



Ciencia y Deporte

Volume 8 issue 3; 2023





Artículo original

DOI: <https://doi.org/10.34982/2223.1773.2023.V8.No3.009>

A Theoretical-Methodological Conception of Innovation through Scientific-Technical Services

[Concepción teórica metodológica de innovación mediante servicios científicos técnicos especializados]

[Concepção teórica metodológica da inovação por meio de serviços técnico-científicos especializados]

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Received: 04/04/2023.

Accepted: 05/24/2023

ABSTRACT

Introduction: Science management based on innovation in high-performance sports constitutes a present-day priority. This paper derives from an initial diagnostic that unveiled the scientific problem: How to contribute to introducing innovation in high-performance sports in the context of Guantanamo?



Aim: To design a theoretical-methodological conception based on an innovative methodology through scientific and technical services that promote high-performance sports in Guantanamo province, with a novel integrating and renovated approach.

Materials and methods: Several theoretical, empirical, mathematical, and/or statistical methods were used in this study. The population consisted of 32 coaches and 31 directors, totaling 62 individuals.

Results: A higher commitment was observed to the introduction of innovation in high-performance sports. The innovation category system's relations were identified with the implementation of special scientific and technical services.

Conclusions: The theoretical-methodological conception proposed confirmed its theoretical and practical usefulness to address the problems associated with the introduction of this innovation, with a particularly novel approach and set of categories designed to seek systematic and continuous insertion depending on its horizontal and vertical articulation that rely on innovation principles established to achieve that end.

Keywords: innovation, special services.

RESUMEN

Introducción: la gestión de la ciencia a partir de la introducción de la innovación en los deportes de alto rendimiento constituye una prioridad en la actualidad. en el presente trabajo se parte de un diagnóstico inicial, lo cual permite formular el problema científico: ¿Cómo contribuir a la introducción de la innovación en el deporte de alto rendimiento en el contexto guantanamero?

Objetivo: diseñar una concepción teórica metodológica concretada en una metodología de innovación mediante servicios científicos técnicos especializados para el alto rendimiento en el contexto guantanamero a partir de una nueva mirada con un enfoque integrador y renovador.

Materiales y métodos: durante la investigación se utilizaron métodos científicos teóricos, empíricos y matemático y/o estadístico, los cuales fueron aplicados a 32 entrenadores y 31 directivos para un total de 62 sujetos.



Resultados: se logró un mayor grado de compromiso con la introducción de la innovación en el deporte de alto rendimiento, se identifican las relaciones que se establecen entre el sistema categorial de la innovación mediante servicios científicos técnicos especializados.

Conclusiones: la concepción teórica metodológica propuesta se revela, tanto en la teoría como en la práctica una solución de la problemática relacionada con la introducción de la innovación, al considerarse un nuevo punto de vista y el conjunto de categorías, las cuales se diseñan en función de que su inserción sea sistemática y continua a partir de su articulación horizontal y vertical sustentadas en principios de apoyo a la innovación, elaborados para el logro de ese fin.

Palabras clave: innovación, servicios especializados.

RESUMO

Introdução: a gestão da ciência a partir da introdução da inovação no esporte de alto rendimento é uma prioridade hoje. No presente trabalho partimos de um diagnóstico inicial, que nos permite formular o problema científico: Como contribuir para a introdução da inovação no esporte de alto rendimento no contexto de Guantánamo?

Objetivo: desenhar uma concepção teórica metodológica materializada em uma metodologia de inovação por meio de serviços técnico-científicos especializados para alto desempenho no contexto de Guantánamo desde uma nova perspectiva com um enfoque integrador e renovador.

Materiais e métodos: durante a investigação foram utilizados métodos teóricos, empíricos, matemáticos e/ou científicos estatísticos, aplicados a 32 treinadores e 31 dirigentes num total de 62 sujeitos.

Resultados: foi alcançado um maior grau de comprometimento com a introdução da inovação no esporte de alto rendimento, foram identificadas as relações estabelecidas entre o sistema categórico de inovação por meio de serviços técnico-científicos especializados.

Conclusões: a concepção teórico-metodológica proposta revela, tanto na teoria quanto



na prática, uma solução para os problemas relacionados à introdução da inovação, considerando um novo ponto de vista e o conjunto de categorias, que são desenhadas a partir de que sua inserção é sistemático e contínuo com base na sua articulação horizontal e vertical sustentada por princípios de apoio à inovação, elaborados para atingir esse fim.

Palavras-chave: inovação, serviços especializados.

INTRODUCTION

Research on innovation internationally was pioneered by Schumpeter (1934), who considered it a new production role in his innovation-related theories. Later, Rosenberg (1994); de Hechavarría (1999), and Lundvall (2009) mainly focused on adjusting basic definitions associated with innovation and its typologies. Meanwhile, Castillo (1999) said that innovating entails not only the production of a new product or form of production. Innovation takes place through the creation of organizations, and by completing certain tasks in particular ways. Moreover, Núñez J (2003) studied the vision of innovation as a social process. These authors also offered a broad set of opinions about innovation.

With that perspective, other outstanding contributors, such as Salazar *et al.* (2013), noted that social innovation is the application of novel ideas, concepts, products, services, methodologies, and practices that promote higher life quality. Bortagaray studied responsible innovation in detail and also considered endogenous innovation in municipalities since it favors the appropriate insertion of scientific and technological advances into society.

Nationally, Escalona (2008) referred to a strategy for the introduction of results in science and education. Castellanos (2005) presented a model for the introduction of scientific and technological results. Chirino (2007) suggested a set of actions for the introduction and dissemination of research results. Meanwhile, Addine, *et. al.* (2020) referred to didactic innovation in the teaching-learning process. In turn, Díaz-Canel (2021)



suggested an innovation-oriented government management model. These contributors provided strategies and procedures for innovation from different perspectives. Hence, the new tools designed are insufficient to fulfill the aim of this research.

In physical culture and sports, Caballero (2016) introduced a system to evaluate the quality of high performance in sports services. The two were oriented to evaluating sports service quality. It confirms the need for related studies.

The introduction of innovation through scientific and technical services in high-performance sports requires planning, organization, implementation, and control of every activity held by this organization. However, certain shortcomings were unveiled, which hinder quality, since the main scientific results in sports (innovations) are not always considered despite their relevance and need.

Another problem affecting the introduction of innovation and therefore, threatening necessary changes, is the lack of detailed research and ruling documents, as well as the theoretical platform that belongs to this process, by directors and coaches. Likewise, there was no renovating approach that favors the spreading of the main scientific, technical, and research results, thus several different theoretical and practical conceptions can be found in high-performance sports.

It was corroborated by means of empirical studies, along with the author's experience as a methodologist in the Provincial Office of Sports, Physical Education, and Recreation in Guantanamo, who also is in charge of teaching. Among the main weaknesses, the following stood out:

- Theoretical, practical, and methodological shortcomings for the introduction of innovation through scientific and technical services in high-performance sports.
- Poor materialization of innovation based on strategic alliances between local bodies for the introduction of innovation through scientific and technical services in high-performance sports.



- The lack of structural and functional relations in science and innovation for the introduction of special scientific and technical services in high-performance sports.

The previous creates a contradiction between the insufficient introduction of innovation in science management for high performance and the need for its inclusion associated with the new demands of contemporary sports.

Accordingly, the aim of this paper is to design a theoretical-methodological conception for the introduction of innovation through scientific and technical services in high-performance sports at the Rafael Freyre Torres Starter Sports School, in Guantanamo.

MATERIALS AND METHODS

The following methods were used in this investigation:

Theoretical methods:

Analytical-synthetic, inductive-deductive to determine the theoretical elements of innovation adjustment and the design of the theoretical-methodological conception of particular conditions for high-performance sports. The systemic-structural-functional method was used to determine the structural and functional elements of the theoretical-methodological conception and the relations of all its components.

Modeling was necessary to model the theoretical-methodological conception and the methodology.

Empirical methods:

Observation, surveys, and interviews, to observe the scientific-methodological preparation for the introduction of innovation through scientific and technical services



in high-performance sports at the Rafael Freyre Torres Starter Sports School, in Guantanamo.

Documentary analysis to corroborate the introduction of innovation.

In-depth interviews of coaches to detect changes and the evolution through the implementation of the methodology.

Socialization workshops were conducted to facilitate the spreading of new contributions and the collection of reliable information.

Expert opinion was helpful to know the opinion of experts about the theoretical-methodological conception and about the methodology, for feasibility analysis.

Pre-test (pre-test-post-test in a single group) to evaluate the feasibility of the methodology.

The methodological triangulation permitted a contrast of the results from the experts' opinions, pre-test, and socialization workshops.

Mathematical-statistics methods:

Descriptive analysis (proportion calculation) and inferential to quantify the results of the instruments used throughout the research, and for data processing. The absolute and relative frequencies were estimated, and the sign rank test was conducted.

In terms of variable operability, the discussions with specialists, as well as synthesis, reflection, and generalization, the theoretical domain was thought to extend over the conceptual, procedural, and behavioral dimensions.



RESULTS AND DISCUSSION

The theoretical-methodological conception of the introduction of innovation through scientific and technical services in high-performance sports consists of the following structure: objective, rationale, new standpoint, categories, and characterization. They include an explanation of the theoretical and methodological components exposed in their relations.

It has two components: theoretical and methodological. The former is made of these categories: Innovating incentives in high performance, scientific and technical services with a renovating approach, advanced settings, strategic surveillance, and follow-up of scientific and technological breakthroughs. It offers a characterization of each, based on the three supporting principles of innovation.

The latter comprises the methodological stages for the introduction of innovation through scientific and technical services in high-performance sports: diagnostic for the introduction of innovation with its several phases, including information sensitization, collection, and processing; planning of actions for innovation introduction; and stages for instrumentation and evaluation of actions for the introduction of innovation. It also includes methodological aspects for the introduction of innovation and advanced projections. The following schematic representation permits a better understanding of the theoretical-methodological conception proposed.

With that perspective, the theoretical-methodological conception of the introduction of innovation through scientific and technical services in high-performance sports is defined as the theoretical and methodological notion to introduce innovation through scientific and technical services with a renovating approach, which reveals new categories synthesized by innovation-based principles that show emerging behaviors and a renovating role (Figure 1).

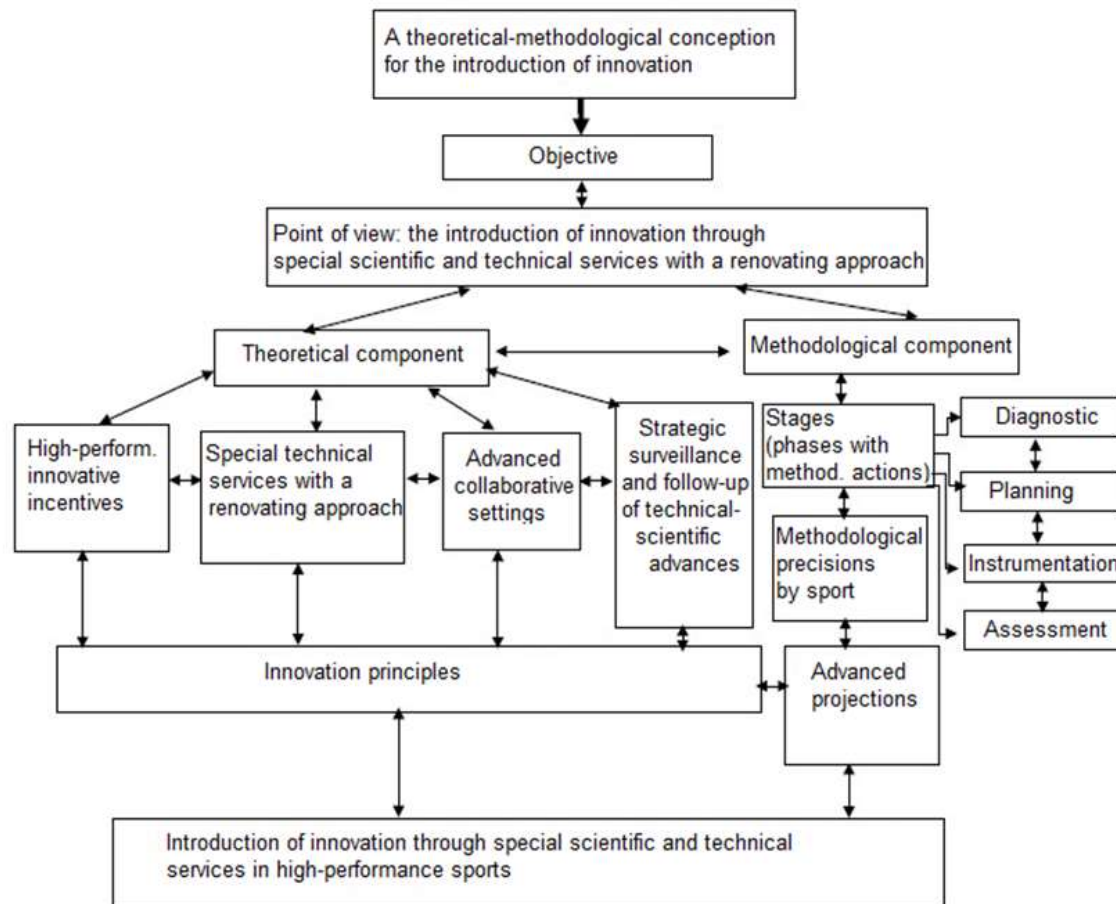


Fig. 1. - A Theoretical-Methodological Conception of Innovation through Scientific-Technical Services

The theoretical component permits the systematization of essential relations set between the different theoretical contents held in the conception. It is based on a new standpoint in which the introduction of innovation and relations between this new look and the categories dealt with epistemologically, are closely related to the principles declared, which are the basis for the design of three innovation-supportive principles.

The methodological component of the methodological conception permits the practical systematization of elements containing the theoretical component for the introduction of innovation, which, in turn, permits the existence of new stages and phases contained in the order, through methodological actions in every sport.



Stage description:

- Information collection consists of searching for the level of knowledge for the introduction of innovation. The search ways are observation of methodological, scientific, and research activities conducted by directors and researchers, as well as the conception of methodological work to achieve that aim.
- A diagnostic is performed to measure the coaches' mastery of theoretical and methodological knowledge about the introduction of innovation, in addition to the work performed in every sport for further implementation, and its conception within the prospective athlete's individual work plan (API).
- API diagnostic focuses on APIs innovative needs. The information enabled the implementation of methodological actions and the fulfillment of the goal proposed in the investigation. The results of science-research activities were analyzed by sports, depending on the API levels. This phase relies fully on the collective assessment by the methodological bodies and the determination of group and individual regularities.
- Information processing aims to process information to determine innovative needs based on the regularities spotted and the projection of actions into the second stage.

The action planning stage for the introduction of innovation.

The training actions for directors and coaches can be planned upon the previous stage results. It tackles the planning of actions to achieve scientific and technical services with a renovating approach.

The training actions will depend on the execution of scientific and technical services. Additionally, a new training program is being designed currently to cope with aspects associated with the categories recommended in the theoretical components.



In planning, the training level acquired by directors and coaches should be checked; it intertwines with the suggested components for the implementation of actions. The design will stress the organization of the research results, and advanced experiences that contribute to the introduction of innovations directly. The methodological actions to be planned comprise the said services, methodological meetings in every sport, the Councils of Science and Innovation in Sports (CCID), and the execution of methodological workshops linked to the introduction of innovation and the design of a methodological chart for the implementation of services, according to their typology, and the principles that back innovation as an expression of the dynamic of this methodology.

Action implementation stage for the introduction of innovation.

The goal is to describe the methodological instrumentation to guide directors and coaches to implementing actions, follow-up, and partial assessment of the introduction of innovation through strategic surveillance and follow-up of scientific and technical advances.

It details every planned activity with its respective methodological instrumentation. Accordingly, the training program of directors and coaches and the implementation of scientific and technical services plan based on their typology takes place.

This stage begins with a methodological meeting.

It permits discussions among directors and coaches about the achievements and weaknesses in terms of the introduction of innovation, and then coherent organization can occur in every sport. Then, there will be methodological workshops for the systematization of the theory around the introduction of innovation to contribute to theoretical and practical knowledge of the individuals, through scientific and technical services in every sport.

Evaluation of the methodology for the introduction of innovation.



It aims to evaluate actions designed for the introduction of innovation through scientific and technical services in high-performance sports with a renovating approach. During this stage, there is a general assessment of the effectiveness of the actions suggested for the introduction of innovation expressed in the theoretical-methodological conception.

Examples of the proposal:

Innovation to be introduced: Cinematic analysis of the different types of throws to enhance pitching techniques in baseball.

1.- Special opening scientific and technical service.

Objective: To enable baseball directors and coaches to access state of the art of cinematic analysis of the different types of throws to enhance pitching techniques.

Didactic-methodological procedure:

- Start with a question: What are your expectations about this service?
- Choose a record keeper.

On teams, the subjects will receive a worksheet with different indications. It will be based on the concept of the model, the cinematic analysis model will be defined, highlighting the aspects that make it up.

The subjects will be asked to include the missing word or words associated with the topic and provide their arguments.

These terms should be arranged depending on their relation to the concepts expressed herein, and then to design new definitions in keeping with the standpoints.

Then, the concepts will be associated depending on their complexity and the argument explaining why they are arranged like that.



Finally, this service will let them know the state of the art about the different throws in baseball, their analysis will be based on the model to be introduced, and they will be asked to illustrate how this is manifested in their sport, in addition to detailing its incidence in daily practice.

2.- Special experimental scientific and technical service.

Objective: To enable baseball directors and coaches to access state-of-the-art cinematic analysis of the different types of throws to enhance pitching techniques.

Didactic-methodological procedure:

- Begin with the following question what are the expectations in terms of the innovation to be introduced?
- The subjects will be asked to elaborate on an idea based on the previous service, which could be conclusive, integrative, or explicative.
- Then they will talk about their ideas, which will be used as the main topic during the service. The best ideas will be shared with all the other participants.
- A cinematic analysis of the different types of throws is shown.

In teams, the subjects will be asked to create game situations, using the cinematic analysis of the different types of throws. These actions will be implemented in the practice of a sport, using API.

In the end, the record keeper will read a report of the facts, assessing the activity and evaluating all the participants according to selected criteria.

- Note: evaluation criteria.
- Topic suitability.
- Originality.



This service will let them know the state of the art about the different baseball throws. The subjects will be asked to illustrate how this is manifested in their sport, in addition to detailing its incidence in daily practice.

3. Concluding a special scientific and technical service.

Objective: To assess the implementation of the model of cinematic analysis of the different types of throws to enhance pitching techniques in baseball.

Didactic-methodological procedure:

The chosen coach receives a worksheet with the following orders: you are in charge of beginning or ending today's service to fulfill several duties, such as going over the main aspects dealt with in previous meetings, ensuring the beginning of the ideas expressed previously, and running the conclusions.

All the participants will receive a strip of paper on which they will write their opinions about the services received their level of satisfaction, and proposals to improve them (anonymous).

All the opinions will be read to all the participants and will be taken into account to redesign the services provided.

The record keeper reads the report about the three previous sessions.

The feasibility evaluation of the theoretical-methodological conception implemented in the methodology through expert opinion, such as

- The new point of view assumed for the introduction of innovation constitutes a relevant contribution.
- The features of the categories suggested in the theoretical-methodological conception, and their utilization in high-performance sports.
- The determination of typologies of scientific and technical services in every sport.



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- The cyclical and ascending character of typologies of scientific and technical services in every sport.
 - There is coherence between the conception and the methodology, as well as their relation between the theoretical and methodological components.
 - The methodology is feasible, and the structure based on stages and phases and corresponding methodological actions are pertinent.
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 - The methodology is feasible, and the structure based on stages and phases and corresponding methodological actions are pertinent.

The application of the pre-test resulted in improvements in the aspects related to innovation theory dealt with by the speakers in every activity. Combined, they helped compare the knowledge acquired to the previous stages.

The main transformations are written below.

- Coherent presentation of the category system associated with the introduction of innovation by directors and coaches.
- Mastery of the main relations that could be set between the category system of the introduction of innovation in high-performance sports through a number of examples of special scientific and technical services in selected sports.
- The inclusion of actions in projects related to control, follow-up, and evaluation of the introduction of innovation by implementing a methodological projection and the indicators recommended in the theoretical-methodological conception.
- The inclusion of topics related to the introduction of innovation in the working system, such as the adjustment level of scientific, technical, and research results.
- The introduction of innovation as a process is shown in the sample of scientific and technical service types.
- The systematic orientation of cyclical and ascending treatment given to the different typologies of scientific and technical services resulted from quality innovation introduction.



As seen so far, there are several opinions about the introduction of innovation in different social processes where man constitutes the pivotal element, in keeping with the contributions of Schumpeter (1934) through Escalona (2008), who emphasized the strategy for introducing results in science and education, since they evidenced their necessity of making new changes to the way a new product is treated (process innovation).

However, these authors introduced several research criteria in this investigation, though they pose general conceptualizations. Based on that perspective, sports contextualization is required to tackle the many theoretical limitations and gaps immediately.

In that direction, several authors have made research efforts in favor of the introduction of innovation, such as Díaz-Canel (2021), who said that innovation is linked to government management supported by quality by the government, such as innovation with a preventive approach toward sustainable development.

Hence, greater emphasis should be placed on the different areas that contribute to Cuban society, such as the constant adjustment in sports based on the introduction of innovation, as an indispensable requisite to get improved results in every sports scenario, as an expression of the long road to high performance.

In that direction, Millán (2016) warned of the need for further work on the introduction of innovation in sports. However, this paper calls for contextualization of such priority in high-performance sports, according to the diagnostic conducted and the completion of several goals in the theoretical-methodological conception for the introduction of innovation through scientific and technical services in high-performance sports at the Rafael Freyre Torres Starter Sports School, in Guantanamo.



CONCLUSIONS

The systematization of theoretical referents about the introduction of innovation evidenced several theoretical knowledge incoherences that demand an approach change to meet the particularities and requirements of science and innovation management in high-performance sports activities.

The empirical queries conducted at the beginning of this research evidenced the lack of systematicity in the introduction of innovation through scientific and technical services in high-performance sports. Besides, their cause lies mainly in the theoretical shortcomings of coaches to implement a working conception that favors emerging behaviors using a renovating behavior.

The new conception reveals that both in theory and practice, there is a possible solution to the problems associated with the introduction of this innovation, with a particularly novel approach and set of categories designed to seek systematic and continuous insertion depending on its horizontal and vertical articulation that rely on innovation principles established to achieve that end.

The results observed upon the implementation of the methodological triangulation following expert opinion, the pre-test, and discussion workshops, revealed the feasibility of the theoretical-methodological conception and of the methodology in the current Rafael Freyre Torres EIDE, in Guantanamo, thus corroborating the hypothesis.

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Conflict of interest statement:

The authors declare having competing interests.

Author contribution statement:

The authors have participated in the redaction of the manuscript and the documentary review.



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