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Original article

STRATEGIC MAP OF BALANCED SCORECARD OF THE GOVERNMENT MANAGEMENT MODEL ORIENTED TO INNOVATION FOR COVID-19

MAPA ESTRATÉGICO DEL CUADRO DE MANDO INTEGRAL DEL MODELO DE GESTIÓN DEL GOBIERNO ORIENTADO A LA INNOVACIÓN PARA LA COVID-19

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Abstract

The innovation-oriented government management model (MGGI) includes the establishment of Balanced Scorecards (BSC) according to the context of application. To do this, the development of strategic maps is proposed using the Matrix of Crossed Impacts of Multiplication Applied to a Classification (MICMAC), which allows reducing the number of variables in the structural analysis, depending on the objectives analyzed in relation to sustainable development. The article addresses the methodological proposal for obtaining the strategic maps of the BSC and its application in the strategic axis referring to Human Potential, science, technology and innovation for COVID-19.

Keywords: Balanced scorecard, strategic map, government management, innovation, indicators, MICMAC, COVID-19

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Resumen

El Modelo de gestión del gobierno orientado a la innovación (MGGI) incluye el establecimiento de Cuadros de Mando Integral (BSC) según sea el contexto de aplicación. Para ello se propone la elaboración de mapas estratégicos haciendo uso de la Matriz de Impactos Cruzados de Multiplicación Aplicada a una Clasificación (MICMAC) lo que permite reducir la cantidad de variables en el análisis estructural, según sean los objetivos analizados en relación al desarrollo sostenible. El artículo aborda la propuesta metodológica para la obtención de los mapas estratégicos del BSC y su aplicación en el eje estratégico referido al Potencial humano, ciencia, tecnología e innovación en el enfrentamiento a la COVID-19.

Palabras clave: Cuadro de mando integral, mapa estratégico, gestión del gobierno, innovación, indicadores, MICMAC, COVID-19

Introduction

Innovation as a complex, non-linear, non-deterministic phenomenon[1] with the necessary interaction between the different actors that make up the national innovation system, such as companies, universities, research centers and the government,[2] determines the need to use systems information management control for decision making from the central government, as well as the use of the Balanced Scorecard (BSC).

The BSC (Balanced Scorecard in English), originally created for private companies,[3] has been extended to those of the public sector and non-profit organizations, adjusting the perspectives and the strategic map to the effectiveness in fulfilling the mission with social impacts in eliminating poverty, pollution, improving health, education and economic opportunities, among others.[4]

The BSC is also used to measure the satisfaction of society's needs[5] and the measurement of economic, social and environmental impacts, with its application in innovative agroindustry ecosystems.[6] This tool serves as the basis for an integrated, strategic and iterative management system, that allows aligning management processes and focusing the organization on the implementation of a long-term strategy.[7] This strategic and systemic approach to innovation has been one of the key success factors in Cuban industries such as basic[8] and biopharmaceuticals.[9]

In addition, the optimization of human capital management considers tangible and intangible indicators through the different key processes such as planning and its strategic management control through the Balanced Scorecard.[10] Its use for decision-making and the development of sustainability strategies for a tourist destination.[11]

The BSC is very useful in the integrated evaluation of performance through qualitative and quantitative measures as an important mechanism for implementing strategies[12] in management control systems and in measuring the performance of innovation in different sectors and business areas.[13] Similarly, it can be useful in government management information systems, for which they should include dissimilar indicators aligned with the Sustainable Development Goals (SDGs), taking into account the complexity of the contexts that are valued with all their relationships.

The innovation-oriented government management model (MGGI) that is projected and deployed in Cuba, includes the development of several BSCs,[14] with their corresponding Dashboards. This government management requires adopting a strategic and comprehensive approach aimed at meeting the goals defined in the indicators of sustainable development (economic, social and environmental) and in the National Plan for Economic and Social Development to 2030 (PNDES 2030). In this sense, for long-term projection, it is recommended to apply strategic prospective[15,16] with methods such as structural analysis and scenario design.[17]

The objective of the article is to show the approach and the method used for the elaboration of the strategic maps of the MGGI Balanced Scorecards. The complexity of the contexts that are valued in the MGGI encourages the adoption of strategic maps with the use of strategic foresight tools for structural analysis such as the Multiplication Cross Impact Matrix Applied to a Classification (MICMAC). The article exposes its application in one of the components of the MGGI for confronting COVID-19, the one referring to the conditions of the factors and in particular that of Human Potential, Science, Technology and Innovation (PHCTI).

Methodology

In the MGGI, the BSC[3] is adjusted with the representation of the strategic map of the SDGs and the objectives of the PNDES 2030, as appropriate, fundamentally for use at the highest level of government management, given the complexity of the contexts that are valued. The strategic map is an inherent characteristic of the BSCs, which allows describing the links between intangible assets and value creation.[18]

The method used to prepare the strategic maps is based on the application of the Multiplication Cross Impact Matrix Applied to a Classification (MICMAC)[15] with the corresponding adjustments for the identification of the variables to be analyzed in the MGGI components.[19]

The MICMAC is widely used in dissimilar types of variables and factors on which it is desired to know which are the most influential and dependent. Among the reported cases are the identification of the macro factors that most influence the innovation systems for the development of photovoltaic technology in Iran.[20] In other contexts, its use is reported as in the strategic projection of a university,[21] the strategic diagnosis and the preparation of the development plan for land use planning[22] and in the identification of public health demands at the national level.[23]

Strategy maps could allow organizations to deal with strategic uncertainty more effectively and make them more sustainable in the long term.[24] An advantage of MICMAC is that it does not require variables to be quantitative in order to obtain the most objective and complex view. possible of the analyzed system, as is the case of the BSC for the management of complex contexts that are based on a direct and indirect interconnection of the strategic objectives.[25]

In this sense, this method was selected to prepare the strategic maps of the BSC and thus characterize and know the interrelationships between the strategic objectives of the MGGI components through structural analysis with the analysis of influence and dependency matrices.

The steps followed for the elaboration of the strategic map of the BSC corresponding to the MGGI are:

1. Identify the specific objectives (SO) of each strategic axis related to the complex problem, macro program, program, project or other context of application of the MGGI.
2. Determine the Matrix of direct influences between the specific objectives, taking the current year (2021) as a reference.
3. Classify the variables according to influence and dependency (link, motor, dependent and autonomous) with the plan of potential indirect influences/dependencies, for which the target year is 2030.
4. Determine the most influential variables with the graph of potential indirect influences/dependencies (for the target year 2030) with the information of 20% of the relationships.
5. Reduce link variables by defining the most influential specific targets.
6. Identify the indicators and goals of the most influential variables.

Results and Discussion

The Control Panel (BSC) is made up of the strategic map of the MGGI components, the identification of a set of indicators that allow evaluation through data and information, the generation of knowledge and the anticipation of future events for decision-making. decisions.[19] In the construction of the strategic maps of the BSC, it is necessary to identify the strategic objectives related to the components of the MGGI.

Table 1 shows the relationship that exists between the components of the MGGI and the strategic axes of the PNDES 2030.

Table 1. Link between the components of the MGGI and the strategic axes and the SDGs

Components	Strategic axes of the PNDES 2030
Government	1. Effective and socialist government and social integration
Factor Conditions	2. Human potential, science, technology and innovation 3. Natural resources and environment 4. Infrastructure
Needs and conditions of demand	5. Human development, equity and social justice
Value creation	6. Productive transformation and international insertion

Source: self-made

This article details the steps followed in the elaboration of the strategic map of the BSC only for one of the components of the MGGI referred to the conditions of the factors and in particular to the analysis of the strategic axis of the PNDES 2030 of the human potential, science, technology and innovation (PHCTI) for COVID-19.

Step 1. Specific Strategic Objectives (OE) of Human potential, science, technology and innovation for COVID-19

The construction of the strategic map of the WCC for confronting COVID-19, made it possible to identify 40 specific strategic objectives (OE) of the PNDES 2030 in the six strategic axes that are most related to COVID-19. In the particular case of the Human Potential, Science, Technology and Innovation (PHCTI) strategic axis, OE 1 to 13 and 16 to 18 were identified. The content of the OE identified is shown in Annex 1.

Step 2. Matrix of direct influences between the specific objectives of the PHCTI in 2021

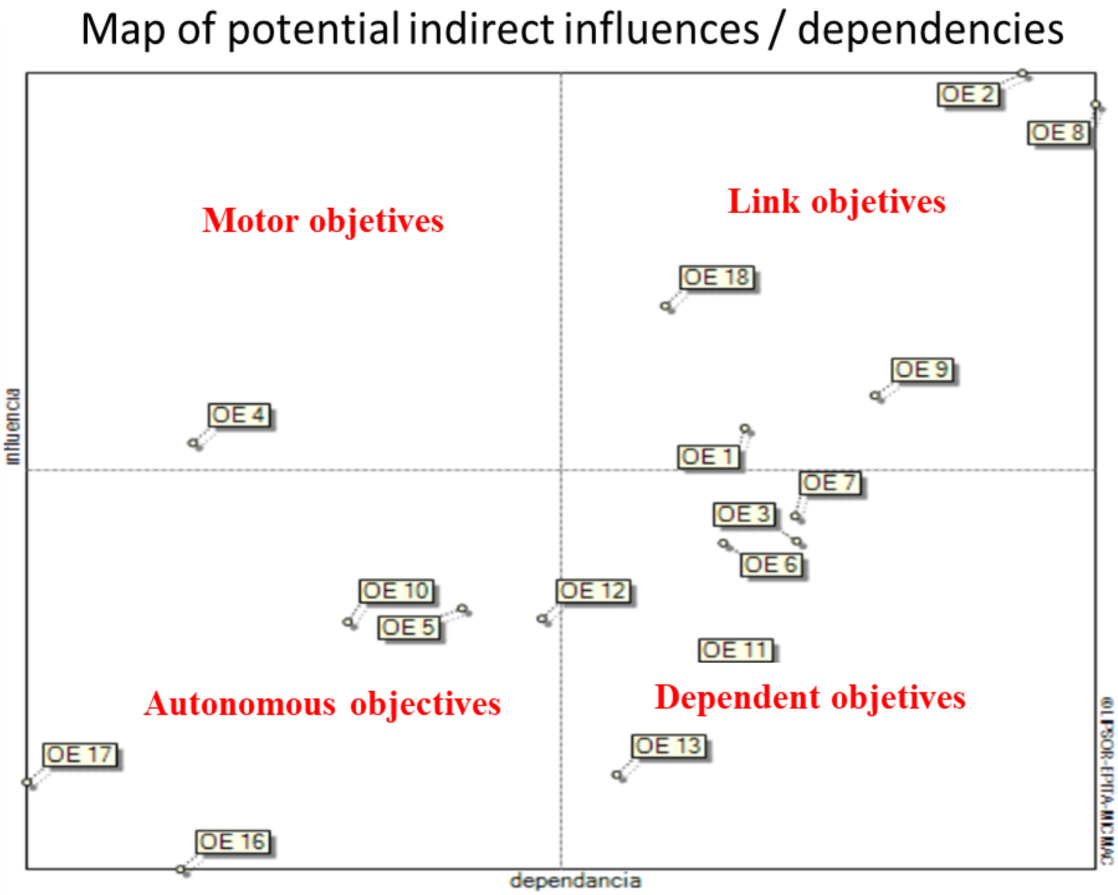
This matrix is constructed by relating the OE in each row with each one represented in the columns, evaluating the relationships in degrees of influence: Intense (3), Medium (2), Slight (1) and Null (0). For those potential relationships that may occur in the future, it is located in cell (P). What we are trying to assess is whether the variable in the row (cause) has a direct effect on the variable in the column. Table 2 shows the matrix of direct influences between the specific objectives of the PCTI in 2021.

Table 2. Matrix of direct influences between the specific objectives of the PHCTI

	1 : OE 1	2 : OE 2	3 : OE 3	4 : OE 4	5 : OE 5	6 : OE 6	7 : OE 7	8 : OE 8	9 : OE 9	10 : OE 10	11 : OE 11	12 : OE 12	13 : OE 13	14 : OE 16	15 : OE 17	16 : OE 18
1 : OE 1	0	2	2	1	1	2	P	3	3	2	3	2	3	1	2	2
2 : OE 2	3	0	3	2	2	3	3	3	3	P	3	3	3	2	3	3
3 : OE 3	3	3	0	1	2	2	2	2	2	1	2	2	1	1	1	3
4 : OE 4	2	3	3	0	1	3	3	3	2	3	2	1	1	2	1	1
5 : OE 5	2	2	2	1	0	2	1	3	2	1	1	2	3	1	2	2
6 : OE 6	2	2	2	3	2	0	2	3	2	1	2	1	2	3	1	1
7 : OE 7	0	3	3	2	1	2	0	3	2	3	2	2	2	1	1	2
8 : OE 8	2	3	3	3	3	3	3	0	3	2	3	3	2	3	2	3
9 : OE 9	3	2	2	1	2	2	3	3	0	2	2	P	3	2	1	2
10 : OE 10	2	2	1	2	1	1	3	2	3	0	2	1	1	1	1	3
11 : OE 11	3	2	2	1	1	1	2	2	2	1	0	2	2	1	1	2
12 : OE 12	3	3	2	1	2	2	1	3	3	1	1	0	1	0	0	2
13 : OE 13	2	3	2	1	3	2	0	2	2	0	2	1	0	0	1	1
14 : OE 16	1	2	2	0	1	3	2	2	1	0	1	1	2	0	0	2
15 : OE 17	2	3	2	1	1	2	2	2	1	1	1	1	1	1	0	1
16 : OE 18	2	3	2	1	3	2	3	3	3	3	3	2	2	2	1	0

Step 3. Most influential and dependent objectives of the PHCTI with the plan of potential indirect influences/dependencies by 2030.

Figure 1 shows the plan of potential indirect influences/dependencies by 2030, which allows the objectives to be classified in the four quadrants. The x-axis measures dependency and the y-axis influence. OE 2, 8, 9, 18 and 1 are valued as the most influential and dependent objectives (known as link variables).



Year 2030

Figure 1. Classification of the specific objectives of the PCTI to 2030

The results are obtained with a prospective software for structural analysis (MICMAC), which allows characterizing the relationships between the objectives and knowing the ones that have the most influence on that component, which fundamentally corresponds to the link variables and those that in turn They are the most dependent. The selection of that quadrant in relation to the fact that they are also dependent variables means that they are the ones that can be transformed.

Step 4. Most influential targets with potential indirect influences/dependencies graph (for target year 2030) with information from 20% of relationships

Figure 2 allows knowing the degree of influence between the specific objectives of the PHCTI, highlighting OE 2, OE 8 and OE 18 as the most influential (marked with green circles) with the information of 20% of the relationships. The legend of the graph shows that the red lines are the ones with the greatest potential indirect influence, which coincides with the relationship between OE 2 and OE 8.

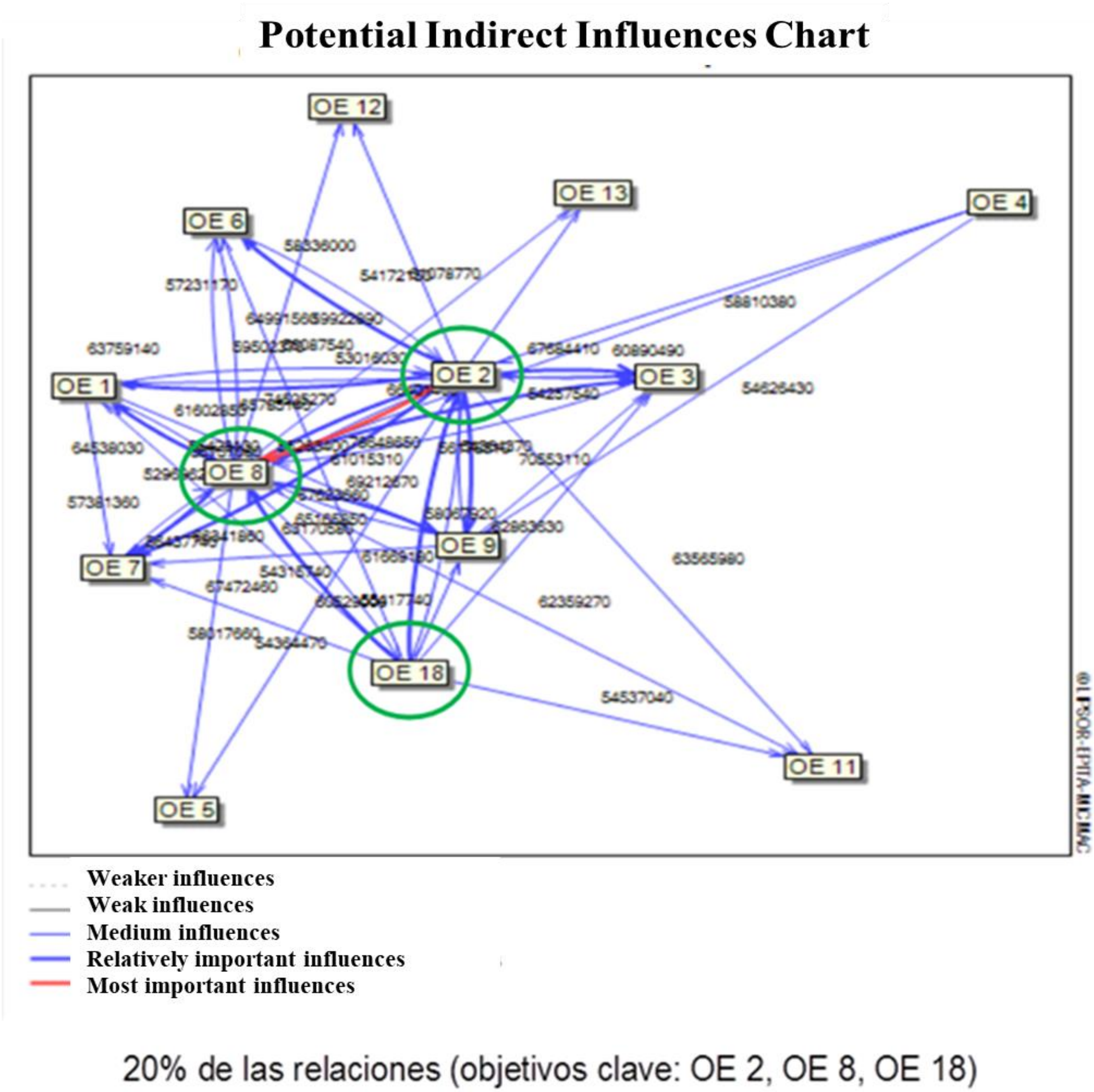


Figure 2. Strategic map of the MGGI Comprehensive Scorecard for COVID-19

Step 5. Variables that change the most in the future based on the definition of the most influential specific objectives.

Figure 3 shows the changes in the position of the specific objectives of the PHCTI when moving from the current situation (2021) to the desired state in 2030. Not only are the most influential objectives appreciated, but also their displacement over time to positions of greater or lesser influence.

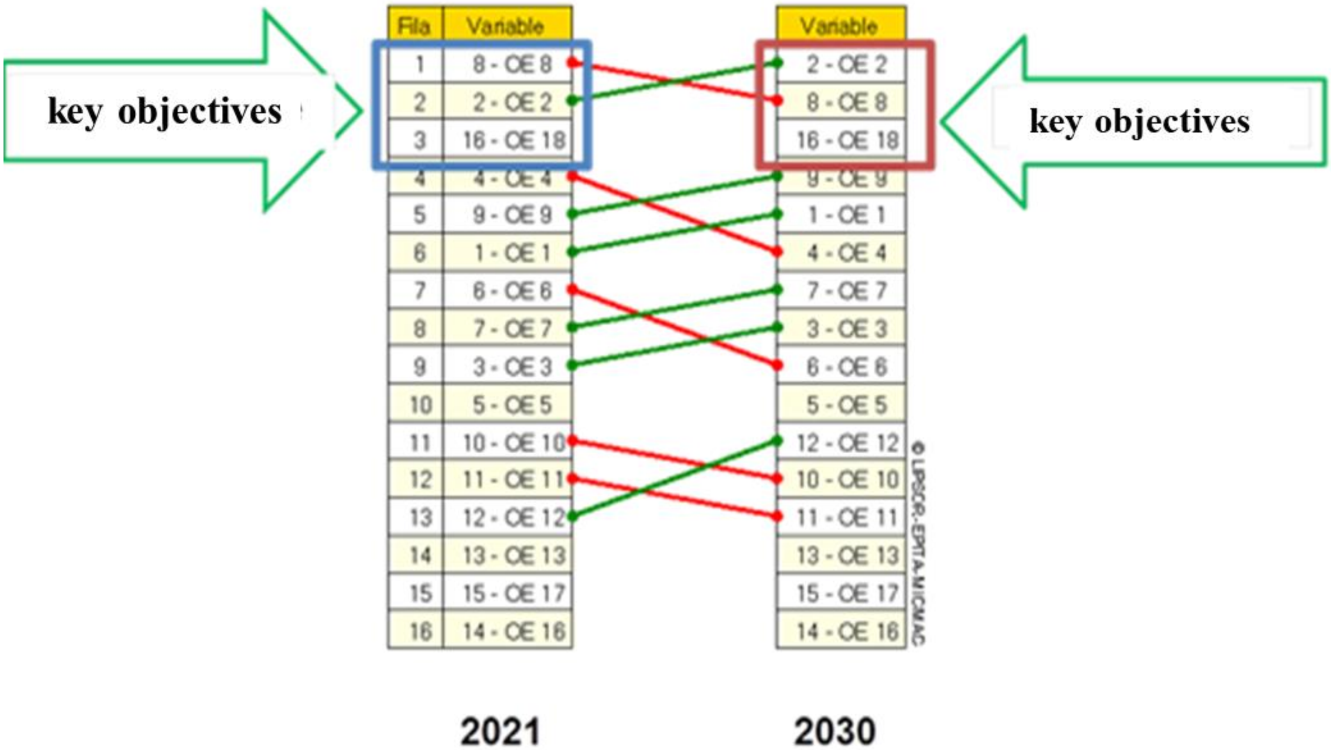


Figure 3. Classification of specific objectives according to their influences (2021) and (2030)

In summary, the key objectives that must be prioritized to achieve the desired transformation in 2030 with the PHCTI are:

– O2. Strengthen the integration and rationality of the science, technology and innovation system, as well as the development of human potential and material infrastructure. Pay special attention to support activities, such as: metrology, standardization, quality, industrial design, industrial property, knowledge and information management, among others.

– O8. Raise and strengthen the role of science and technology in the growth of economic efficiency and productivity in strategic sectors.

– O18. Promote international collaboration and cooperation in science, technology and innovation as an instrument for achieving priority objectives and of interest to the parties, obtaining financial resources, high-impact joint publications, undergraduate and postgraduate training and staff training and improvement.

It is interesting to know that O2 is in second position in 2021 and should move to first position by 2030, which implies deploying strategic actions to achieve it. This strategic objective also evidences the relevance of implementing the science, technology and innovation system with comprehensiveness and rationality, highlighting the support activities, which are part of the MGGI by including the cycles of quality management and Research, Development and innovation (R&D&i).

Step 6. Indicators and goals of the most influential variables

In this step, the indicators established in the PNDES 2030, the SDGs, those of the National Office of Statistics and Information (ONEI) or another reference information system can be taken as a reference. Those indicators most closely related to the most influential and dependent specific objectives should be selected, in such a way that it becomes the management control system. The elaboration of the strategic maps with the MICMAC allows the reduction of the SOs and at the same time the identification of those most relevant indicators, which are the ones that most drive the desired changes by 2030. **Table 3** establishes which are the SDGs that have the most links with OE2, OE8 and OE18.

Table 3. Link between the Specific Objectives of the PHCTI and the SDGs

OE	SDGs
OE2	4. Ensure quality and equitable inclusive education and promote lifelong learning opportunities for all.
	7. Guarantee access to affordable, reliable, sustainable and modern energy for all.
OE8	2. End hunger, achieve food security and improve nutrition, and promote sustainable agriculture.
	8. Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all.
	9. Build flexible infrastructure, promote inclusive and sustainable industrialization, and foster innovation.
	12. Ensure sustainable consumption and production patterns.
OE18	17. Intensify implementation measures and revitalize the global partnership for sustainable development.

Source: self-made

It should be noted that in the PNDES 2030 for each strategic axis there is a large number of indicators and goals established for 2021, 2026 and 2030. Thus, those indicators most related to the OE and SDGs in **Table 3** can be identified. that may be of interest to monitor in the context of applying the BSC.

Additionally, Dashboards can be built for the identified indicators that are more closely linked to the SOs and SDGs in confronting COVID-19. **Figure 4** shows the results of the Science and Innovation Dashboard for COVID-19 in a cut made during the month of January 2021.

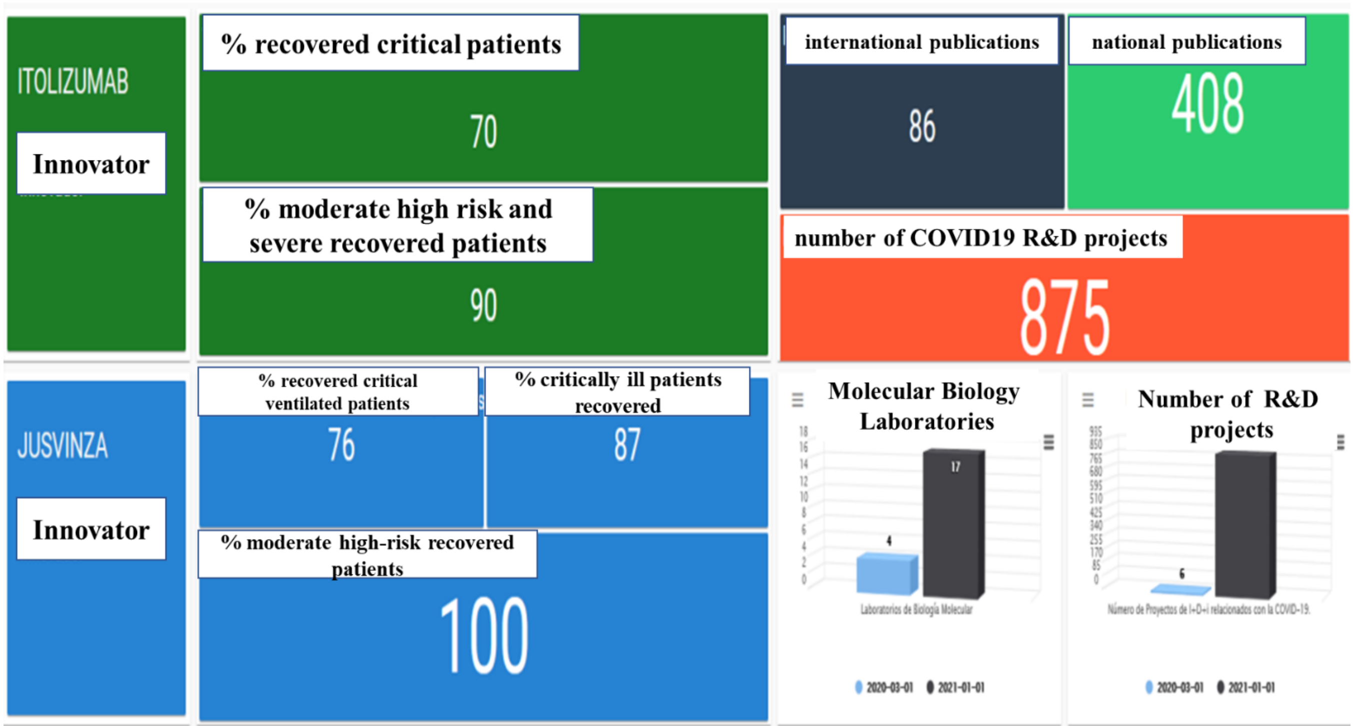


Figure 1. Dashboard of science and innovation in the fight against COVID-19 in Cuba (January 2021)

Dashboards are regularly updated. Thus, in the month of May 2021, the number of molecular biology laboratories in which PCR samples are processed in Cuba for the detection of the SARS-CoV-2 virus increased to 27, including the special municipality of Isla de la Juventud. Similarly, there are five vaccine candidates in different phases of clinical trials in the country. On May 1, 2021, the phase III clinical trial of the Abdala vaccine candidate concluded, which was applied in Santiago de Cuba, Guantánamo and Granma to more than 45,000 subjects.[26] Currently, the Phase III clinical trial of the Soberana 02 vaccine candidate is underway in eight municipalities of Havana with more than 44,000 subjects, 48 vaccination points and 32 clinical sites.[27]

Also encouraging is the fact that 415,161 doses of both candidates were applied in Cuba on May 7, during the phases of clinical trials and intervention studies, with results that demonstrate safety (low incidence of adverse events in the course of the administration of the candidates) and immunogenicity (immune response developed by the individual), as well as the start of a health intervention in risk groups and territories with the Cuban vaccine candidates Soberana 02 and Abdala until the authorization of the State Center for Quality of Medicines for mass use, it is expected that in the month of August 70% of the population will be immunized.[28] These results are just one example of the contribution of human, scientific and technological potential to confront COVID-19 in Cuba, which in turn has been managed by the government based on science and innovation.

Conclusions

The MGGI, as it extends to the entire national level, from the central to the local level, and encompasses all spheres of society, requires the preparation of dissimilar Balanced Scorecards, fundamentally for the assessment of complex problems and macro programs corresponding to the axes strategies of the PNDES 2030.

In the design of the Balanced Scorecards, the elaboration of strategic maps using the MICMAC is recommended for the structural analysis of the variables that characterize the object of study, with the reduction of variables to the keys, which are the ones that must be monitored. through indicators and evaluated their behavior in relation to the projected goals for compliance with the PNDES 2030 and the SDGs.

The strategic map of the Human Potential for Science, Technology and Innovation (PHCTI) corresponding to the MGGI component referring to the conditions of the factors made it possible to identify O2, O8 and O18 as key objectives (more influential and dependent), which should be prioritized in the strategic actions, the indicators and the goals to 2030 to achieve the expected transformations of sustainable development in Cuba.

The strategic map of the BSC of the MGGI allows the modeling of the interrelationships of the specific objectives, the orientation of actions with a preventive approach to achieve the desired goals and the adjustments required in the event of unwanted deviations, with the assimilation of that information in the Dashboards, as part of the management control system by the highest management of the country.

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Conflict of interests

The authors declare no conflicts of interest

Authors contribution

- Miguel Díaz-Canel Bermúdez: Conceptualization, methodology, supervision, writing, review and editing.
- Mercedes Delgado Fernández: Conceptualization, formal analysis, methodology, writing, review and editing.

Annex 1. Strategic Axis: Human potential, science, technology and innovation

Specific objectives

1. Prioritize science, technology and innovation in the sectors that have the greatest and most immediate impact on economic and social development and the well-being of the population, considering the characteristics of the territory. The foregoing, without neglecting the basic sciences, as a guarantee of the scientific development of the country.

2. Strengthen the integration and rationality of the science, technology and innovation system, as well as the development of human potential and material infrastructure. Pay special attention to support activities, such as: metrology, standardization, quality, industrial design, industrial property, knowledge and information management, among others.

3. Promote and ensure, based on the integration of the results to the productive chains and value networks, the closure of the scientific-productive cycle by ensuring a close interaction between the generation of new knowledge and the production of goods and services. .

4. Adapt the legal and regulatory framework of science, technology and innovation to the process of updating the economic and social model in such a way as to achieve agility, flexibility and efficiency in the organizational and economic-financial mechanisms for the materialization of the impact of these activities in economic and social development.

5. Promote a culture that encourages scientific, innovative and entrepreneurial vocation at all levels of society, especially from an early age.

6. Promote innovation and its generalization in the productive and service sectors, through the use of the necessary material and spiritual incentives so that innovation constitutes an essential component of increasing economic efficiency, competitiveness, technological change, saving and clean production.

7. Strengthen the role of national and foreign direct investment in the introduction of internationally advanced technologies in the country, and promote the creation of dynamic structures (science and technology parks, business incubators, special development zones and others) .

8. Raise and strengthen the role of science and technology in the growth of economic efficiency and productivity in strategic sectors.

9. Develop indigenous processes and technologies that guarantee an adequate and sustainable use of the country's raw materials, materials and natural resources, and that contribute to technological sovereignty.

10. Sustainably increase and diversify the financing of science, technology and innovation activities.

11. Raise and strengthen technological sovereignty in the development of information technology and telecommunications, as well as promote the development of new technological platforms.

12. Strengthen the capabilities of prospecting and technological surveillance, as well as the protection of intellectual property (copyright and industrial property) in Cuba and abroad.

13. Promote the formation of highly qualified human potential and the generation of new knowledge, guaranteeing the development of universities and education in general, their human resources and infrastructure.

16. Establish the incentives that are necessary to ensure the stability of the most highly qualified personnel.

17. Continue promoting the development of research in the field of social and humanistic sciences on the priority issues of society, as well as promoting the introduction of its results in decision-making at different levels, systematically anticipating and evaluating the impacts obtained.

18. Promote international collaboration and cooperation in science, technology and innovation as an instrument for achieving priority objectives and of interest to the parties, obtaining financial resources, high-impact joint publications, undergraduate and postgraduate training and staff training and improvement.