

Key Features of Technological Surveillance Systems: A Comparison Between Cuba and the Global Context

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ABSTRACT

The proposal of technological surveillance systems in various sectors, both in Cuba and internationally, has been an area of knowledge that has evolved. This research intends to delve deeper into the particularities that distinguish technological surveillance systems, so that organizations that plan to design this type of system know what aspects they must take into account. A total of 21 technological surveillance systems were identified. The elements that were used to describe them were: institution to which they belong, diagnosis of technological surveillance, processes of technological surveillance, norm or model of technological surveillance, system roles, products/services, dissemination of the results of technological surveillance, platforms for the management of technological surveillance and evaluation of the operation of the system. Documentary analysis was used to identify and analyze the various sources of information to analyze the theoretical aspects and distinctive elements of the technological surveillance systems under study. The main results showed that the elements that coincide in the structure of this type of system are: stages of the technological surveillance process, purpose of the technological surveillance systems, sources of information used, definition of roles, information products/services and platforms. for the management of technological surveillance systems.

Keywords: technological surveillance systems; technological surveillance; Cuba; at international level

INTRODUCTION

Technology surveillance (VT) has evolved and focuses on three directions: ¹ the first to describe the concept and implications for organizations; the second in pointing out tools, resources and models for its application. The publication in 2006 of an experimental standard that allows its certification and serves as a guide for its application, UNE 166006:2006 EX (modified to its definitive version in 2011) stands out as a fundamental milestone in the application models. , ^{2,3} from which various works emerged that analyzed the standard and how to carry out a certifiable VT. The third is aimed at collecting individual application experiences in various companies and research centers. These practices analyze the composition of the department that executes the VT, the phases and computer resources that are used and the products they generate. The main contribution of these works is to serve as an example to similar organizations for their application.

Taking the third direction as a reference, the development of technological surveillance systems (SVT) represents one of the individual application experiences in various organizations. "These systems are integrated into the management system of an organization. It manages all the means and resources necessary to carry out the VT and competitive intelligence process. It is responsible for supporting R&D&i. Among the benefits what it brings to the organization is reinforcing strategic decision making". ⁴

This research aims to characterize the SVT in the Cuban and international context in order to identify the elements that characterize them. This objective is carried out to delve into the particularities that distinguish the SVT, with the purpose that the organizations that have among their projections to implement them, know what path they can follow based on the theoretical references consulted in this study.

THEORETICAL FOUNDATIONS ABOUT TECHNOLOGICAL SURVEILLANCE SYSTEMS

One of the most complete concepts about SVT is the one proposed by the authors *Salgado Batista*, *Guzmán Sánchez*, and *Carrillo Calvet*.⁵ These authors state that an SVT is a "structured system that allows coordinating the activities of information retrieval, processing, analysis and dissemination, both of internal and environmental information, all in accordance with an organizational plan and strategy." ". For their part, other authors have a more technological approach and a more collaborative vision of SVTs. They state that "it is a collaborative tool, where access by all members to a certain platform is necessary to enter information of organizational interest, as well as to consult documents."⁶

The authors *Escorsa Castells*,⁷ *Morcillo*,⁸ *Salgado Batista* and others,⁵ *Rey Vázquez*⁹ and *Guerrero Pérez*¹⁰ agree that the stages of the SVT process are broken down into the search, processing, analysis and dissemination of internal and external information. They make it explicit that their purpose for companies and managers is to prevent technological and competitive threats existing in the environment, and to analyze an alert on certain critical aspects. *Morcillo*, for its part, lists in detail typologies of information sources that can be used in the search processes.⁸ It coincides with the concept established by the UNE 166006: 2006 standard by reflecting in the SVT the presence of resources and means that are necessary to carry out surveillance.^{eleven}

METHODS

DOCUMENTARY ANALYSIS

The identification and analysis of the various sources of information was carried out to analyze the theoretical aspects and the distinctive elements of the SVT

available in the literature.

The strategy used to develop this work was the following:

- The search strategy was established based on the keywords "technological surveillance systems".
- Google Scholar, the EBSCO database and the proceedings of the International Information Congress, Info 2002, 2004, 2012 and 2014, as well as the International Workshop on Business Intelligence and Knowledge Management in Business, were used as sources of information. IntEmpres 2002, 2004, 2012 and 2014 *.
- After the search, a total of 21 SVTs were recovered (15 in the national context and 6 in the international context). The sample was drawn considering as valid the theoretical references that included a detailed description of the SVT and its components. From the sample, the analysis was carried out considering the following elements: institution to which the SVT belongs, diagnosis of the VT, stages of the VT process, standard of the VT or Model of the VT, system roles, products or services , dissemination of the results of the VT, platforms for the management of the VT and evaluation of the functioning of the system.
- To distinguish the theoretical aspects addressed by the authors consulted about the concepts about SVT and its relationship with VT, a conceptual map was designed. For this the Cmap Tools tool was used.

Through Figure 1, a Abstract of the main elements defined in an SVT is made based on the concepts stated by the consulted authors and the relationship with the VT is established.

ELEMENTS OF A TECHNOLOGICAL SURVEILLANCE SYSTEM

According to *Vergara*¹², 4 fundamental components have been considered:

1. Monitoring of competitors.

2. Technological surveillance.
3. Regulatory oversight.
4. Commercial surveillance.

This author recommends that these components should be merged to form part of the strategic surveillance of the organization and serve decision making. An SVT must take into account the needs of executives, the strategic objectives of the organization, the definition of each phase of the process and the corresponding selection of information sources. It is essential to define the type of computer tool that is best suited for each situation. It must be adapted to the company's environment and culture, and must be integrated into its normal procedures.¹³⁻¹⁵ The aforementioned aspects determine that the SVT includes:⁵

- Purpose of the system.
- Recipients.
- Aspects to monitor.
- Origin or types of sources necessary.
- Products to be offered, according to added value (level of depth in reports or information analysis, comments and recommendations).
- Response time, measured from the request.
- Mode of dissemination of results.
- Modalities of readjustment or interactivity.
- Service evaluation.

The proposed aspects facilitate the planning of an SVT that, merged with the organization's procedures, improves the company's strategy, alerts about changes or threats - especially those that may affect its position in the market -, identifies possible knowledge, new applied technologies, equipment, competitors and customer preferences.¹⁶⁻¹⁸

Therefore, an SVT must respond to the organization's strategy. For this, models,

methodologies, techniques, standards and technological platforms must be used. Furthermore, it must be adapted to the sector where it is implemented, as this determines the type of surveillance that must be carried out.

ANALYSIS OF THE RESULTS

CHARACTERIZATION OF SVT AT THE NATIONAL AND INTERNATIONAL LEVEL

To characterize the SVTs and determine their distinctive elements, a total of 21 SVTs were identified (15 systems in the Cuban sphere and 6 internationally). Figure 2 shows the main sectors and institutions to which the systems under analysis belong.

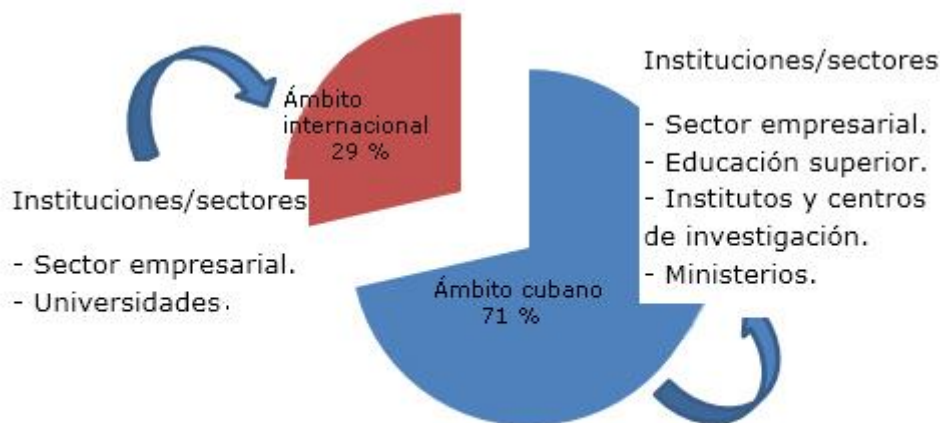


Fig. 2. Instituciones y sectores de los Sistemas de Vigilancia Tecnológica identificados.

At international level

The geographically identified SVTs are located in Colombia and Spain. In the Spanish context they are located in the aquaculture sector, in the agri-food sector, in ferroalloys and in biotechnology. In Colombia it is limited to the sector of small and medium-sized businesses and universities.¹⁷⁻²² In the SVTs analyzed, the VT process differs in the number of phases, activities or stages it contains, which fluctuate between four and six. The phases of identification of needs, identification of information sources, search, analysis of information and

dissemination coincide. Some systems use the stages defined in the process of Standard UNE 166006:2006 Ex. ²

The purposes of the SVT are aimed at monitoring the behavior of competitors in the sector, monitoring aspects related to the advancement of technologies, identifying emerging technologies and those that are obsolete, recognizing the lines of research that are being carried out and which ones are already developed, and propose strategies or policies to carry out improvement processes in organizations. The sources of information used in the search process are: metasearch engine called COPERNIC AGENT, with its complements COPERNIC TRACKER and COPERNIC SUMMARIZER, to search the database of scientific publications such as Scopus and Compendex, WIPO patent database, internal information of the company, free and paid resources available on the Internet. ^{19,22,23} In the Spanish aquaculture sector, research centers act as engines of information transmission. ¹⁷ The use of experts, fairs, events, as well as blogs and forums is evident.

The role of VT expert, entrepreneur or decision maker, VT coordinator and system administrator prevails. The possible causes for the proposal of these roles are the automation of VT processes and that they respond to the business sector. It is perceived that the surveillance actors are made up of a multidisciplinary team of professionals from computer sciences, information sciences and specialists from each thematic area of the sector. They share their results through newsletters, reports and alert services.

Three of the SVTs have their VT support platforms. The Colombian small and medium-sized business sector and the Spanish agri-food sector have their automated SVTs. ²² Colombian universities define a technological platform in the design of their SVT. In the case of FERROATLÁNTICA SL, in Spain, they have a management system made up of a physical library and a system set up

with external information BD web technology.⁹ The theoretical references consulted do not explicitly reflect the evaluation stage of the operation of the SVT, although it is inferred that these companies use the results obtained for decision making with the aim of being more competitive in the market and generating income. They use web 2.0 tools, such as the use of social networks, wikis, redistribution of content through syndication channels (RSS), blogs and forums.

National scope

In Cuba it is notable that the evolution of SVT is distributed in different sectors of society. The Ministry of Higher Education prevails with the design of SVT in universities, such as the University of Computer Sciences (UCI), the Instituto Superior Politécnico José Antonio Echeverría (ISPJAE), the University of Holguín and the Central University of las Villas.^{13,14,23,24,27,29} The Ministry of Information Technology and Communications has stood out with the support of its D'ICT Platform.²⁵ In the business sector, they are implemented in the sugar agroindustrial company, the Industrial Works Construction Company No. 8 belonging to the central region of the country and the Food Industry Research Institute (IIIA).^{5,24} In the eastern zone, these systems are implemented in the CIGET of the Granma province.³⁷ Some of the research centers that work on the topic are: Research Center of the Institute of Cybernetics, Mathematics and Physics (ICIMAF), the Research and Development Center of the Ministry of the Interior and the "Indio Hatuey" Experimental Center.^{33,36.}

Distinctive elements

The elements that prevail in the SVT in the Cuban context are: stages of the VT process, diagnosis of the VT situation, purpose of the system, sources of information, roles of the system, dissemination of results, information services/products, evaluation of the operation of the system and platforms for

the management of VT. The VT process performed varies in the number of stages. The phases of identifying information needs, searching, processing and validating information, as well as disseminating the results, coincide in all systems. In five organizations ' the definition of the stages of the SVT process is supported by the surveillance standards AFNOR XP ^{5,24,27,28}

In the information validation and selection stage, variables and indicators are proposed that can serve as a guide in the SVT of institutions in various sectors and fields. The authors who have addressed the topic in the SVT analyzed propose the following:

- Current content.
- Types of tools available.
- Number of specialists in a branch of knowledge. The purpose of this indicator is to have a portfolio of reliable experts who serve as support in the validation phase of the VT product.
- Volume of information captured by the tools for the information storage and analysis phase.
- Delivery times of the information product.
- Levels of impact that information products will have on decision making.
- Typology of information sources: the indicators that would be taken into account for their selection would be framed based on cost, accessibility, geographic coverage and updating.

Of the total SVTs, only five systems propose the diagnosis of the VT situation among their phases. ^{5,27,29-31} In this stage, the organization is characterized in terms of product and service portfolio, business plan, organizational structure, strategic planning and objectives, among others. Another of the actions carried out is an audit of the fundamental aspects of the VT, knowing the professional level, the company culture, the markets, the competition, as well as conveniently

interpreting the company's organizational chart, the functions performed by each part and identify the strengths and weaknesses that are the input for the design of the SVT.

The state of existing information resources, specifically information technologies, is analyzed with the purpose of carrying out a survey of internal and external information resources, such as documentary and non-documentary sources. In this phase, it is recommended to use techniques such as direct observation, surveys, interviews, the structured questionnaire and the Likert scaling method, with the category from 1 to 5. The information collection technique they recommend is the survey. on the fundamental aspects of VT proposed by *Palop and Vicente* ,³² adapted to the conditions of each context.

In the bibliographic review carried out on the SVT, it was evident that the purpose of the SVT responds to increasing market knowledge, detecting opportunities and threats, identifying emerging technologies and developing new technologies, analyzing the behavior of R&D&i in the sectors. business and higher education, facilitate the research work of academics, reduce risks when detecting competitors or incoming or substitute products and facilitate the incorporation of new technological advances to the products and processes themselves.

The sources of information used in SVTs depend on the technological conditions of the organizations. The use of search engines, metasearch engines and specialized databases is evident. One of the common aspects for most of these systems is the use of scientific and patent databases. It is interesting that, in addition to the use of external information, they use internal information and the use of experts as sources of information.

In the university context, the role of information seekers and the inclusion of high-performing students is distinguished. The staff in charge of the SVT to

perform these functions must be good communicators, possess computer and documentation management skills, show initiative, etc. The research analyzed explains the functions and skills of surveillance roles.^{5,13,25,33} The diversity of roles is in correspondence with the objective, the particularities of each system and the human resources available in each organization. The following roles converge in the systems: decision-makers, internal and external experts, observers and analysts.

The channels used to disseminate the results are:

- Automated network of the organization.
- Organization email.
- Directly personally.
- Telephone conversations, meetings.
- Company website.
- Internal network.
- Intranet.

The variety of information services/products that predominate as a result of the SVT are reports, newsletters, trend studies and strategic profiles. Other products that have been generated are : value-added information products, databases of experts and offers, thematic maps, technological profiles, information compendiums, reports and strategic plans for the introduction of organizations/companies or products in a country. or geographic area. With respect to services, information monitoring and alert services coincide in several institutions. The little use of content syndication channels is evident. In the context of higher education, it is worth highlighting the preparation and distribution of VT reports, newsletters, informative compendiums, trend, market and competition studies.

In evaluating the functioning of the system, the SVT studied propose the survey

as a technique, and the questionnaire as an instrument. In general, it is recommended that this stage should be evaluated periodically to confirm if it meets its objectives and if it provides benefits in the management of organizations, the increase in R&D&I, as well as the availability and use of information. Its purpose is to improve and refine the decision-making process.^{5,13,24,2730,31,35,36} However, no proposals for indicators that can be used are provided, which represents a knowledge gap on this topic.

Cuban organizations, in accordance with their technological conditions, have developed their platform proposals to manage VT. The typology of computer applications that prevails are databases, portals and observatories. Among the institutions that have these technological facilities are the Research Institute for the Food Industry (IIIA), with the design of a database (DB) on regulations associated with foods of interest. The virtual library supports the surveillance axes through informational products;⁵ The CIGET of the Granma province has a database of technologies and technological offers and another for experts.³⁷

The Ministry of Information Technology and Communications (MIC) has its D'TIC platform. Its objective is to have a space that brings together the information resources of greatest interest to specialists in the ICT sector and that virtually facilitates communication and the exchange of knowledge and information between them.²⁵ The "Indio Hatuey" Pasture and Forage Experimental Station Research Center has the Internet-Intranet-Extranet platform.³⁶ The UCI has Vigitec Technological Observatory⁶ and the ISPJAE has "Tricia", a collaborative platform that has wiki and social network characteristics.²⁹ The proposal of models for the SVT is evident in a total of 5 references, which are individualized according to the characteristics of each organization.^{30,31,33,36,38}

The examples of platforms analyzed serve as a reference to carry out a diagnosis

of the technological and human resources conditions in organizations that, with favorable conditions, can determine which are the ideal platforms in each context.

CONCLUSIONS

After characterizing the SVT at the national and international level, it is concluded that the VT has evolved towards the collection of individual experiences of application in various companies and research centers and its main contribution is to serve as an example to similar organizations for its application. . The design and implementation of these systems demonstrates the benefits they have for decision making and how they can support the fulfillment of strategic objectives. In Cuba they stand out in the higher education sector and in the business sector and how they have increased in recent years. This demonstrates the importance and impact it has within the framework of the R&D&I management systems of Cuban organizations.

The definition of the stages of the analyzed SVTs mostly coincide with the stages proposed by the surveillance standard AFNOR XP This demonstrates the level of formalization and structuring of the process. The elements that characterize these systems converge among the stages of the VT process, the purpose of the system, information sources used, definition of roles, information products/services and platforms for VT management.

In recent years, the role of systems administrator has emerged as a result of the implementation of technological tools in different application contexts. Technological tools to support VT systems mostly respond to the dissemination or distribution stage of information, but the use of tools for information processing and analysis is still insufficient.

Despite practical experiences, there is little theoretical discussion about

SVTs; This represents a gap in knowledge and opportunity for the community that investigates this topic, especially for research that is related to the proposals of indicators for the evaluation stages of system operation and the selection and validation of information.

CONFLICT OF INTERESTS

The authors declare that there is no conflict of interest in this article.

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