, which are critical for the research center, as ties with companies, publications, and attendance to conferences have increased, as well as greater visibility nationally.

Conclusions: the program is appropriate and pertinent, since the highest priority is given to R + D + i management, as the main driving force of other critical activities at the facility. On the other hand, the results are apparent in terms of number of researchers and improvements in basic laboratory conditions.

Key words: innovation; innovation factors; innovation management; knowledge management.

RESUMEN

Objetivo: exponer la evolución de indicadores de la gestión de innovación del Centro de Estudios de Explotación, Fabricación y Recuperación de Equipos y Piezas, perteneciente a la facultad de Electromecánica de la Universidad de Camagüey *Ignacio Agramonte Loynaz*, Cuba, a cinco años de que se comenzara la implementación gradual de un programa para fortalecer la capacidad de innovación de dicha área, que fue el resultado de una investigación a la cual se da seguimiento.

Métodos: análisis histórico lógico y el de análisis y síntesis.

Resultados: Los resultados de las medidas aplicadas fueron favorables en aspectos relativos a la ciencia y la innovación, medulares en la vida del centro de estudios, con el consiguiente incremento de la efectividad del trabajo con las empresas, las publicaciones y la participación en eventos, además de aumento de la visibilidad en el ámbito nacional.

Conclusiones: el programa es adecuado y pertinente por concederle prioridad a la gestión de la I + D + i, como fuente principal dinamizadora de las demás actividades sustantivas del centro. Por otra parte, se evidencia que no se avanza al ritmo esperado en cuanto al incremento del número de investigadores y en las mejoras de la base de laboratorios

Palabras clave: innovación; factores de innovación; gestión de innovación; gestión del conocimiento.

Received: 27/01/2019

Accepted: 06/12/2019

INTRODUCTION

Any research directed to optimizing the components of university structures must include reference of the role and social responsibility of the University as an institution. The needs

and demands of society pave the way of university actions in all its facets, and therefore, all its structures must act in keeping with these policies.

Historically, universities have focused on the preservation, creation, and transmission of knowledge. Saborido and Alarcón (2018) stress the determining role of knowledge as national wealth, at the same time being an essential instrument of development in different areas. These authors also highlight the importance of the innovating role of universities, acknowledging that it must be object and subject of innovation in all directions of work.

These ideas are confirmed by other authors, who state that “University policies should not only be guided by the ideas of the academic community, but also be linked to the perceptions and expectations of other actors, favoring their interactions” (Núñez, Alcázar, and Proenza, 2017, p. 234).

Resolution No. 365/1987, signed by the Minister of Higher Education of the Republic of Cuba, and cited by authors González and García (2010), defined that Study Centers are teaching and research entities with a multidisciplinary character, which grant high importance to scientific research works. They ensure active participation of higher education in the solution of problems emerging along social and economic development of the country.

Study centers, as explained by the two previously mentioned authors, were conceived with the idea of performing actions in relation to graduate and post-graduate professional training. Other criteria related to flexibility of this organizational form, are added as well, which allows scholars to carry out research activities in a proportion similar to a research center. Under these conceptions, the creation of a new study center has been proposed in the University of Camagüey. Accordingly, Resolution No. 106/2004 was issued by the Ministry of Higher Education (MES), endorsing the creation of the Study Center for Exploitation, Manufacturing, and Recovery of Parts and Equipment (CEEFREP), adjoined to the Faculty of Electromechanics of the University.

Since formalization in 2004, until 2011, CEEFREP carried on with graduate training and several postgraduate assignments, particularly in the form of courses.

Almost simultaneously, with the inclusion of remarkable improvements in infrastructure, computing equipment, and work conditions, made in 2011, a new research study was conducted. The aim of the research was to study the process of innovation management, centered on the organization of R+D+i processes.

Then, it was necessary to establish new approaches to project and execute processes, especially those related to research, development, and innovation.

The main result of that research was that by 2013, the institution could access a program of measures to strengthen the innovation capacity of CEEFREP, whose particularities are expressed in the work of authors Castelló, Romero, and García (2015).

The aim of this research is to present results of the evolution of aspects identified as insufficiencies of innovation at CEEFREP, after five years of implementing the Improvement Program.

DEVELOPMENT

R+D+i: a substantive activity for the University and its interaction with society

There is a tacit recognition of the role played by the University in social development. It has been demonstrated by previously mentioned sources, especially, Saborido and Alarcón (2018), who found it remarkable within the national scenario. Its possibilities in terms of interaction with the society are enormous, and have been highlighted in most related works. Knowledge management alone is a clear example of a referent of associations with companies that provide goods and services. A strategic approach is important in this sense. The engine of economic growth based on science and technology will have to rely on exporting goods and services with high-added value. This will require companies that perform active roles in science and technology, and scientific institutions connected to companies, (...) Scientific institutions will have to change, companies will too (Lage, 2018, p. 40).

Today, universities are asked, besides traditional ways of research, a greater and more direct participation in the generation of technologies and innovation.

The local dimension has a key role to play today, as to connecting knowledge, innovation, and development. The Cuban case is not the exception, as part of the basic conceptions of national development, and in accordance with university structures that have spread throughout the country, facilitating it, according to Núñez, Alcázar, and Proenza (2017).

In that sense, Rubio (2016) summarizes three moments, consisting of structuring pertinent integrated policies of scientific research, technological innovation, and postgraduate education, in accordance with national policies. In a second moment, an approximation of the academic structure to the productive apparatus of society, considering their respective specificities. Finally, the formation of masters in sciences and doctors at the service of society, as highly skilled resources for research and innovating activity. The main aspect of this training is scientific research.

This turns out to be an interesting choice, regarding the university-company ties, the results of an international research project published by the Chamber of Commerce of Spain (2015). The sample studied comprised a group of companies from the industrial, service, and new technology sectors of five different European countries, particularly in relation to aspects concerning the forms in which that interaction is produced and observed, especially cooperation in terms of R+D+i. Almost half of them claims to have collaboration ties with universities in that area, through national or international projects, research contracts for product development, process improvement, and the like.

Of the industrial companies surveyed, 66.7% expressed a high level of cooperation with universities in R+D projects, the most commonly used form, which is given high priority.

The companies studied identified three important aspects of this cooperation: differences between university and company in relation to motivations and values; the temporary horizon of the company is different from that of the university, and bureaucracy in and outside the university.

Authors Suárez, de la Rosa, Jiménez, and Toyos (2009), presented a set of elements surrounding the university-company ties, in Cuba. Some of the main limitations of recent years are the ones related to structures, the attitudes of teachers and researchers, poor participation of students, shortcomings in project participation, and so forth. In this case, based on practical experience, there is a need of transformations in knowledge management spreading out from the university, creating interaction.

Pérez, Simeón, and Trinchet (2019) consider that in the Cuban case, a dynamizing element of the cooperation process was, without a doubt, the creation of flexible forms of organization, which enabled active links between universities and their productive

surroundings. The Teaching Units, Research-Development areas, and Study Centers (SC) are a reflection of the previous.

Talent management, leadership, and strategic planning of human resources, together with commitment, are internationally considered the four elements or factors to cover by organizations at the highest urgency, according to (Cuesta and Valencia, 2018).

Saborido (2018) confers high importance to structuring doctoral programs conceived in integration with research, and based on R+D+i projects that correspond to national or territorial priorities, with emphasis on training young talents as doctors.

Every transformation confronted by organizations, around or inside the organizational-productive grid, demands an adaptative reaction in the modes of action that allows it to keep or increase a competitive capacity in the markets. Additionally, it demands changes of attitudes internally, and new ways to target markets, which requires innovation management. (Sosa, Garciandía, Valdés, and Rosquete, 2017, p. 88)

In this case, highly skilled human capital seen as a critical mass is given high importance as a decisive resource to manage innovation. This is applicable to university structures and organizations, which have close ties with productive companies.

Any analysis and projection seeking scientific-innovative improvements in the role of institutions of higher education in Cuba should consider the fundamental programmatic documents of the nation, approved by the VII Congress of the Communist Party of Cuba (PCC, 2017). To consider during the analysis, the projections are linked to guidelines 98, 106, and 115¹ Concerning the Bases of the National Plan of Economic and Social Development up to 2030, which were also approved by the VII Congress. In the relation with the Strategic Axis, the aspects below stand out: Human potential, science, technology, and innovation, with total coincidence, given the case, and their three general objectives with several specific objectives.

These different approaches and situations, reflected in diverse contexts, synthesize common aspects taken into consideration in this study.

Evolution of CEEFREP in R+D+i during the 2013-2018 period

For the analysis, a descriptive diagnosis based on document review and structured interviews was performed with the main interest of determining if the aspects identified as flaws when the Program was designed, remained as such. Its application in the 2013-2018

period had an impact, favorable or not, on the solution. It also allowed researchers to access information about the pertinence of measures throughout time within the transformations implemented in the country.

The diagnostic was based on review and analysis of the following documents and activities:

- Resolution No.106/2004 of MES, to create CEEFREP.
- National documents concerning the reorganization process of the national scientific activity, and the entities of science and innovation.
- Oral presentations in scientific sessions of CEEFREP and Scientific Council of the Faculty, especially the ones related to master's degrees, and PhD.
- Reports for re-accreditation of the degree of Mechanical Engineering.
- Reports of annual results of work at CEEFREP, particularly in relation to R+D.
- Documents of business and institutional projects, and a proposal of international projects.

Moreover, personal interviews were performed to the members of CEEFREP about these topics.

Essential lines of the program Validity of application and completion

It was considered that the application of the Program in CEEFREP during the period, was essentially conceived with the interest, as explained, of implementing actions to fulfill research and innovation policies, and their articulation with educational graduate and postgraduate processes, to encourage greater rapprochement of CEEFREP with the industry, and maintain human resources management as a priority, providing access to master courses and PhD whenever possible.

The program emphasized on organizational and methodological aspects of R+D+i processes, and the ties with the industry, as action cores.

As to organization and methodology, it means adjusting the national science and innovation policies with the policies of the university to the study center, together with the specification of the mission and strategic bases; to have a projection to develop a minimum lab infrastructure, along with the center's own approach adjusted to their needs, regarding human resources, and scientific and technical information, which are very important referents for an evaluation like this. These essential lines are dealt with below:

Fundamental human resources

The study case is not aside from previously stated considerations about the importance of human resources covered by various authors, in terms of conformation and preparation of the staff. Hence, it is an aspect whose evolution requires attention before focusing on other particularities of the Center's work. The teachers and researchers, and their composition was considered a weakness-threat, since, among other issues, there were no new members, and the average age is high (50.5 years): see figures 1 and 2.

A comparative chronological analysis shows that the Center slightly reduces its highly qualified staff; new members join the center (two graduate students and a young specialist (MSc) from production). In spite of that, the staff is aging, with an increase of average age in 2.3 years (52.8 years of age). One thesis dissertation was presented by a collaborator and other two professors have advanced in their dissertations.

A favorable tendency is observed, though, not at the expected speed.

R+D+i and its link to companies

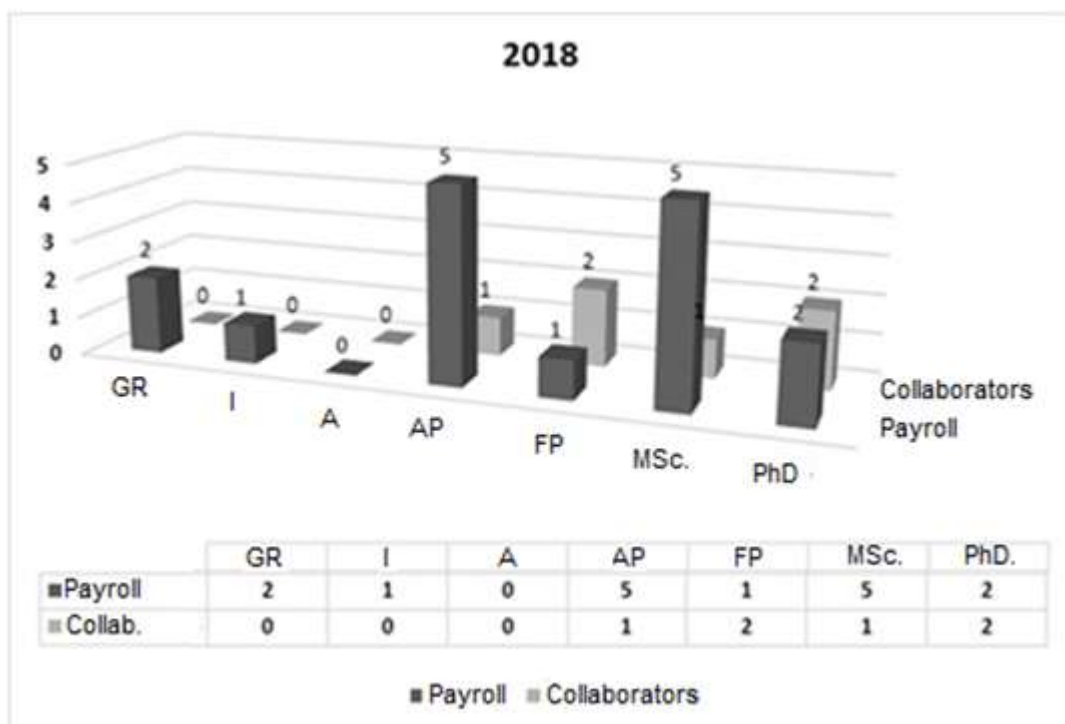


Fig.1. Composition of CEEFREP staff, according to their teaching category, master's degree, and scientific degree. 2013

Source: Self-made.

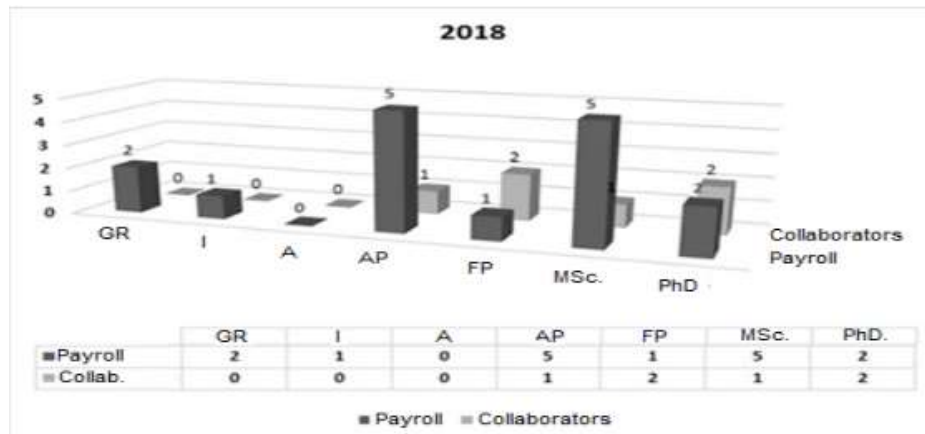


Fig. 2. Composition of CEEFREP staff, according to their teaching category, master's degree, and scientific degree. 2018

Source: Self-made.

Another branch that received high priority within the measures of the Program during that period was a number of methodological aspects of science and innovation.

Concerning research, the program was conceived in three levels, as shown below, considering several classification criteria, including those at Cervantinos Study Center (2018).

Level A: Oriented basic research.

Field: Applications of materials and advanced design processes, and manufacture and recovery of parts and tools.

Level B: Applied research.

Field: Assimilation of technologies; development of design and processes applied to manufacture and recovery of parts and tools.

Level C: Innovation and scientific and technical services.

Field: Technology transfer and maintenance solutions, improvements in the design of technological processes applied to manufacture and recovery of parts and tools.

This work relied on the vision that by 2020 the distribution of research would be distributed as follows: group A (10%), group B (20%), and group C (70%).

Quantitative information about structuring the main research done, and continues to be done, as shown in table 1, where some results are also stated.

Table 1. Summary of projects, publications, and patents approved (2014-2018)

Research topics	Projects involved			Publications			Patents	Contributes to level		
	NPST	BP	International P.	Level I and II	Level I and II	Papers submitted in events (ISSN)		A	B	C
Tools	--	1	--	2	--	71	--	X	X	X
Materials (Casting technology)	--	2	1	4			--	X	X	--
Materials (Welding technology)	--	1		1			--	X	X	X
Materials (machinery technology)	--	--	1	1			1	X	X	X
Design of parts, add-ons, and equipment	1						--	--	--	X
Others				3	2		--	--	--	--
Total	1	4	--	11	2	71	1	--	--	--

NPST National Project of Science and Technology

BP: Business project

International P: International project

Source: Self-made.

In this aspect, there is a favorable trend in the organization and direction of science and innovation, which contrasts previous stages. High priority was given to work organization in the form of project, changing the situation existing before 2013, substantially. Nine business projects or institutional projects have been developed with the Union of Military Industries (UIM), with contributions to defense, the national economy, and training of Cadets in Mechanical Engineering. A national project run by this Union in the area of metallic molds to build homes, which were totally designed by CEEFREP, was significant. The members and collaborators at the Center participated actively in the efforts of the national project related to biomass use to produce power, by designing a prototype machine to cut and harvest sicklebush biomass (LeyCa). This result contributed to further efforts in that direction at the national level, concerning the use of renewable energy sources.

This Center takes part in a national project associated to the National Science and Technology Program (NSTP), along with other entities of the university and the industry, to create a wind turbine prototype.

CEEFREP is contributing with ideas to raise casting yields at the Mechanical Plant in the province of Holguin, in collaboration with Oscar Lucero Moya University of Holguin.

A project to use non-metallic minerals in the industry is under review (associated to accurate casting, and the creation of synergies with an existing project). A new, already implemented project was introduced in collaboration with the Steel Products Company of Camagüey, and the participation of Marta Abreu Central University (UCLV). The goal of the project is to produce and introduce arc-welding electrodes with a composite cover layer to recover parts. The advances achieved in this area have been linked to association with companies. The Center has additionally set out to foster and improve student scientific research and post-graduate training, qualitatively.

The activity level in relation to associations with industry was increased multifold, compared to the years preceding this study, with special participation of UIM entities, and others. Those entities have kept ties in relation to innovation, favoring and widening student engagement. Other companies included are the Basic Unit of Mechanical Solutions (SOMEK), from the Ministry of Construction; the Railroad Works Company, and the Steel Products Company, from the Business Group of Steel-Mechanical Companies (GSIME). The increase observed in the number of teaching-research projects done by students is remarkable, with a strong participation of third-year students, some fourth-year students, and some diploma works of last-year students.

Postgraduate training was benefited, with an increased response to the needs of the industry, mainly, totaling thirteen courses. The engagement of CEEFREP members has been permanent and stable, particularly the doctors in technical sciences and the masters in Mechanical Engineering sponsored by the main department of the degree. Participation is also effective in master's courses offered to other faculties, and the universities of Holguin and Oriente. As part of the training activities received by the staff is a six-month research stay at the Technological Institute of Monterrey, Mexico, of a PhD candidate (2016).

Publications, is an indicator with a totally different record from the previous stage, despite ongoing objective limitations. As a complement of Table 1, some examples are the publication of three papers in the journal *Ingeniería Mecánica*, from the Technological University of Havana (CUJAE) (level II), and the submission of a fourth article to the same institution. The Center is involved in the redaction of two papers submitted to the *Handbook of Research on Managerial Strategies for Achieving Optimal Performance in Industrial*

Processes IGI Global 2016 (level I). One article was published in the database of Thompson Reuters, and another in Springer (both level I).

In the last five years, the average of professor researchers at CEEFREP was 11.5, with 14 published articles, and a total average indicator of 1.22 papers. The annual indicator is 0.24 papers published per professor researcher, having the best trend in the last three years. Then, it was corroborated that the expected rate of published papers was not met, though an improvement is observed.

Laboratory equipment

The analyses and experiments in the areas of material and tool behavior, which help measure parameters reliably is an essential premise to corroborate or not the expected results. The lab equipment used in the Center should meet several requirements, whose compliance is a premise for the validation of results of scientific reports and publications in indexed journals.

The situation of research laboratories continues to receive limited support by the industry. Request and purchase of a set of equipment using national funds (via Ministry of Higher Education (MES) of modern research equipment, has been considered the initial core to set up a state-of-the-art laboratory, whose specifications are defined by an institutional project. The conception of this lab is to become a new capacity created in association with companies and organisms, which would respond to integrated tasks and projects. However, the idea of completing the first stage of the lab by 2020 is not realized yet.

It continues to be a weak side that hinders the implementation of international projects or concrete participation in any of them. Two projects have been suggested and are under analysis.

Recognitions

In the last five years, the Center increased its repute, and was acknowledged for its national and international impact. It became a leader in Defense, within the new scientific policy of the university, and collaborated with other research lines like Energy and Housing. In that sense, the Center received several Annual Awards from the President of the University of Camaguey, for the work that contributed most to the defense. In the same category, the Center was granted the Annual Award from the Minister, in 2014. Also remarkable was the Outstanding Award during the I Conference of Metal-mechanics, along with two Mentions in

the II Conference, in 2016, and a Remarkable Award and a Mention in the III Conference, in 2018. In 2016, The Provincial CITMA Award was granted to the Center, for the work with the highest economic value (relative to Metallic Molds, and the University President's Award in the same category). These results have given the Center greater visibility.

As a whole, the purpose of the Program to dynamize the substantive activities of the Center following strengthening of R+D+i, has been achieved. Accordingly, during the period studied, a marked difference was observed, and pertinence with the above-mentioned favorable tendencies, was confirmed. Moreover, the relationships with other universities and entities of the economy and defense of the country were transformed positively.

CONCLUSIONS

The main results show the status of those aspects in the period, leading to the conclusion that it is appropriate and pertinent for the Program to grant priority to R+D+i management, as the main dynamizing source of all the other substantive activities.

The implementation of a group of measures in the Program contributed to favorable results in the last five years, in aspects concerning science and innovation. The concentration of efforts toward scientific work lines was improved, by offering higher priority and new partners that led to the design of different projects. The rate of published articles also increased. The participation in scientific meetings, and the attention and performance of students' work were observed to have an increasing trend. The ties between the university and companies also grew stronger, though did not fulfill all its potential.

The three levels of reference considered for research tasks have led to the perception that the Center has begun to engage in aspects of boundary knowledge, even with the existing material limitations. However, the remarkable innovating character (essential vocation of the staff) has not been threatened.

The situation concerning the number of professor-researchers, and the composition by categories and scientific degrees in CEEFREP continues to be a challenge to stability and future continuity, whichever official form is adopted in the University.

The improvements achieved in terms of laboratory equipment for research fall short in view of the goals set. New progress will have to be associated to the participation in international projects.

REFERENCES

- Cámara de Comercio de España. (2015). *Nuevas Formas de Cooperación entre Universidades y Empresas*. Retrieved from https://www.camara.es/sites/default/files/publicaciones/nuevas_formas_de_cooperacion_entre_universidades_y_empresas.pdf
- Castelló, J., Romero, C. y García, A. (2015). Programa para fortalecer la capacidad de innovación del centro de estudios de explotación, fabricación y recuperación de equipos y piezas (CEEFREP). *Retos De La Dirección*, 8(2), 51-59. Retrieved from <https://revistas.reduc.edu.cu/index.php/retos/article/view/73>
- Cuesta, A. y Valencia, M. (2018). Capital Humano: Contexto de su gestión. Desafíos para Cuba. *Ingeniería Industrial*, 39(2), 135-145. Retrieved from http://scielo.sld.cu/scielo.php?script=sci_arttext&pid=S1815-59362018000200135&lng=es&tlng=es
- González, W. y García, J. L. (2010). El centro de estudio. Una forma organizativa de la investigación científica de amplia generalización en la Educación Superior cubana. *Universidad & Sociedad*, 1(2), Retrieved from <https://rus.ucf.edu.cu/index.php/rus/article/view/19>
- Lage, A. (2018). *La Osadía de la Ciencia*. Retrieved from https://www.clacso.org.ar/cubaenrevolucion/detalle.php?id_libro=1735
- Núñez, J., Alcázar, A. y Proenza, T. (2017). Una década de la Red Universitaria de Gestión del Conocimiento y la Innovación para el Desarrollo Local en Cuba. *Retos de la Dirección*, 11(2), 228-244. Retrieved from http://scielo.sld.cu/scielo.php?script=sci_arttext&pid=S2306-91552017000200015&lng=es&tlng=es.
- Partido Comunista de Cuba (2017). *Documentos del 7mo Congreso aprobados por el III Pleno del Comité Central del PCC y respaldados por la Asamblea Nacional Poder del*

- Popular*. Retrieved from <http://www.granma.cu/file/pdf/gaceta/%C3%BAltimo%20PDF%2032.pdf>
- Pérez, R., Simeón, R. y Trinchet, C. (2019). La gestión de la innovación en el centro de estudios CAD/CAM. *Ciencias Holguín*, 25(4), 22-34. Retrieved from <http://www.ciencias.holguin.cu/index.php/cienciasholguin/issue/view/99>
- Rubio, A. (2016). Algunas consideraciones sobre la reorganización de la actividad científica en las universidades del Ministerio de Educación Superior de Cuba. *Revista Cubana de Educación Superior*, 35(1), 85-98. Retrieved from http://scielo.sld.cu/scielo.php?script=sci_arttext&pid=S0257-43142016000100008&lng=es&tlng=es.
- Saborido, J. R. (2018). Universidad, investigación, innovación y formación doctoral para el desarrollo en Cuba. *Revista Cubana de Educación Superior*, 37(1), 4-18. Retrieved from http://scielo.sld.cu/scielo.php?script=sci_arttext&pid=S0257-43142018000100001&lng=es&tlng=es
- Saborido, J. R. y Alarcón, R. (2018). La integración de la Universidad: experiencias de Cuba. *Revista Cubana de Educación Superior*, 37(3), e17. Retrieved from http://scielo.sld.cu/scielo.php?script=sci_arttext&pid=S0257-43142018000300017&lng=es&tlng=es
- Sosa, N. Garciandía, G, Valdés, M. y Rosquete, R. (2017). Interrelación entre gestión de innovación y formación continua del personal como procesos gerenciales. *Retos de la Dirección*, 11(2), 73-92. Retrieved from http://scielo.sld.cu/scielo.php?script=sci_arttext&pid=S2306-91552017000200006&lng=es&tlng=es
- Suárez, R. P., de la Rosa, L., Jiménez, B. y Toyos, A. (2009). *El desafío de la innovación*. (1ª ed.), Matanzas, Cuba: Editorial Universitaria.
- Centro de Estudios Cervantinos. (2018). *Tipos de Investigación y sus características*. Retrieved from <https://www.centroestudioscervantinos.es/tipos-de-investigacion-y-caracteristicas/>

Conflicts of interest

There are no conflicts of interest.

Author contribution statement

José Amado Castelló González: Theoretical rationale; development of measurement instruments and control; analysis of and conclusions; redaction.

Ricardo del Risco Alfonso: Development of measurement analysis of results; redaction of conclusions.

Asdrúbal Braulio García Domínguez: Aspects related to management and creation of the interface; review of all the contents.

Carlos Emilio Romero Perdomo: Methodology of research. Continuity of aspects dealt with in the initial research.

NOTES

¹Guidelines of the economic and social policy of the party and the revolution for 2016-2021

V.Science, technology, innovation, and the environment guidelines

98. To place science, technology, and innovation in the first plane, in all instances, with a vision that ensures meeting the goals of the National Plan of Economic and Social Development in the short and mid terms.

106. To guarantee stability, completion, and renovation of the scientific-technological potential of science, technology, innovation, and the environment systems, to work in a selective, step-by-step, proportionate, and sustainable way of growing. To perfect different stimulation mechanisms.

115. To encourage interaction among the entrepreneurial, subsidized, academic, education and training sectors, with science, technology, and innovation entities, so that the scientific and technological results find application and generalization in production and services.