SciencePG
Science Publishing Group

Information Architecture Proposal for a Science, Technology and Environment Web Page in Villa Clara, Cuba

Gretter Beatriz Andreu Moya[*], **Danelys Zamora Suri**[*], **Katia Mayuli Alonso López**

Information and Technological Management Center, Villa Clara, Cuba

Email address:
gretterandreu@gmail.com (G. B. A. Moya), nani.vcl@gmail.com (D. Z. Suri)
[*]Corresponding author

To cite this article:
Gretter Beatriz Andreu Moya, Danelys Zamora Suri*, Katia Mayuli Alonso López. Information Architecture Proposal for a Science, Technology and Environment Web Page in Villa Clara, Cuba. *International Journal of Information and Communication Sciences.*
Vol. 6, No. 4, 2021, pp. 93-100. doi: 10.11648/j.ijics.20210604.12

Abstract: Introduction: The Information Architecture aims to make more visible and organized all contents on the web in order to facilitate access to information. Objective: to propose an information architecture for the web page of the Territorial Delegation of the Ministry of Science, Technology and Environment in Villa Clara, Cuba. Materials and methods: the research was developed with a mixed approach and was classified as descriptive. Historical-logical, analytic-synthetic and systemic-structural methods were used as theoretical level methods, and documentary analysis and survey were used as empirical level methods. Questionnaires, interviews and Card sorting techniques were used for the triangulation of the results. The methodology of Pérez-Montoro 2010 was adopted, applying three phases proposed by this author: analysis, design and implementation. Results: factors that made it necessary to propose a new web page were identified, as well as the objectives it pursues. The web page was designed based on the user study carried out, taking into consideration the criteria of those surveyed. The information architecture guidelines and their evaluation contributed to organize the contents to be included in the web. Conclusions: with the use of Information Architecture techniques and tools, relevant data were obtained for the design and improvement of the web page contents, which contributed to increase the visibility of science, technology, innovation and environment results of Villa Clara territory in Cuba.

Keywords: Information Architecture, Web Page Design, CITMA, Villa Clara, Cuba

1. Introduction

With the emergence of Internet, the development of Information and Communication Technologies (ICTs) and the complexity of new information systems, man has felt the need to design, plan, anticipate and evaluate web environments; in order to efficiently organize, represent and retrieve the large amount of stored information. Due to this growth of information and information resources on the web, a new discipline called Information Architecture (IA) has been consolidated and developed.

All this brings with it the need to primarily use the AI discipline principles within the web, defined as: Discipline (art and science) in charge of structuring, organizing and labeling the elements that make up the informational environments to facilitate the location (or access to) of the information contained in them and thus improve their usefulness and use by users. [10]

On the other hand, Peréz-Montoro (2010) establishes several categories that are considered intrinsic in this discipline, which are defined as "documentary vocabularies or languages". He also defines them as documentary resources (thesauri, taxonomies, synonym rings, among others), which facilitate information search and retrieval. These previous criteria and user studies combined are the ones that favor the establishment of IA guidelines (organization, labeling, browsing and searching).

The term IA was first used by Richard Saul Wurman before 1975, to describe the transformation data need into relevant information. And hence, to facilitate access to this resource. In later years he has defined the term as: "The emerging professional occupation of the 21st century, devoted to the

needs of the era, focused on clarity, human understanding and the science of information organization". [13]

Although, its rise as a discipline does not happen until Rosenfeld and Morville (1998) conceptualize it as: "The combination of organization, labeling and navigation schemes within an information system". [11]

On the other hand, Hassan-Montero and Martín-Fernández (2004) understand the IA for a website as: "the result of the activity of classifying, describing, structuring and labeling the contents of the site". [4]. It is in order to obtain a final product in an organized way, which provides information in a simple and timely manner in digital spaces.

On the other hand, Dillon y Turnbull, (2005) defined IA as follows: "IA is an interdisciplinary field of practice and research". [2]

Thus, IA is related to other scientific and academic disciplines. The researcher Montes de Oca-Sánchez de Bustamante (2004) acknowledges the interdisciplinarity of this science, from the role of the information architect. He refers to the fact that IA must bring together a minimum of knowledge from different disciplines, among which the following can be identified: graphic design, documentation and information, journalism, marketing, computer science and usability engineering. [7]

Information architecture, whose purpose is the search for better designs for the presentation of information and its understanding, as well as usability. Which studies the set of characteristics of the design and operation of a user interface, to obtain a correct operation and understanding of the contents; are disciplines whose activity is aimed at achieving maximum user satisfaction during the process of interaction with information products. Structured and coherent information undoubtedly facilitates both its consultation and the process of assimilation and introduction into practice. [7]

For this reason, Information Architecture is not only graphic design, software development or usability engineering, but they are large disciplinary fields where it is nourished to form a methodology. [3]

IA is one of the disciplines of Information Science that seeks to make content more visible and organized on the web. To achieve this, the related professional must be prepared and know how to apply the techniques and methodologies of his specialty, which allow him to successfully develop his work as an information architect.

Given the relevance of this topic, several authors have contributed to its study; donde destacan la importancia del arcquitecto de la información among them are: Rosenfeld and Morville (1998), Gonzales-Cam (2003), Hassan-Montero and Núñez-Peña (2005), Hassan-Montero (2006), Ronda-León (2013), Rosenfeld, Morville, and Arango (2015).

The following are concepts of AI defined by such authors: The information architect has the function of clarifying the mission and vision of the site, balancing the needs of the sponsoring organization and those of the public; determine what content and functionality it will have. [12]

The role of an information architect is to organize large amounts of content so that the user can handle it, navigate through it easily, and meet their information needs. In other words, organize the disorder, make the information retrievable, locatable or accessible ('findability'). [5]

The Information Technology architecture of a website, as a result of the activity, comprises the content organization and structuring systems, the labeling systems for said content, and the information retrieval and navigation systems provided by the website. [6]

In the book Information Architecture for the World Wide Web by Rosenfeld and Morville (1998) they suggest: "applying the principles of architecture and documentation sciences to web site design". [11]

The Territorial Delegation of the Ministry of Science, Technology and Environment in Villa Clara (CITMA in Spanish), is integrated by seven centers, which collaborate according to the innovative activity of the institution, each one fulfilling its specific function. Although, this institution does not have an informative space that visualizes its own activity, results, science programs, projects, achievements and awards. As a result, the scientific activity in Villa Clara territory lacks accessibility on the web.

For that reason, to design a web page to visualize the work of the province in terms of science, technology, innovation and environment was necessary.

Therefore, the proposal of this IA will contribute to increase visualization of the activity of this institution and of those centers that are part of it. Hence, the objective of the study is: to propose the information architecture for the web page of CITMA's Territorial Delegation in Villa Clara, Cuba.

2. Materials and Methods

The research presents a mixed approach, where we engaged directly with people in the study population to elicit the informational priorities of the participants. Research techniques were used in a flexible way to determine the needs of potential users. From the descriptive component in the research, the different phases of the IA methodology proposed by Pérez-Montoro (2010) were explained in order to achieve the design and implementation of the final product.

Several methods were used to collect the initial information. Among the theoretical level methods, the historical-logical method was identified, which was used to establish general criteria about the study phenomenon, based on the facts recorded, and to know the antecedents and current trends concerning IA. This allowed for a bibliographic synthesis of the evolution of some terms and their derivations. An analysis of the sources reviewed made it possible to determine essential aspects related to IA and the methodology applied in the study by means of the analytical-synthetic method.

Moreover, the elements concerning to the topic addressed were determined in order to establish the relationships between information organization, labeling and navigation schemes; and thus conform the proposal for the IA of the CITMA web page in Villa Clara by means of the systemic-structural approach.

Documentary analysis as an empirical method was used in

the research for the collection of information from a detailed search on IA. Several sources of information were consulted. Among the most relevant, they could be mentioned: magazine articles and books, performing a deep search by key words and nesting, in order to obtain the necessary knowledge for the development of the study. A thorough analysis of these documents allowed the authors to apply the IA methodology of Pérez-Montoro (2010) aimed at web spaces.

A survey by means of oral and written questions allowed the information obtaining on the structure of the contents of the web page, as well as the users' needs. In addition, the different categories in which the information would be grouped were identified.

Three techniques were used jointly to triangulate the results of the research process:

A questionnaire was applied to 25 specialists of the CITMA system to identify their needs. Based on the results, the design of the IA was proposed, taking into consideration the suggestions.

An interview was applied to the sample to know aspects related to the design and structure of the contents of the web page.

From the early stages of the design process, the Card sorting technique allowed to anticipate what would be the organization of categories or navigation menus that best suits the users' mental model.

EndNote X7 Bibliographic Manager was used for the bibliography, using the APA Standards sixth Edition (2019); and the book Research Methodology by Hernández-Sampieri (2014) was used as reference for the development of the methodological framework.

3. Results and Discussion

Recent studies of Rodríguez-Valerio, D., Vargas-Zúñiga, J., & González-Pérez, E. (2019) at the University of Costa Rica, demonstrate the need for the presence of an AI process for the organization of content on the web, with the aim of facilitating navigation for users to access information and thus avoid its excessive growth.

In this sense, the potential of the information architecture lies in the development of sites that facilitate the meeting of the user with the information they need, making them quickly familiarize themselves with the Web environment. [9]

Considering the important role that AI plays for the search and retrieval of information, as well as usability, safe browsing and web positioning, in this study the three phases of the methodology proposed by Pérez-Montoro (2010) were applied: Analysis Phase, Design Phase, Implementation phase. Which is appropriate to organize content on the web and achieve these purposes.

3.1. Analysis Phase

This phase is the first action to know the context in which the CITMA web page will be designed, which allows to identify the real expectations of users.

3.1.1. Context Analysis

The country is currently involved in the process of informatization of society where e-government plays a fundamental role. It is intended to put ICTs at the service of the country's economic and social development, from a perspective of equity and participation [1]. The Cuban government has offered indications on the subject on multiple occasions. Hence the need for the government of each province to have an institutional web page on the Internet to provide mechanisms for communication and exchange with users. A new proposal is therefore being made to comply with the e-government policy.

Villa Clara province currently has *El Villaclareño* web page, which offers a characterization of the province, promotes the activities of the business sector, enterprises, universities, libraries, cultural centers, information centers, science entities, institutions, museums, among others. It was founded in 2003 with the objective of announcing the scientific work of the region. It offers sections on science, culture, history, publications, events, yellow pages and an institutional directory, thus fulfilling the essential requirements to become a Citizen's web page. The consequence of this change for CITMA in Villa Clara province is the need for a new proposal of designing a web page to disseminate its policy on science, technology, innovation and environment, thus complying with the ministerial authorities that require all organizations and institutions to automatize their processes and socialized them by means of web platforms.

3.1.2. Background Analysis

The design proposal of the CITMA web page for Villa Clara aims to raise the visibility of the results of science, technology, innovation and environment in the territory. It disseminates scientific information that allows exchange among users and shows the results of CITMA policy. The web is also used as the main channel of useful and updated information, where to find a large amount of information and provide a variety of scientific-technical services related to information management, archival management, industrial property, metrology, commercial activities, meteorological information and environmental services. This proposal is aimed at specialists of the CITMA system, businessmen, researchers, innovators and university students who have a close relationship with the institution or who are interested in researching the topics addressed, science entities in the province of Villa Clara and the international community interested in Cuba's socio-economic issues.

3.1.3. Technological Analysis

The Territorial Delegation of CITMA is equipped with computers capable of supporting large sites, in addition to full-time Internet. For the design of the web portal, the Joomla Content Management System in version 3.9.10 was employed, as it is one of the most widely used and vital free software platforms for content management at present. It was chosen because it provides a nice and friendly design and meets the expectations of actual and potential users, which will allow to address their needs and modify the portal in the future depending on their interests.

3.1.4. Content Analysis

A heuristic evaluation was carried out with the objective of critically examining and evaluating the existing web information architecture, which allowed the identification of architectural problems, from which a new proposal was made to solve the problems identified. Solutions were proposed after the analysis and the need arose to propose a new web page that visualizes the activity of the CITMA system in Villa Clara territory, complying with the heuristic principles established in the adopted methodology.

3.1.5. User Analysis

In this analysis, it was found that 100% of the users are proficient in working with new technologies, 80% claim that they are not satisfied with the current design, since it does not contribute to the objectives of the institution in particular. 100% agree that the design should be changed, with the objective of identifying the policy of the governing body, 80% state that Tarea Vida Program should be included, a gallery section and a space for attention to the population, in addition 20% state that the portal should include a section highlighting the values and strengths of the organization, as well as access to "Tarea Vida" Program, as well as access to the "Science Today" program, managed by the Provincial Meteorological Center of Villa Clara (CMP), to inform the users community about the scientific-technical and environmental events of the province and the work of scientists from Villa Clara. 100% prefer the information to be presented in a combination of text, images and audio, using the Spanish language. Sixty percent agree the color should predominate in the portal is green, 20% say that the color blue should predominate, and the remainder say the colors identified in the logo can be combined. All the respondents (25) agree with the categories to be included in the news section

characterizing the work of the institution, and also agree to add the offers of the services offered by each of the centers that make up the CITMA system, with the objective of informing the national and international community of the commercial activities that are available to them. 60% stated that the web page should not show the institution's projects. The following (Figure 1) shows the opinions of potential users with respect to the new web page:

The links proposed by the respondents were diverse: 72% expressed their interest in having links to the websites of each of the centers belonging to CITMA; other links favored were Cubadebate, Granma, Juventud Rebelde and Vanguardia newspapers. The total of those surveyed preferred that the sites El Directivo al Día, Biblioteca Centro Ciencia, EcuRed, the new Portal del Ciudadano de Villa Clara and Fórum Villa Clara would appear on the new web page.

In a complementary way, the hybrid Card sorting technique was applied, a technique that allows exploring people's mental models in relation to the organization and labeling of content where a series of categories in which users had to sort the content.

The possibility of creating other categories with meaning for them was also offered, in order to determine which ones should be included in the portal. Based on the behavior of the internal users of the institution, the information to be published on the portal was organized and classified according to the proposed mental model. This technique has been applied in several studies, for example the author Verano, Verónica (2019) applied this open-type technique at the National University of Patagonia San Juan Boscoordenar in Argentina, with the aim of studying the mental models of librarians and undergraduate students.
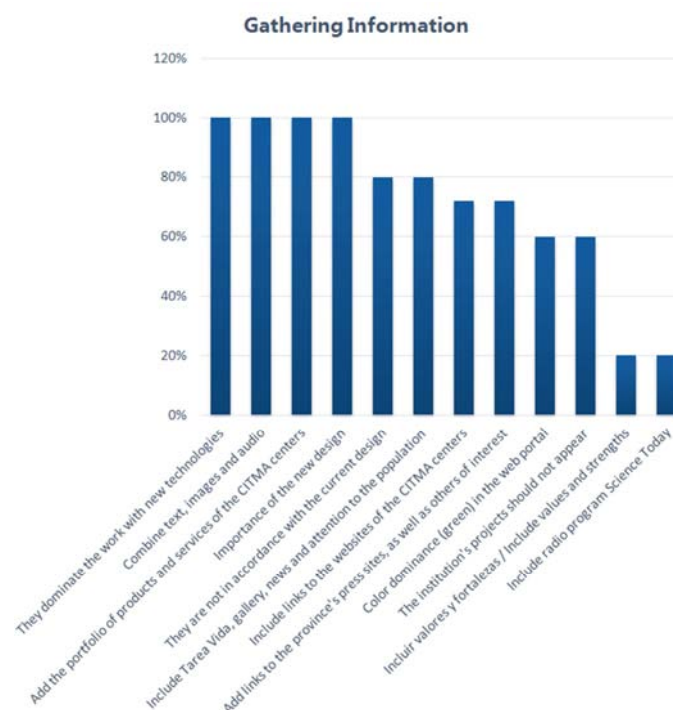

Figure 1. Information gathering of the current portal. Source: own elaboration.

3.2. Design Phase

3.2.1. Content Inventory

The content inventory contains all the information and documentation necessary for the development of the web page. The following table (Table 1) shows the content inventory.

Table 1. *Content inventory. Source: own elaboration.*

Name	Description	Format
Home	Displays the home page of the portal.	HTML
About Us	We offer a brief description of who we are, our mission, vision, objectives, main results in science, technology and innovation impacts, achievements and program for Science Day.	HTML
Centers	A brief description of the centers that make up CITMA is provided: mission, vision, services.	HTML
News	To disseminate news and announcements related to the organization and its centers, in the areas of science, technology, innovation and environment.	HTML
Tarea Vida Program	Describes what Tarea Vida Program is and the protected areas of the province.	HTML
Gallery	Contains photos of the organization and the specific activity of each center.	HTML
Public Attention	A comments section, open to the public, is provided.	HTML
About CITMA in Villa Clara	A direct access about who we are is provided.	HTML
Calls	Direct access to calls for national and international events and activities.	HTML
Our Services	The services of the CITMA system are displayed	HTML
Main Characteristics	The values and strengths of the organization are shown	HTML
Science Today	Presents a program where scientific-technical and environmental topics are discussed.	HTML
Contact us	Provides the location: address, phone, e-mail, facebook and twitter account.	HTML
CITMA Centers URL	Provides the link to the website of each center.	HTML
Sites of Interest and other links	Provides links to different sites related to the services offered by the centers; and access to the national press.	HTML

Table 1. *Continued.*

Name	Update frequency	Location
Home	Monthly	http://www.villaclara.cu/index.php
About Us	Annual	http://www.villaclara.cu/index.php/services.html
Centers	Annual	http://www.villaclara.cu/index.php/team.html
News	Daily	http://www.villaclara.cu/index.php/latest-items.html
Tarea Vida Program	Annual	http://www.villaclara.cu/index.php/tarea-vida.html
Gallery	Annual	http://www.villaclara.cu/index.php/galer%C3%ADa.html
Public Attention	Not defined	http://www.villaclara.cu/index.php/atenci%C3%B3n-a-la-poblaci%C3%B3n.html
About CITMA in Villa Clara	As updated	http://www.villaclara.cu
Calls	Monthly	http://www.villaclara.cu
Our Services	As updated	http://www.villaclara.cu
Main Characteristics	Annual	http://www.villaclara.cu/index.php
Science Today	Weekly	http://www.villaclara.cu/index.php/ciencia-hoy.html
Contact us	Annual	http://www.villaclara.cu/index.php
CITMA Centers URL	Annual	http://www.villaclara.cu/index.php
Sites of Interest and other links	Annual	http://www.villaclara.cu/index.php

3.2.2. IA Guidelines for CITMA's Web Page in Villa Clara

For the design of the IA guidelines, the labeling, organization, browsing and search systems is established. This will favor the organization of the contents in the web, as well as the interaction of the users with the final product.

3.2.3. Labeling System

For the architecture of the web portal, iconic, textual and a combination of both labels are proposed; the labeling used is mainly textual, although iconic labels are sometimes used. The function and description of each of these labels were determined.

3.2.4. Organizational System

The following taxonomy is proposed for the organization system. (See Figure 2), which shows the hierarchy of the navigation labels based on the grouping of the contents retrieved by means of the inventory of contents made from the techniques applied.

3.2.5. Browsing System

The browsing system will use the institution's logo and name as a resource or contextualization clue for the user, in addition to visually displaying the hierarchical aspects. The proposal presents a browsing bar at the top of the page, guides users at all times on where they are through the locator breadcrumbs, as

they are directly related to the architectural structure of the portal and inform where the current page is located, with the use of these is achieved more interpretable URL, explicitly offers the branch of the hierarchical structure in which the page is located, in addition to allowing the performance of links that form the breadcrumbs. It includes the option to return to the home page and allows access to key content.

1. About Us
2. About us
3. Centers
  3.1 CIGET
  3.2 CESAM
  3.3 OTN
  3.4 AHP
  3.5 Servicitma
  3.6 Citmatel
  3.7 CMP
  3.8 Delegation
    4. News
      4.1 Calls
      4.2 Science
      4.3 Technology
      4.4 Environment
      4.5 Culture
      4.6 Industrial Property
      4.7 Innovation
    5. Tarea Vida Program
    6. Gallery
5.1 CIGET
5.2 CESAM
5.3 OTN
5.4 AHP
5.5 Servicitma
5.6 Citmatel
5.7 CMP
5.8 Delegation
    6. Public Attention
    7. About CITMA in Villa Clara
    8. Announcements
    9. Our Services
   10. Main Characteristics
   11. Science Today Program
   12. Contact us at
      12.1 Address
      12.2 Telephone
      12.3 E-mail
      12.4 Facebook
      12.5 Twitter
   13. URL CITMA Centers
      13.1 CMP
      13.2 AHP
      13.3 OTN
      13.4 CESAM
      13.5 CITMATEL
   14. Sites of Interest
      14.1 The Executive Update
      14.2 Science Center Library
      14.3 EcuRed
      14.4 Villa Clara Citizen's Portal
      14.5 Villa Clara FORUM
   15. Press
      15.1 Cubadebate
      15.2 Granma
      15.3 Juventud Rebelde
      15.4 Vanguardia

Figure 2. Proposed IA taxonomy. Source: own elaboration.

3.2.6. Search System

The search system will be carried out depending on the place where the previously established tags are located. The system to be implemented in this case is the reactive one, where the user plays the fundamental role and is the one who defines the search through the equation. The use of metadata prevents users from visiting unnecessary pages to locate what they are looking for.

3.3. Implementation Phase

Evaluation of the proposed guidelines for the IA of the CITMA web page in Villa Clara

In order to evaluate the IA guidelines, the criteria of the respondents were taken into account, being these the sample chosen from the population of real users of the portal. The questionnaire was applied in the Information and Communication Council of CITMA, and it was also possible to debate on the subject, providing relevant information in relation to the design of the visual communication of the web and the IA.

The main criteria the specialists were referred to:
1) Colors used in the visual identity of the portal.
2) Labels and categories used.
3) Typography used.
4) Documentation related to the characterization and activity of the institution.
5) Relevant information to be included in the web (Life Task Program and "Science Today" Radio program)
6) Images and audiovisuals related to the CITMA system.

The labeling used is mainly textual, although sometimes a combination with iconic labeling is used. The browsing system is global, facilitating access from one page to another, since they all communicate. The existing interrelation between all labels was corroborated, since they are structured in a logical and coherent manner, the use of colors shows great homogeneity, with a predominance of green.

Finished all the phases for the design of the IA of the portal. (See Figure 3) It can be seen as follows:

4. Conclusions

The methodology of Pérez-Montoro (2010) adopted in the study allowed the development of a proposal for the Territorial Delegation of CITMA web portal in Villa Clara, with the objective of raising the visibility of its results in such territory, as well as making the work of this institution known to different communities of users around the world.

The new web page will characterize CITMA's science, technology, innovation and environmental policy activities, meeting the expectations of users and specialists who participated in the surveys conducted during the study.

As a final result, the proposal for the information architecture of CITMA web page was made, complying with the requirements and standards established by the superior ministry that regulate the development of the information and communication processes.
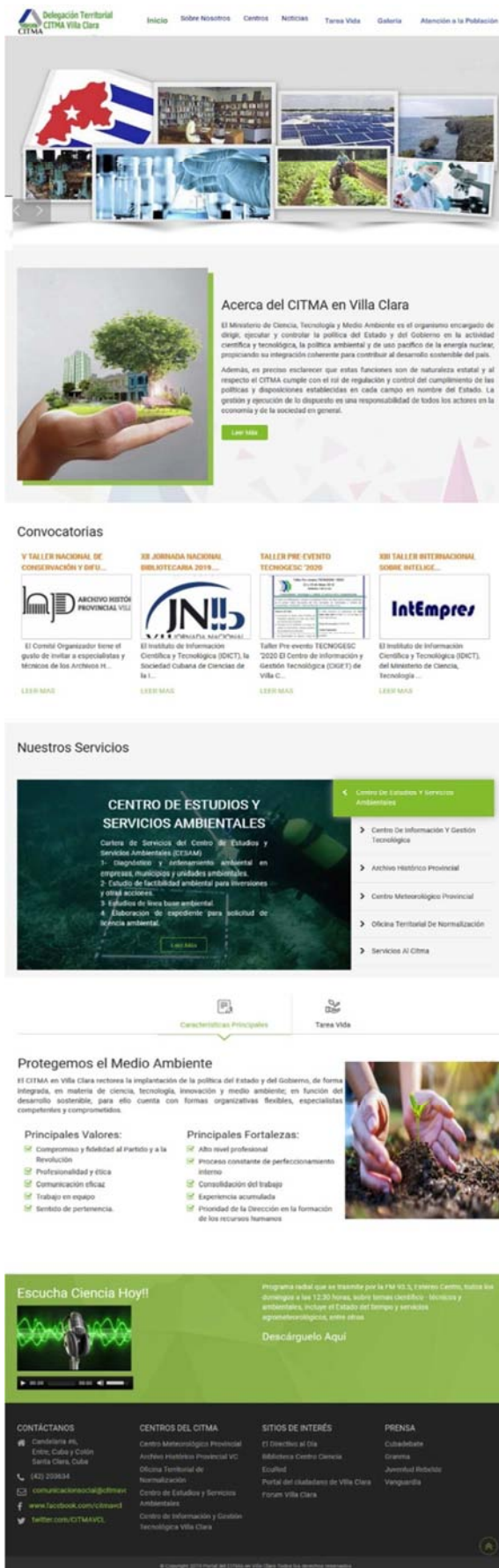
Figure 3. Final proposal for the web page design. Source: own elaboration.

5. Recommendations

Consider each website as an easy-to-use, intuitive, simple and interactive tool, adapting it to technological changes and the needs of users.

It is recommended to create a renewal guide for the constant updating of the web portal, where the Information Architecture is taken into account as a necessary practice.

Carry out subsequent studies that include the mobile device version of the website designed, with the aim of providing online services from any device and attracting the user community.

References

[1] Council of State. (2018). Decree Law No. 370 on the Computerization of the Society in Cuba. Havana Cuba. Retrieved from https://www.mincom.gob.cu/sites/default/files/marcoregulatori o/dl_370-18_informatizacion_sociedad.pdf.

[2] Dillon, A., Turnbull, D. (2005): "Information Architecture". En DRAKE, M. (Ed.): Ecyclopedia of Library and Information Science: First Update Supplement. London: Taylor & Francis.

[3] Gonzales-Cam, C. (2003). *Information Architecture: design and implementation.* Paper presented at the Workshop presented at Infotech.

[4] Hassan-Montero, Y., & Martín-Fernández, F. J. (2004). Information Architecture in virtual learning environments. Application of the Card Sorting technique and quantitative analysis of the results. *Not only Usability*, *13* (2), pp. 93-99. Retrieved from https://www.yusef.es/cardsorting.pdf.

[5] Hassan-Montero, Y., & Núñez Peña, A. (2005). Information Architecture Design: Description and Classification. *Not Just Usability*, 4. Retrieved from http://www.nosolousabilidad.com/articulos/descripcion_y_cla sificacion.htm.

[6] Martín Fernández, F. J. & Hassan Montero, Y. (2003). What is Information Architecture? Not Just Usability. Available at: <http://www.nosolousabilidad.com/articulos/ai.htm.

[7] Montes de Oca-Sánchez de Bustamante, A. (2004). Information architecture and usability: basic notions for information professionals. *Acimed*, *12* (6), pp. 1-62. Retrieved from http://scielo.sld.cu/pdf/aci/v12n6/aci04604.pdf.

[8] Pérez-Montoro, M. (2010). *Information architecture in web environments.* Retrieved from https://www.researchgate.net/publication/250197107_Arquite ctura_de_la_informacion_en_entornos_web.

[9] Rodríguez-Valerio, D., Vargas-Zúñiga, J., & González-Pérez, E. (2019). Information architecture as a process to organize usable and intuitive web sites: The case of the Central American Population Center (CCP). *e-Information Sciences*, *9* (1). doi: https://doi.org/10.15517/eci.v1i1.34185. Retrieved from https://www.scielo.sa.cr/pdf/eci/v9n1/1659-4142-eci-9-01-60. pdf.

[10] Rosenfeld, L., Morville, P., & Arango, J. (2015). *Information Architecture: for the Web and Beyond.* (4th.). New York: O'Reilly Publisher.

[11] Rosenfeld, L., & Morville, P. (1998). *Information Architecture for the World Wide Web: Designing Large-scale Web Sites.* Cambridge: O'Reilly. Retrieved from https://repo.zenk-security.com/Others/Information%20Archite cture%20For%20The%20World%20Wide%20Web.pdf.

[12] Rosenfeld, L., & Morville, P. (2000). *Information Architecture for the www.* México: McGraw-Hill.

[13] Wurman, R. (1997). *Information Architects*. Los Angeles. Watson-Guptill Pubis.