Universitätsverlag Potsdam

Article published in:

The MOOC-CEDIA Observatory

Study of the Current Situation of MOOCs and Recommendations To Improve Their Adoption in Ecuadorian Universities

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In the last few years, an important amount of Massive Open Online Courses (MOOCS) has been made available to the worldwide community, mainly by European and North American universities (i.e. United States). Since its emergence, the adoption of these educational resources has been widely studied by several research groups and universities with the aim of understanding their evolution and impact in educational models, through the time. In the case of Latin America, data from the MOOC-UC Observatory (updated until 2018) shows that, the adoption of these courses by universities in the region has been slow and heterogeneous. In the specific case of Ecuador, although some data is available, there is lack of information regarding the construction, publication and/or adoption of such courses by universities in the country. Moreover, there are not updated studies designed to identify and analyze the barriers and factors affecting the adoption of MOOCs in the country. The aim of this work is to present the MOOC-CEDIA Observatory, a web platform that offers interactive visualizations on the adoption of MOOCs in Ecuador. The main results of the study show that: (1) until 2020 there have been 99 MOOCs in Ecuador, (2) the domains of MOOCs are mostly related to applied sciences, social sciences and natural sciences, with the humanities being the least covered, (3) Open edX and Moodle are the most widely used platforms to deploy such courses. It is expected that the conclusions drawn from this analysis, will allow the design of recommendations aimed to promote the creation and use of quality MOOCs in Ecuador and help institutions to chart the route for their adoption, both for internal use by their community but also by society in general.

1 Introduction

Massive Open Online Courses (MOOCs) are a global phenomenon that is transforming teaching and making researchers reason about new ways to support the teaching/learning process in Higher Education Institutions (HEIs). Since Dave Cormier coined the term MOOC in 2008, these courses have become the catalyst for changing the traditional teaching/learning model of universities. Since then, universities have launched into an unbridled career of mass networked course production. Until November 2020, more than 16,300 MOOCs were registered worldwide involving around 180 million students, according to the MOOCs Class Central Global Observatory [10].

The adoption of MOOCs in different regions of the world has been quite heterogeneous [5, 9]. Most MOOCs are produced in Europe and the United States while only a small proportion are produced in Latin America. For instance, it can be seen in a report prepared in early 2016 [8] that the incorporation of MOOCs in Latin America HEIs has been very slow and cumbersome; the rate of production of MOOCs has been between 4 and 5 times smaller than their peers in Europe. However, in Latin America, the great takeoff of MOOCs began in 2015. The rise of the initiative and the increase in the number of MOOCs was mainly given to three reasons: (1) the alliance of Latin American universities with platforms such as Coursera, MiríadaX and edX; (2) the dissemination and development of Latin American MOOC platforms such as Telescopio (Guatemala) or Veduca (Brazil) which promoted the dissemination of such courses, and (3) the dissemination of the MOOC-Maker project, co-financed by the Erasmus+ program of the European Union, and whose objective was to create a network between European and Latin American IES to improve the relevance, quality and access to teaching-learning programs through the implementation of quality MOOCs [1].

According to the data published by the MOOC-UC Observatory for Latin America [8], until 2018, more than 929 MOOCs were produced in Latin America, being Mexico (341 MOOCs) and Brazil (239 MOOCs) the countries that lead the production of such courses. In the specific case of Ecuador, 2014 was the year in which the first MOOC course initiatives were registered in the country. The Private Technical University of Loja and the University of Cuenca pioneering such initiatives [13]. According to the MOOC-UC observatory, a total of 26 MOOCs were registered in 2016 and in 2018 a total of 37 MOOCs [8], making evident the slow growth of MOOCs in the country in 2 years (just 11 MOOCs) if compared to other countries in the region (such as Mexico that went from 157 MOOCs in 2016 to 341 MOOCs in 2018 or Brazil that went from 110 MOOCs in 2016 to 239 courses in 2018).

Currently there is no report providing an overview and specific state of the art of MOOCs in Ecuador. Information is needed on the current state of the MOOCs

initiative in Ecuadorian HEIs. Moreover, an analysis of the factors and barriers that have limited the growth of this initiative in the country is needed. In order to better understand the current situation of MOOCs in Ecuador, it has been proposed to build the MOOC-CEDIA Observatory (CEDIA stands for The Ecuadorian Research Development Consortium and the Academy), an interactive web platform that presents a global view on the state of MOOC's initiatives in Ecuador. Based in the first data gathered in MOOC-CEDIA observatory, several recommendations are proposed to improve the adoption of MOOCs in Ecuadorian HEIs.

This article is structured into 6 sections in addition to the introduction. Section two describes the context of the study, section three describes the methodology used to conduct it; section four introduces the MOOC-CEDIA observatory, section five presents the analysis of the first data gathered by the observatory; section six presents some recommendations to improve the adoption of MOOCs by Ecuadorian HEIs. Finally, section seven includes an outline of the main findings of the study.

2 Context of the Study

The Ecuadorian Research Development Consortium and the Academy (CEDIA) was established in 2002 by a group of Ecuadorian universities, with the purpose of creating the national node of the global academic network and improving the conditions of provision of the Internet to member institutions. CEDIA is a private non-profit corporation and currently brings together 44 universities (73% of the total of the HEIs), 12 technology institutes and 36 colleges. The organization provides its members with a broad portfolio of services, without neglecting its original technological vocation. The organization has evolved to become a fundamental pillar of support to Ecuador's HEIs system. Over time, CEDIA's service portfolio has been internationalized to the point that, researchers from more than 20 countries collaborate with Ecuadorian researchers on various projects funded by the institution. In addition to offering its members more than 90 continuing education courses per year, CEDIA operates and maintains in its infrastructure the LMS platform of 24 institutions, an open access learning object platform and the MOOC platform available to all its members. CEDIA is continuously assessing global trends in the digitization of education, to get ahead of the provision of services relevant to its members. That is why the present study and the first version of MOOC-CEDIA Observatory (an interactive web platform), are considered a very relevant asset by the organization.

The MOOC-CEDIA Observatory aims to become a reference to support decision-making in the design of effective recommendations around MOOCs in Ecuador.

This observatory presents data of MOOC initiatives through 2020. This development, as well as the data collection, is part of CEDIA's MOOCs – Phase 1 project, whose main purpose is to build capabilities to produce MOOCs in Ecuadorian HEIs, as well as to conduct research around the initiatives that are developed. The data presented at the observatory were collected through a detailed review of the initiatives developed at each of the universities in Ecuador. This study conducts an HEIs comparison exercise that lightens and helps to better understand the specific situation in each institution over the past 4 years. The results of this report are expected to help advance and gain a global view and a greater understanding of the current state of MOOC initiatives. In the context of this study, a number of research questions arise, focusing on HEIs, government institutions, networks and corporations:

- *RQ1. How many MOOCs are developed by HEIs or other institutions in Ecuador?*

- *RQ2. Which universities/institutions produce MOOCs and represent national leaders in the field in the benchmarks?*

- *RQ3. What are the main characteristics of MOOCs in Ecuador's HEIs (topic, duration, dedication required by the student?*

- *RQ4. Which platforms are most commonly used for MOOCs deployment?*

3 Methodology

This section presents the methodology followed for data collection and analysis, as well as the methodology followed for defining metrics and visualizations for web platform development [8]. The web platform displays interactively and intuitively the number of MOOCs developed in Ecuador, which universities or institutions produce MOOCs, the kind of topics and the platforms used to deploy the courses. This article focuses on the data collection process and the explanation of the metrics used to display on the web platform, but no technical details will be given about its implementation.

3.1 Data Collection Analysis

The search methodology is structured in 3 phases (Figure 1): (1) selection of the sources of information and definition of the search strategies to be carried out; (2) collection, registration and review of the data collected; and (3) evaluation of the results and main conclusions. Each phase is detailed below.
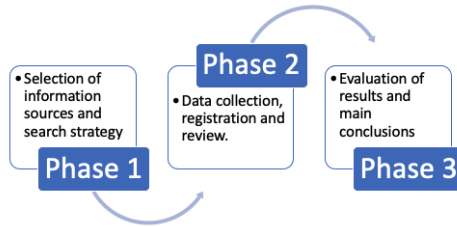
Figure 1: Data collection and analysis strategy

Phase 1: Selecting Sources of Information and Search Strategy

This work has leveraged different sources of existing information. First, and in order to delimit the search field, lists of HEIs from Ecuador were obtained, as well as a selected list of the most significant MOOC platforms for this study. Second, the sources of information and searches for the collection of MOOCs data in Ecuador were selected.

HEIs list and MOOC platforms:
- The list of universities analyzed was extracted from the list of HEIs members of CEDIA (44 of the 60 institutions active in Ecuador) and complementary we use the list of the web portal called "Altillo.com". This portal maintains a complete and up-to-date list of Latin American universities, including both traditional and online universities. This study considered only Ecuadorian HEIs.

- The MOOC Platforms list consists of 4 different platforms. Coursera and edX, world-leading American MOOCs platforms; and MiríadaX which was included in the list as the platform that hosts the most courses in Spanish. MOOC platforms implemented in Ecuador such as Open edX (implemented by CEDIA, Universidad de Cuenca and ESPOL) were also added to the list.

Sources of information for data collection and search strategy:
- Web portals of each University. A thorough search was conducted on the web portals of each of the selected universities. This search was carried out from the search engine of each university, and web scraping techniques were used to be able to map the courses offered by each university.

- MOOC platforms. Many of today's MOOC platforms have search engines that allow you to filter courses by university name or by authors. The search on

the different platforms was done by name of the university (from the list of selected universities) and selecting the country as Ecuador.

- Google. This search engine was included in order to find information related to MOOCs in Ecuador that may have been mentioned in different online media. To systematize the search, a set of keywords that were crossed with the name Ecuador and the selected universities were defined. The keywords used are: MOOC, MOOCs, Massive Open Online Course, Massively Open Online Course, Massive Course, Free Online Course, Free Online Course(s), Open Course/s.

Phase 2: Data Collection, Registration and Review

The data collection was carried out by 7 researchers. In order to homogenize results, each of the researchers involved was provided with a manual[5] with instructions on how to perform searches. Also, a shared document in a Google Spreadsheet for data registration was provided. The data was reviewed to remove redundant information and supplement the missing information.

Phase 3: Evaluation of the Results and Main Conclusions

Data analysis was performed with Excel and Tableau on the 153 MOOCs selected in the validation phase (MOOC, SPOC, NOOC). The process that was performed to analyze the recorded data and answer the different research questions (defined in section 2) are described in section 5. For the development of the web platform was followed the SCRUM methodology was followed, to support agile and iterative development. The main phases of this methodology are: (1) development, (2) closure, (3) review and (4) adjustment. These phases form an iterative development cycle. The design of the web platform was conducted following the principles of Vogel [11], functionality of the application, navigation (easy to recover and easy to navigate the contents), mechanisms of interaction and satisfaction of users who use the web application.

3.2 Defining Metrics and Visualizations

This section describes the metrics used for data analysis and visualizations. In order to analyze the number of MOOCs produced at each University, we started by differentiating a MOOC from a SPOC and a NOOC. It should be noted that in this

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[5]Instruction manual provided to researchers for systematic search: https://www.dropbox.com/s/acrzq9kpbo8hfo6/Manual-Investigadores-vfinal-blind.pdf?dl=0

study we take as a reference the definition of MOOC proposed in the HOME & OpenupEd project [2]: *"MOOCs are courses designed for a massive number of students, accessible by anyone from anywhere as long as they have an internet connection, without restrictions of access by grade, and that are offered only online through a MOOC platform, periodically or continuously"*. On the other hand, SPOCs are *"courses that use the same methodology and platforms as MOOCs but privately with access control. They are generally used as a complement to face-to-face teaching through what is known as blended learning. Being a controlled environment, you can add special functionalities that don't make sense in an open and massive course"* [3]. While NOOCs are a new concept, although it is not yet recognized by the scientific community, but they are similar or equivalent to Learning Objects implemented in a MOOC platform.

We accounted the total number of MOOCs, SPOCs and NOOCs produced in Ecuador. The web platform MOOC-CEDIA presents this information through a map that divides Ecuador into its provinces. In addition, a ranking of the 9 universities and/or institutions with the highest MOOC production was performed. This ranking is presented in an ordered bar chart from highest to lowest; it can be filtered according to the type of institution (public, private or other). The analysis seeks to learn which learning domains the courses are aimed at. The domain classification follows the domain taxonomy proposed by Wu [12]. It includes the following domains: Humanities, which includes history, language, linguistics, literature, arts; Social sciences, which includes areas related to economics and sociology; Natural sciences, including areas of chemistry, physics, biology; Formal sciences, including mathematics, statistics and computer science and related; professional and/or applied sciences, including areas such as engineering, law, health, among others; Transversal, courses where cross-cutting skills such as teamwork, time management, productivity, among others are worked.

4 Description of the MOOC-CEDIA Observatory

This section describes the MOOC-CEDIA Observatory web platform, developed to provide different visualizations that help analyze the current situation of MOOCs initiatives in Ecuador. Currently the web platform is hosted on the CEDIA server (https://www.cedia.edu.ec/en/) and can be accessed from the site https://observatoriomoocs. cedia.edu.ec/ (see Figure 2). From the web platform, researchers have the possibility to interact with the visualizations and filter the information to be displayed, helping in the analysis of the data of interest for the researcher. In all the visualizations, data can be filtered by year. Depending on the analysis, data can be visualized in different levels of detail; for instance, this is the case of demographic data which can be filtered by province. Currently, only the 2020 data is available. To keep the

observatory up to date, an annual update of the data collected is planned. In this way, we will be able to track and analyze the evolution in terms of the adoption of MOOC in Ecuador.
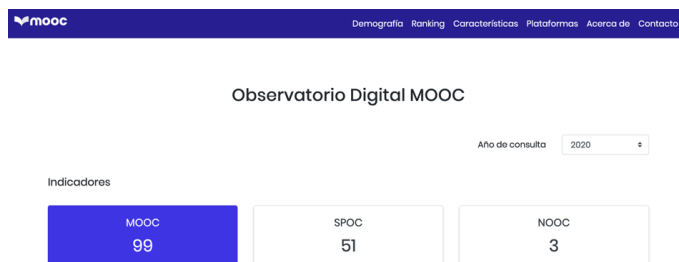

Figure 2: Observatory MOOC-CEDIA

5 Results: Ecuadorian Higher Institutions Adoption

This section presents the main results of the adoption of MOOCs in Ecuador, based on the visualizations offered by the MOOC-CEDIA observatory. The results have been organized to answer the research questions proposed in section 2: (1) an overview of MOOCs in Ecuador; (2) the characteristics of the courses; and (3) the technological platforms used for their implementation.

5.1 Overview of MOOCs in Ecuador

This section addresses the first two research questions:

- *RQ1. How many MOOCs are developed in HEIs or other institutions in Ecuador?*

- *RQ2. Which universities/institutions produce MOOCs and represent national leaders and benchmarks?*

R1. Until October of 2020, a total of 99 MOOCs were registered, 51 SPOCs and 3 NOOCs, were the 14.2% (N = 9) of Ecuador's institutions (7 HEIs, 1 corporation and 1 network) are MOOCs producers, the 10% (N = 7) of HEIs develop SPOCs and the 1.4% (N = 1) develop NOOCs.

R2. Universities with the highest production of MOOCs are the Private Technical University of Loja – UTPL (N = 50), the National Polytechnic School – EPN (N = 22), followed by the MOOCs repository of CEDIA (N = 11) and the Network of Financial Development Institutions (not a HEI) (N = 6).

R3. Universities with the highest production of SPOCs are the Polytechnic School of the Litoral – ESPOL (N = 32), the Universidad de Especialidades Espíritu Santo – UEES (N = 6), the Pontifical Catholic University of Ecuador – PUCE (N = 5) and the Universidad Católica Santiago de Guayaquil – UCSG (N = 5).

R4. From the 99 registered MOOCs, most have been produced by Private Universities (N = 54), followed by the Public University (N = 29) and finally CEDIA's MOOCs repository (N = 11).

R5. From the 51 registered SPOCs, most have been produced by Public Universities (N = 34), followed by the Private University (N = 17).
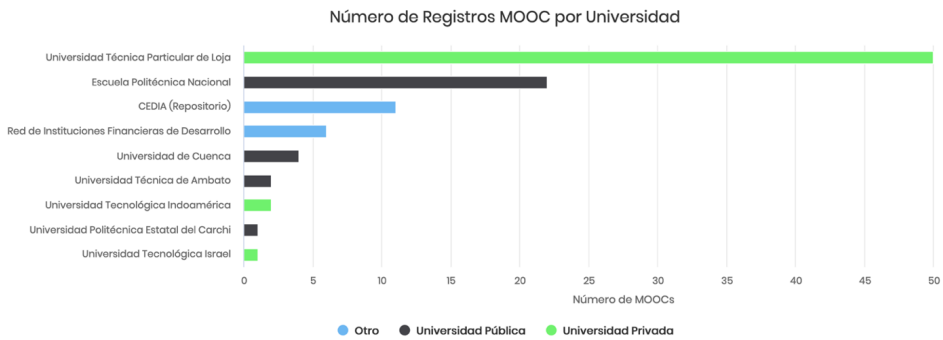
Figure 3: Ranking of institutions with MOOC

5.2 Characteristics of the MOOCs in Ecuador
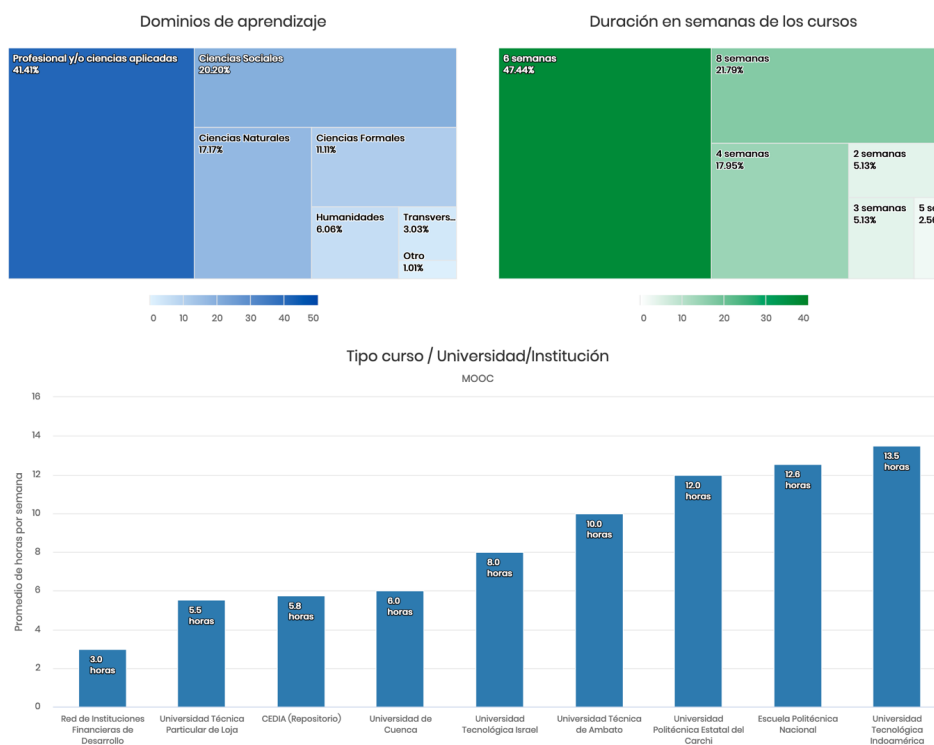
This section addresses the following research question:

- *RQ3. What are the main characteristics of MOOCs in Ecuador's HEIs (topic, duration, dedication required by the student?*

R1. Available MOOCs cover domains related to professionalization and/or applied sciences (41.41%, N = 41), social sciences (20.20%, N = 20) and natural sciences

(17.17%, N = 17). The area of humanities and cross-cutting sciences are the least covered by the offer of MOOCs.

R2. The average dedication required by the student in Ecuadorian IES to review the MOOC is 8 hours per week.

R3. On average, the duration in 41% of the MOOCs in Ecuadorian HEIs is about 6 weeks (N = 37), for 23% of HEIs is about 4 weeks (N = 21), and for 22% of them is 8 weeks (N = 20).

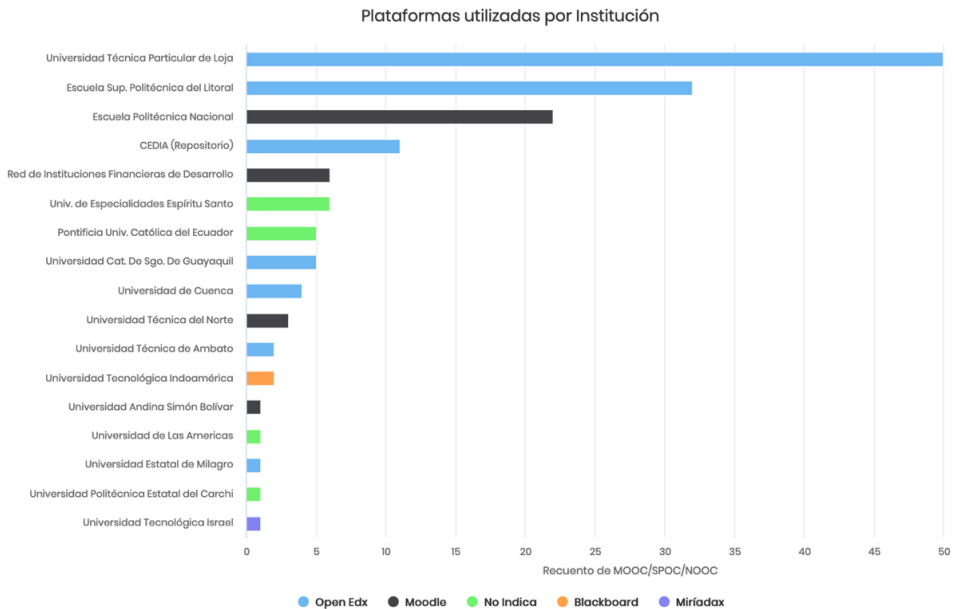**Figure 4:** Characteristics of the MOOCs in Ecuadorian HEIs

Figure 5: Platforms used to deploy MOOCs in Ecuador

5.3 MOOC Platforms in Ecuador

This section addresses the following research question:

- *RQ4. Which platforms are most commonly used for MOOCs deployment?*

R1. The predominant platforms for MOOCs in Ecuador are Open edX (44.4%, N = 4) and Moodle (22.2%, N = 2).

R2. The use of leading platforms such as Open edX focuses on 4 institutions (UTPL, CEDIA Repository, U. de Cuenca and U. Técnica of Ambato), while the use of Moodle focuses on 2 HEIs (EPN, Network of Financial Development Institutions).

R3. Only 2 Public Universities use Open edX (U. de Cuenca and U. U. Técnica of Ambato) and 1 Public University uses Moodle (EPN), while only 1 private IES (UTPL) uses Open edX.

6 Recommendations to Improve the Adoption of MOOCs in Ecuador

Studies such as those described in [6, 4], reveal that, although open platforms, such as MOOC platforms – for example Open edX (https://open.edx.org), Course-builder (https://code.google.com/p/course-builder) and OpenMOOC (https://openmooc.org/) – are very useful and are considered the solution for distributing and reusing learning material. However, the amount of work, time required for its implementation, and the services they provide, are the main reason for HEIs to give up their adoption against their use. Other works such as [7] have identified barriers that limit access and use of open platforms, including: (1) lack of broadband availability to give visibility to the digital resources (technical); (2) lack of resources to invest in hardware and software required to develop and share MOOCs (economic); (3) lack of competence in the use of these technological inventions and style of communication (social); (4) resistance to sharing and using resources produced by other teachers or other institutions (cultural); (5) lack of knowledge on how to license intellectual property (legal). In addition, these works cite factors of different nature that compromise the usability of platforms and MOOCs, including: (6) conceptual and pedagogical factors (relating to concepts about what is and is not a MOOC, the amount of terminology created to refer to such courses in a different way, and lack of knowledge about the use of these courses in contexts other than virtual); and (7) politicians and organizations (position of the institution and the services involved for the implementation of a MOOC initiative, definition of processes and management of the platform, content and the establishment of metrics to measure impact).

The definition of recommendations to improve the adoption of MOOCs in HEIs, is a process that will require even more study. However, this work is a good start point to be able to explore the real situation in HEIs regarding MOOCs and to be able to define some recommendations in relation to the gaps and factors described in this section (see Table 1). Table 1 shows the direct ("D" relationships, those that are directly described and whose answers have been possible to obtain them through this study) and indirect ("I", those that can be inferred from the answers obtained in this study), identified between the answers to the questions included in this study and, the gaps – factors that affect the adoption of an institutional MOOC initiative. However, the following questions were used to define some early recommendations in relation to bridge the gaps and factors described in this section:

- *Q1. How many and which HEIs have institutional mechanisms for the creation and management of MOOCs (institutional initiative)?*

- *Q2. What kind of infrastructure can HEIs provide to produce MOOCs?*

- *Q3. What are the mechanisms used for the quality assessment of MOOCs?*

- *Q4. What are the methods or guides used to produce MOOCs?*

- *Q5. What platforms are used to deploy MOOCs?*

- *Q6. What training needs do HEIs have, that are relevant to the production of MOOCs in Ecuador?*

Table 1: Relationship between barriers and factors affecting the adoption of MOOCs at HEIs

Barriers and Factors	Questions					
	Q1	Q2	Q3	Q4	Q5	Q6
1- Technological (relating to the implementation, operation, visibility, use of the MOOC platform and MOOCs).	D	D	I	I	D	I
2- Economic (lack of resources to invest in hardware and software required to develop and share MOOCs)	D	D	I	I	D	I
3- Social (lack of competence in the use of these technical inventions, communication style)	D	I	I	D	D	D
4- Cultural (resistance to sharing and using MOOCs produced by other teachers and other institutions)	D	D	I	D	D	D
5- Legal (derecognize about how to license intellectual property)	D	I	I	I	D	D
6- Conceptual and pedagogical (relating to MOOC, SPOC, NOOC, MOOC platforms and reuse concepts)	D	D	I	I	D	I
7- Political and organizational in nature (as regards the position of the institution and the services involved in the implementation, definition of processes and management of a MOOC initiative and the development of its contents)	D	D	I	I	D	I

From Table 1 we have stablished a set of recommendations to improve the adoption of MOOC initiative in Ecuadorian HEIs. We present the recommendation, explain the type of barrier and the proposal.

Recommendation 1: Delegated and Centralized Management of MOOC Platform

Barriers: Technology and Economics
Proposal: To update CEDIA's centralized national infrastructure platform, so that its administration, implementation, deployment and data analytics services improve the academic visibility of MOOCs produced by different HEIs, adopting common standards (conceptual and pedagogical) at the national level.

Recommendation 2: National Training Plan on the Design, Implementation, and Use of MOOCs

Barrier: Social, conceptual and pedagogical
Proposal: As a recommendation to overcome this barrier, a national training plan (virtual, online or face-to-face) can be designed in the use of technologies for the design of educational content in low-cost MOOC format and design incentive and reward programs for outstanding teachers within the HEIs academic community.

Recommendation 3: MOOC National Conference and Competition

Barrier: Cultural
Proposal: In addition to the existence of a centralized MOOC platform, this barrier can be overcome by the stimulus that would generate a national MOOCs competition, which would seek to promote collaboration between institutions, publication, sharing and reuse of MOOCs produced by the participants, giving visibility to the content generated. This will help HEIs to start sharing good practices, discuss different views, and find technical, technological, conceptual and pedagogical agreements that allow them to move forward in the creation and exploitation of these resources.

Recommendation 4: Support Mechanisms for Quality Validation and Licensing of MOOCs Content

Barrier: Legal
Proposal: This barrier can be overcome with the development of a support service in CEDIA, that includes the review and validation of MOOCs by academic peers after publication on the platform. This will allow the collaborative evolution of the creation of MOOCs, maintaining the intellectual property of both original and evolved versions, together with training on how to license and reuse published MOOCs.

Recommendation 6: National Policies on the Creation, Publication and Use of MOOCs

Barrier: Political and organizational
Proposal: To build the internal capacity in CEDIA service to establish specific guidelines and the necessary monitoring and follow up on the creation, publication and use of MOOCS in its centralized platform. This will allow to analytically evaluate its effectiveness in content management, and to integrate into other global ecosystems, seeking their sustainability over time.

7 Conclusions

In order to better understand the current situation of MOOCs in Ecuador, this study presents the state of the art of *the adoption of MOOCs in Ecuador and the analysis of barriers and factors that facilitate their adoption.* This study describes the main objectives and also describes the methodology followed for the survey of the analyzed data presenting the analysis of the data obtained of MOOCs in Ecuador, from the number of MOOCs produced by all the institutions that are part of the study, to the analysis of the universities that have the highest production of this type of courses. Finally, this study presents the barriers as well as the factors that facilitate the adoption of the MOOC initiative in HEIs and establishes several recommendations that will enable this initiative to be carried out at the national level. In general, as main findings we can mention that: (1) until 2020 there have been 99 MOOCs in Ecuador, (2) the domains of MOOCs are mostly related to applied sciences, social sciences and natural sciences, with the humanities being the least covered, (3) Open edX and Moodle are the most widely used platforms to deploy such courses. These results help to identify the barriers and the factors that hinder their adoption. It is expected that the conclusions drawn from this analysis will allow the design of the first recommendations as a strategy aimed to promote the creation and use of quality MOOCs in Ecuador and help other institutions to chart the same route.

References

[1]   C. Alario-Hoyos. "MOOC-Maker: Tres Años Construyendo Capacidades de Gestión de MOOCs en Latinoamérica". In: Proceedings of the II International Conference MOOC-Maker. 2018, pages 4–14.

[2]   *European Project Home & OpenEd*. 2015. URL: https://home.eadtu.eu/ (last accessed 2020-09-01).

[3]   A. Fox. "From MOOCS to Spocs". In: *Communications of the ACM* 56.12 (2013), pages 38–40.

[4]   J. J. Maldonado Mahauad, J. P. Carvallo, and J. Siguencia. "Educational repositories'". In: *IEEE Revista Iberoamericana de Tecnologias del Aprendizaje* 11.2 (2016), pages 79–86.

[5]   J. Maldonado-Mahauad. "Participation of Latin America in MOOCs: Exploring Trends Across Providers'". In: *IEEE Learning With MOOCS (LWMOOCS)*. 2020, pages 25–30.

[6]   X. Ochoa. "Learning Object Repositories are useful, but are they usable?" In: *IADIS AC*. 2005, pages 138–144.

[7]   J. M. Pawlowski and V. Zimmermann. "Open Content: a concept for the future of e-learning and knowledge management". In: Knowtech (Frankfurt, 2007). 2007.

[8]   R. Pérez-Álvarez. "Observatorio MOOC UC: La adopción de MOOCs en la Educación Superior en América Latina y Europa". In: *EMOOCS*. Madrid, Spain, 2017, pages 5–14.

[9]   J. A. Ruipérez-Valiente. "Macro MOOC learning analytics: exploring trends across global and regional providers". In: Proceedings of the Tenth International Conference on Learning Analytics & Knowledge. 2020, pages 518–523.

[10] D. Shah. *By the numbers: MOOCS in 2020*. 2020. URL: https://www.classcentral.com/report/mooc-stats-2020/.

[11] B. Vogel. "An interactive web-based visualization tool in action: User testing and usability aspects". In: IEEE 11th International Conference on Computer and Information Technology. 2011, pages 403–408.

[12] W.-H. Wu. "Review of trends from mobile learning studies: A meta-analysis". In: *Computers & education* 59.2 (2012), pages 817–827.

[13] M. J. Zúñiga-Zhañay, M. Campoverde-Molina, and J. J. Maldonado-Mahauad. "Análisis bibliométrico de los cursos masivos abiertos en línea investigados en las Instituciones de Educación Superior del Ecuador". In: *Dominio de las Ciencias* 6.4 (2020), pages 751–779.