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# Research management and virtual accessibility: the case of Paraguayan universities

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**Abstract.** The main objective of this article is to analyse how research management is carried out in some higher education institutions in Paraguay, based on the analysis of good practices analysis developed. It also analyses the virtual accessibility of how the information and the communication in research and science is carried out.

Accessibility to digital information of the institutional Web contents of these institutions and their research units are analysed in order to understand if they comply with the accessibility requirements of the Accessibility Guidelines for Web Content WCAG 2.0 (Web Content Accessibility Guidelines 2.0), of the World Wide Web Consortium (W3C), as stated in the Directive (EU) 2016/2102 of the European Parliament and the European Standard EN 17161:2019. The final analysis revealed several weaknesses affecting users' interest and motivations.

**Keywords:** university websites, research websites, research management, digital accessibility.

## 1 Introduction

Research is a core element in higher education institutions. The academic community is expected to be engaged in research, produce knowledge, and contribute to the science development. Nowadays, HEIs invest strategically in developing and producing

high-quality research and disseminating it across the globe (Quitoras & Abuso, 2021). Others state that research should meet specific regional needs and contribute to local economic development (Feldman & Desrochers, 2003). In this context the role of HEIs and its research units are crucial to develop cutting edge research and in particular responding the regional needs. First of all, it is of great value to ensure accessibility of research information on the websites of HEIs, considering that the use of web-based resources have widely increased among HEIs and can be served as virtual gateway to access necessary information (Agangiba & Agangiba, 2019). Therefore, this article has twofold objectives: to present research promotion and management good practices of selected higher education institutions in Paraguay, as well as to investigate the digital adaptation resulting from the technological innovation, in order to help the academic managers in formulating research policies and enhancing research culture.

This paper is organised as follows: the second section is a brief review of existing literature and conceptual background on the issues covered; the third section presents the method and data collection; the fourth section presents the results and, finally, the discussion and conclusion.

## **2 Contextualization**

As research is a key element of the HEI, it is fundamental to have research management units that enable the production of links between science and society in general. Research management is becoming more and more indispensable and should not be seen as just another service in the administration of the HEI, but as a unit that allows decision making in two main areas: scientific dynamics (production and certification of knowledge) and relationship with society (Schuetzenmeister, 2010). The same author also refers that “Research management requires a general view of a subject matter, the ability to coordinate interdisciplinary efforts, and individuals who are highly interested in the societal implications of their fields” (2010:6).

In the case of the research management units that belong to HEI, it is also necessary to consider universal accessibility, which should be present in the research management websites. The progressive need to develop and access reliable information online has stimulated the creation of access guarantees to the content of websites (Silva, Borges, Albuquerque, 2021). As Agangiba et. al. (2017) refers, websites of the universities, namely the ones related to research management, should fulfil accessibility standards, according to the guidelines of the World Wide Web Consortium (W3C). This consortium identifies several elements to be articulated in the interaction and development of a web page to be accessible (W3C, 2020), namely the adaptation to each user’s needs, the adaptability, perceptibility, and keyboard accessibility.

### 3 Methods and Data Collection

#### 3.1 Case study methodology: good practices

For the identification and exploratory analysis of the good practices in research management in higher education institutions in Paraguay, the case study methodology is employed. Selection of the case studies is assorted according to the criteria such as relevance within the context of Paraguay, scalability in terms of viability of the transposition of similar schemes to other institutions of the consortium and cost-effectiveness. The coordination of this task was carried out by the Portuguese University together with USFX, Bolivia. In order to collect more detailed information about good practices in the most efficient and effective manner, semi-structured interviews are used. The information related to good practices is presented in the Table I.

**Table I**

Good practice	University
Specific research management policies and strategies at institutional level - Establishment of the Office for the Transfer of Research Results	Universidad Nacional del Este – UNE
National or international fundraising and successful project management by the Climate Change Working Group	Universidad Nacional de Asunción - UNA
Programme for the incorporation of new researchers	Universidad Católica «Nuestra Señora de la Asunción» – UC

#### 3.2 Methodology for analysing the websites

The methodology followed in this research was based on a selective sampling of four universities and related research units homepages in Paraguay. In addition, the websites of the Ministry of Education and Science, National Science and Technology Council and INNOVA Project was also studied. Thus, the study is based on nine websites.

We prepared observation grids for compliance with the requirements of virtual accessibility and, after collecting the URLs, we performed quantitative and qualitative analysis of the information disclosed on the respective websites.

Regarding the quantitative analysis, the degree of compliance with the WCAG 2.0 recommendations was checked, as currently implemented by AMA - Agência para a Modernização Administrativa, I. P. - Accessibility.gov.pt project (<https://www.acessibilidade.gov.pt/>), and we used the automatic validator AccessMonitor Plus, version 2.1. This software is an automatic validator of Web accessibility practices (WCAG 2.1), which checks the application of accessibility guidelines in HTML contents, on a scale of 1.0 to 10.0. The three types of results are stratified by three priority levels ('A', 'AA' and 'AAA').

Contrary to what we have been developing in other papers (Silva & Borges 2020; Pinto, et al., 2020; Borges, et al, 2020; Costa et al, 2020), we do not privilege quantitative analysis. We only verified the A, AA and AAA level errors, regarding acceptable, not acceptable and warnings to be manually checked (Table 3), whose results reinforce the analysis performed.

The elements chosen for the qualitative analysis concerning the virtual accessibility of the websites included in the sample were the following: existence of the accessibility symbol or reference to the accessibility of the website, existence of search functionality, and the languages in which it is displayed.

## **4 Results and discussion**

### **4.1 Good practices in research management**

#### **Specific research management policies and strategies at institutional level - Establishment of the Office for the Transfer of Research Results - Universidad Nacional del Este – UNE**

The National Council for Science and Technology (CONACYT), in the framework of the Paraguayan Programme for the Development of Science and Technology (PROCIENCIA) invited interested institutions to apply to the call for the Creation or Strengthening of Offices for Technology Transfer and Research Results (Oficinas de Transferencia de Tecnología y Resultados de la Investigación, OTRI). Within this framework, the UNE prepared the project, in accordance with the requirements of the call, and as a result the proposal was accepted. The main requirement to obtain the funding was to generate the information from the OTRI and to prepare two transfer projects. The general objective of the Office for the Transfer of Research Results (OTRI) is to plan, execute and evaluate, together with the academic units of the UNE, activities related to the identification, protection and exploitation and/or transfer of intellectual property rights derived from the research activities carried out at the institution. Internally, the OTRI has structures that deal with the process of technology transfer of research results. These include intellectual property, business plans and technology watch.

The overall impact of the good practice is installation of documentations such as intellectual property regulations, transfer manual, laboratory notebooks; advance in the systematisation of technology portfolios; documents on own management indicators and documents on market research.

#### **National and international fundraising and successful project management by Climate Change Working Group (GTCC) of Universidad Nacional de Asunción - UNA**

The GTCC - Working Group on Climate Change (FPUNA) is responsible for the Virtual Centre on Climate Change - Paraguay. Paraguay joins international efforts to address the causes and consequences of climate and variability change. At the Polytechnic Faculty of the National University of Asunción (FPUNA), the Climate Change Working Group (GTCC), which operates within the institution's Meteorological Centre, develops research related to this phenomenon. The main objectives of the Virtual Centre are: disseminate and offer collaboration to generate public policies by relevant institutions; build a (virtual) entity that concentrates, organises and coordinates information

on the impacts of climate change carried out in the Faculty; promote collaboration in the development of public policies with the capacity to adapt and reduce the vulnerability of social sectors; create a collaborative policy framework for adaptation, vulnerability and mitigation for Paraguay; promote the creation of research networks on climate change; to make visible the work developed by the GTCC and collaborators.

### **Program for Incorporating Researchers of the Catholic University "Nuestra Señora de la Asunción" - UC**

Relating good practices in terms of research management with the degree of virtual accessibility achieved, we can refer to the Program for Incorporating Researchers of the Catholic University "Nuestra Señora de la Asunción", Paraguay (UC). This is a programme that is included in the strategic plans of the Catholic University. It seeks to incorporate new researchers through an open competition, directed to the teachers of the institution, adjusting to pre-established criteria, lines of research or priority areas.

It has pre-established criteria for the evaluation of the projects presented, inspired by the Marie Stokowski-Curie programme of the European Community, such as excellence, impact and implementation.

The Research Centre has a website, which presents the various research centres of the University, considering the complexity and diversity of spaces and centres: <https://www.universidadcatolica.edu.py/pensamiento-e-investigacion/>. However, the information is not attractive or accessible to potential new researchers who want to participate in research. Currently, the programme is not in practice.

To overcome these difficulties, dissemination must be reinforced with scientific events organised in partnership with other universities, such as congresses, where preliminary or definitive research results are presented.

## **4.2 Accessibility of websites: quantitative and qualitative analysis results**

The sample chosen, as already mentioned, is related to nine websites of four universities and research units in Paraguay. In addition, the websites of the Ministry of Education and Science, the National Council for Science and Technology and the INNOVA Project were also studied.

These are, therefore, the organisations responsible for higher education and research in Paraguay.

As the websites are constantly being updated, the validity of the analysis is relatively short, so the tests carried out on the pages under analysis in the Monitor access version 2.1 were compiled on only two days, 10 and 11 January 2022.

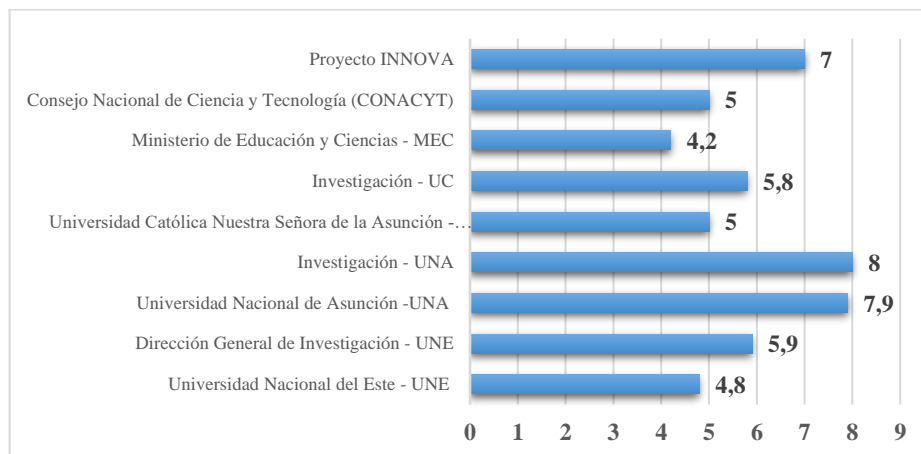
One of our objectives is to conduct a summary qualitative analysis from the user/consumer perspective. The elements chosen for the qualitative analysis were those we have mentioned and whose results are shown in Table 2 (existence of the accessibility symbol or reference to the accessibility of the website, existence of search functionality, and the languages in which it is presented).

The quantitative analysis on the compliance of websites, analysed with the various levels, although variable (Table 2; Fig. 1), shows average and weak values, with none reaching the desired value of 10.

**Table 2** – Characterization of some elements of the analysed websites according to the Web accessibility practices report (WCAG 2.1 do W3C).

WEBSITE OF THE INSTITUTION	Index <i>access- monitor plus</i> 2.1	Accessibility symbol or ac- cessibility ref-	Search func- tionality	Languages
Universidad Nacional del Este – UNE (Paraguay) - <a href="http://www.une.edu.py/web/index.php">http://www.une.edu.py/web/index.php</a>	4.8	No	Yes	1
Dirección General de Investigación - Universidad Na- cional del Este - <a href="http://investigacion.une.edu.py/">http://investigacion.une.edu.py/</a>	5.9	No	No	1
Universidad Nacional de Asunción-UNA (Paraguay) - <a href="https://www.una.py/">https://www.una.py/</a>	7.9	Yes	Yes	4
Investigación - Universidad Nacional de Asunción (una.py) - <a href="https://www.una.py/investigacion">https://www.una.py/investigacion</a>	8.0	Yes	Yes	4
Universidad Católica «Nuestra Señora de la Asunción» Unidad – UC (Paraguay) - <a href="https://www.universidadca-&lt;br/&gt;tolica.edu.py/">https://www.universidadca- tolica.edu.py/</a>	5.0	No	No	1
UC – Investigación - <a href="https://www.universidadcato-&lt;br/&gt;lica.edu.py/investigacion/">https://www.universidadcato- lica.edu.py/investigacion/</a>	5.8	No	No	1
MEC - Ministerio de Educación y Ciencias (Paraguay) - <a href="https://www.mec.gov.py/cms/">https://www.mec.gov.py/cms/</a>	4.2	No	Yes	2
Consejo Nacional de Ciencia y Tecnología (CONACYT) - <a href="https://www.conacyt.gov.py/">https://www.conacyt.gov.py/</a>	5.0	No	Yes	2
Proyecto INNOVA - <a href="https://www.innova-project.eu/es">https://www.innova-project.eu/es</a>	7.0	No	Yes	1

We limit our summary analysis at the best performing websites. INNOVA project website, although still under construction, has already managed to achieve the value of 7.0 of compliance with the requirements of virtual accessibility, so in the future it may reach the ideal value of 10, fulfilling the requirements of full virtual accessibility that is intended.



**Fig. 1** – AccessMonitor Plus Indexes for the websites analysed.

On the positive side, only the webpages about teaching and research at the Universidad Nacional de Asunción - UNA can be highlighter, with a rating of 8.0. These are also the only webpages that refer to virtual accessibility issues. Moreover, with the perspective of achieving greater dissemination and reaching different audiences, especially those related to higher education and researchers, these webpages are available in several languages other than Spanish, namely English, Portuguese and their native language, Guaraní. In this way, UNA allows greater accessibility and inclusion.

At this level only Ministry of Education and Science and the National Council for Science and Technology (CONACYT) present their respective websites in Spanish and Guaraní.

The qualitative analysis is resulting from the study of the websites through Access Monitor Plus version 2.1 and were chosen for the analysis only the quantifiable results of the level A, AA and AAA errors, concerning the acceptable, not acceptable and the warnings. It would be tiring and useless to enunciate all errors in relation to the tests referred to and make their analysis, so we only present the summary in the analytical table (Table 3) and the average of errors and warnings (Table 4).

The website with the best degree of accessibility is, as we have mentioned, from Universidad Nacional de Asunción-UNA. The websites analysed are clearly deficient, as we can see, with low to very low values in terms of performance when analysed on their virtual accessibility.

The elements that we usually select and submit to a quantitative analysis are the image captions, the use of multimedia, the forms, the menus, the headers, the indication of the main language, the links, the menus and the text of the links, the links to outline information blocks, the w3c standards and, finally, the metadata presentation elements and attributes.



**Table 3.** "A", "AA" and "AAA" level test results found.

WEBSITES	Índice AccessMonitor	NIVEL A				NIVEL AA				NIVEL AAA			
		Acceptable	Not Acceptable	Warnings	TOTAL	Acceptable	Not Acceptable	Warnings	TOTAL	Acceptable	Not Acceptable	Warnings	TOTAL
UNE	4.8	5	1	6	12	0	1	1	2	0	2	1	3
UNE - Investigación	5.9	4	0	4	8	0	0	1	1	0	3	1	4
UNA	7.9	6	3	2	11	0	1	2	3	0	1	0	1
UNA - Investigación	8.0	6	2	2	10	0	1	2	3	0	1	0	1
UC	5.0	4	3	6	13	0	1	2	3	0	3	1	4
UC - Investigación	5.8	4	4	6	14	1	0	0	1	0	2	1	3
MEC	4.2	6	1	12	19	1	0	1	2	0	1	0	1
CONACYT	5.0	5	1	6	12	0	0	1	1	0	3	2	5
INNOVA	7.0	6	3	2	11	0	0	1	1	0	1	1	2
MÉDIA	5.95	5.2	2.0	5,11	-	0,22	0,33	1,22	-	0	1,88	0,77	-

**Table 4 - Average number of acceptable and non-acceptable errors and warnings per level**

A		AA		AAA	
ERRO	AVISO	ERRO	AVISO	ERRO	AVISO
7,2	5,11	0,55	1,22	1,88	0,77

The obtained data confirm that the accessibility is poor, so users will find it difficult to find and subsequently grasp the information they need. Thus, the quantifiable results of level A, AA and AAA errors, concerning acceptable, non-acceptable and warnings, show very high values, especially in the results of level A errors, as can be seen in Tables 3 and 4.

In this quantitative analysis of errors per level we found high values and, as such, revealing the problems that the vast majority of websites present, in terms of conformity with what is intended to be considered an accessible website aimed at everyone. In conclusion, we can say that the quantitative data corroborate the qualitative data.

## 5 Discussion and Conclusions

Good practices analysis revealed that the HEIs in Paraguay recognizes the value of research development and attempts to meet regional demand. Some steps were taken such as creation of offices for technology transfer in UNE, which can be replicated in the case of other HEIs, or the development of a Virtual Centre concerning the research of Climate Change, or the creation of a Program for Incorporating Researchers (even being not active currently). Further actions are needed to promote research management.

The results obtained through the Web accessibility practices report (WCAG 2.1 of the W3C) reveal that these websites are not prepared to comply with the guidelines of

European legislation, and the guidelines made public on March 21, 2019, enshrined in the European Accessibility Act and the Design for All Standard.

Naturally, Paraguay does not have to follow European standards or legislation. However, in the absence of others, it could be important to gather existing information towards the improvement of existing websites, bringing them closer to the parameters that are intended for a more inclusive and accessible virtual information for all users. The higher education institutions in Latin America must taking some steps to raise awareness of the importance of virtual accessibility in managing research and ensuring digital accessibility for all (Amado-Salvatierra, Hernández & Hilera, 2014).

According to the data presented by Access Monitor Plus, the average compliance with accessibility requirements is 5.95 on a scale of 1.0 to 10, which is not enough to pass the level A of accessibility of online pages. For this reason, we found that none of the websites under study is considered accessible.

The research revealed several weaknesses that affect the interest and motivations of users in the face of the many different offers that the websites of the universities and the ministry can provide.

The computer analysis of the results of the websites allowed us to obtain measurable data, which can enhance the qualitative analysis concerning the strengths and weaknesses and the needs for improvement that the analysed websites require, from the perspective of any user and of those who present, permanently or temporarily, limitations. It can therefore be concluded that the results obtained in this research are not satisfactory, revealing non-compliance with accessibility and no concerns at that level.

It should be noted that the effective and efficient development of a website necessarily implies knowledge of different areas, namely technical, but also accessibility experts, and the creation of multidisciplinary teams is advisable.

The aim of the guidelines is to help organisations develop a consistent approach, defining requirements that enable them to develop and provide products, goods or services that can be accessed, understood and used by everyone, including people with disabilities. As each user has their own profile of needs, characteristics, or abilities, it is crucial to take these factors into account when planning products or services. An accessible Internet, responding to the requirements of universal accessibility, allows all people with or without special needs to participate more actively in society (Silva & Borges, 2020).

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## 6 References

1. Agangiba, M., & Agangiba, W. A. (2019). Evaluation of Accessibility for the Visually Impaired-The Case of Higher Education Institutions' Websites in Ghana. *Ghana Journal of Technology*, 3(2), 58-64.
2. Amado-Salvatierra, H. R., Hernández, R., & Hilera, J. R. (2014, October). Teaching and promoting web accessibility in virtual learning environments: A staff training experience in Latin-America. In *2014 IEEE Frontiers in Education Conference (FIE) Proceedings* (pp. 1-4). IEEE.
3. Borges, Isabel; Silva, Fátima Matos; Costa, Eusébio; Pinto, Agostinho Sousa; Abreu, António. (2020). Infoaccessibility on the websites of inbound markets of Portugal destination © Springer Nature Singapore Pte Ltd. *Advances in Tourism, Technology and Smart Systems, Smart Innovation, Systems and Technologies* 171, 117-129. [https://doi.org/10.1007/978-981-15-2024-2\\_10](https://doi.org/10.1007/978-981-15-2024-2_10)
4. Costa, E., Silva, F. M., Borges, I., Pinto, A. S., & Abreu, A. (2020). Usability and accessibility of institutional websites in demarcated wine regions: The cases of Vinhos Verdes and Douro. *Advances in Tourism, Technology and Systems (ICOTTS 2020, Smart Innovation, Systems and Technologies)*, vol. 1, pp. 415-429. Singapore: Springer Nature. [doi.org/10.1007/978-981-33-4256-9\\_38](https://doi.org/10.1007/978-981-33-4256-9_38).
5. Feldman, M., & Desrochers, P. (2003). Research universities and local economic development: Lessons from the history of the Johns Hopkins University. *Industry and Innovation*, 10(1), 5-24.
6. Quitaras, M. C. L., & Abuso, J. E. (2021). Best Practices of Higher Education Institutions (HEIs) for the Development of Research Culture in the Philippines. *Pedagogical Research*, 6(1).
7. Pinto, A., Costa, E., Borges, I., Silva, F., & Abreu, A. (2020). Virtual accessibility on digital business websites and tourist distribution. *Advances in tourism, technology, and smart systems: Proceedings of ICOTTS 2019* (pp. 93-103). doi: [10.1007/978-981-15-2024-2\\_9](https://doi.org/10.1007/978-981-15-2024-2_9).
8. Silva, F., & Borges, I. (2020). Digital accessibility on institutional websites of Portuguese tourism. *Technological progress, inequality and entrepreneurship: From consumer division to human centricity* (pp. 67-85). Springer: Cham. doi: [10.1007/978-3-030-26245-7\\_5](https://doi.org/10.1007/978-3-030-26245-7_5).
9. Silva, F. M.; Borges, I., Albuquerque, H. (2021). Virtual Accessibility in European Cultural Heritage: Analysis of the Major Tourist Destinations Websites. *Proceedings of the 4th International Conference on Tourism Research - ICTR 2021, Conferences and Publishing International Limited Reading UK*, pp. 349-359
10. Schuetzenmeister, Falk (2010). *University Research Management: An Exploratory Literature Review*, California Digital Library, University of California, <https://escholarship.org/uc/item/77p3j2hr>