Modern architecture in the professional discourse: analysis of the Architectural Biennial of Quito's 1976–92 archive using bipartite networks

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Abstract

This article studies the contents of the Architectural Biennial of Quito's (BAQ) archive from its first edition in 1978 to its eighth in 1992, using technological tools and producing bipartite networks that make visible the inter- and intra-relationships of the archive's data through quantitative and qualitative analysis. By using these methods and means, the results firstly show how the BAQ articulated discussions of modern architecture in Ecuador, and secondly, the extent of local and international exchanges implicated in the professional scope throughout the BAQ. The study of this archive allows one to understand the most important relationships in the architectural productions and communications at the hands of BAQ as a platform for circulating ideas.

1 Introduction

In 1978, the Ecuadorian Architects Association[1] (hereinafter CAE) established the first Architectural Biennials of Quito (hereinafter BAQ for its Spanish acronym), a project immersed in the local modern architecture blossoming during the oil boom of the 1970s, which constituted the highest economic upturn in this country in the second half of the twentieth century (del Pino, 2003). In a broader context, the process of returning to democracy that most Latin American countries faced during the 1970s and 1980s boosted unprecedented levels of regional interlocution in the field of architectural critics (Segawa, 2005). With an integration-focused rhetoric, academic and professional spheres aimed to establish channels of regional exchanges and shared-reflection agendas. One of the main topics discussed was the analysis of architectural modernity in Latin America due to the advent of postmodernity in global production centres.

In the Ecuadorian context, BAQ held a major role in the dissemination of productions and critical discourses about modernity. This placed Ecuador in an emerging regional network of architects' meetings that have proliferated since the 1970s in Latin America. The Architectural Biennial of Sao Paulo was established in 1973, followed by the Architectural

Biennial of Chile in 1977, the Architectural Biennial of Buenos Aires in 1985, and the Latin American Architecture Seminars (SAL, after its Spanish initials) in the same year. Moreover, the organizers of these events were active agents in the implementation of recurrent publications in their respective countries, which produced dynamism in the editorial sphere (Gutiérrez, 2011). Thus, the architectural colloquies became prevailing platforms for the circulation of ideas throughout the region.

In recent years, a series of governmental institutions have manifested their interest in incorporating 1970s architectural productions into Quito's patrimonial assets, This city's historic centre dates back to the colonial and republican periods and was declared a World Heritage Site by the United Nations Educational, Scientific, and Cultural Organization (UNESCO) in 1978. The inclusion of modern architecture in the heritage properties registry demands, first of all, the examination of the analytic category of 'modern', which is attributed to these productions and cultural values that could shake off their condition of modernity. In the case of twentieth-century heritage, the reception of dissemination processes and discourses about 'modern architecture' could be useful in evaluating the cultural significance and relevance of these productions to contemporary society. This is an inescapable reflection for managing and conserving sustainable heritage (Harrison, 2013).

Hence, this research project began with locating primary sources from the BAQ's founding editions (1978–92), where approximately 13,000 unpublished documents that belong to CAE were recovered and safeguarded in supporting documentaries and digital carriers for ensuring their conservation and accessibility.[2] The archive includes meeting records, newsletters, bulletins, periodicals, press clippings, post, letters, advertisements, lists of participants, jury verdicts, programming, catalogues, conferences, and photographs. The purpose of this article was to review the contents of the BAQ's archive (1976–92) using digital tools, as the development of a dynamic database analysed through bipartite networks to graph, visualize, and describe the inter- and intra-relationships between the quantitative and qualitative data obtained. Likewise, the spectrum of discussion articulated in the first eight BAQ editions became evident based on the identification of predominant

topics, actors, and institutions, the internationally traced channels, and the density of these connections.

Hence, for the purposes of this article, the archive analyses are divided into two parts: the first consists of the creation of a dynamic database that includes bibliographic data and information descriptors; the second involves the generation of bipartite network graphs that make different kinds of connectivity visible, as depicted in Fig. 1. The document is organized as follows. In Section 2: Literature Review, the main elements of digital scholarship and documentary works are detailed. In Section 3: Methodology, we describe how the BAQ archival data were digitized and organized, and how the network was constructed from it. In Section 4: Results, we present the main outcomes of characterizing the intra- and inter-relationships for the top identified authors and topics in the documentary corpus. Finally, Section 5: Conclusions, consists of wrapping up the paper and discussing the main findings.

2 Literature Review

In 1972, the UNESCO General Conference hosted the World Heritage Convention. The resulting document confirmed the value of monuments and architectural complexes as cultural achievements of humanity (UN, 1972). However, architectonic productions from the twentieth century have remained systematically under-represented in the UNESCO World Heritage list since 1978, despite the implementation of specific initiatives, such as the creation of the International Working Party for Documentation and Conservation of Buildings, Sites and Neighbourhoods of the Modern Movement (Docomomo International) in 1988 (Guillet, 2007). According to one of the most recent issues of the 'World Heritage' journal, edited by UNESCO, it is an imperative requirement from the global discussion agenda to define what is modern heritage and which parameters address aesthetics, technique, and social dimensions (Conti, 2017).

The rise of the heritage movements in recent decades has boosted the architectural analysis as a cultural device (Huppatz, 2018). Thus, recent historiographic methodologies tend to analyse the contexts of objects' productions as well as processes of diffusion and reception that they undergo over time (Bluestone,
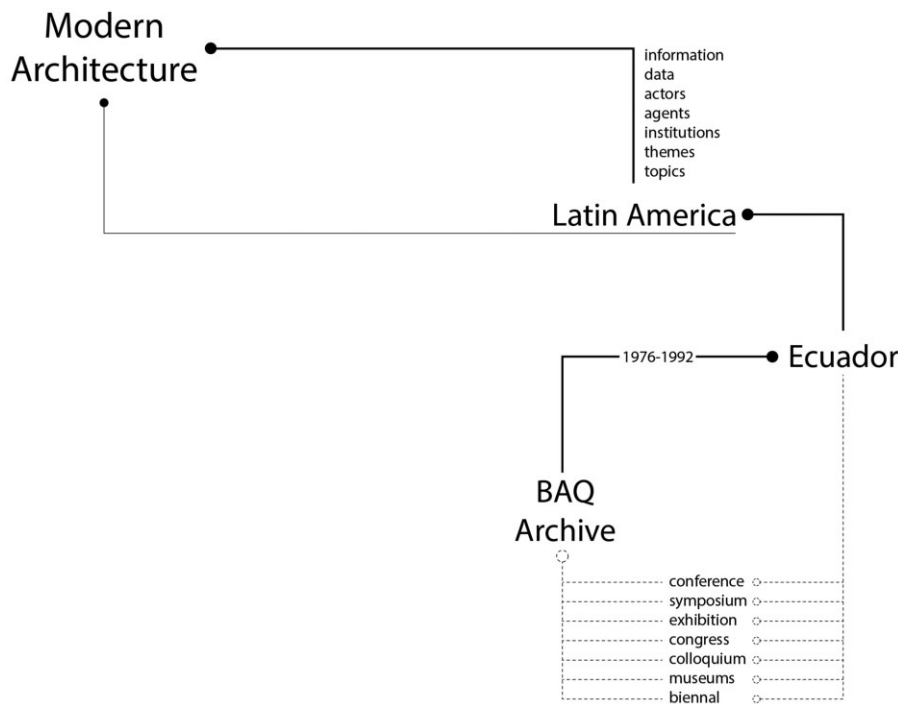
Fig. 1 BAQ archive configuration

1999). Since the 1980s, a plethora of research has employed written media—books, periodicals, magazines, newspaper articles, and editorials—as one of the main documentary sources for the dissemination and communication of modern architecture. The international symposium 'The site of discourse. Thinking architecture through publication' held in Lisbon in 2015 brought together more than fifty specialists from Europe, Asia, and Latin America to reflect on the role of editorial culture in contemporary architectural discourse (Figueiredo et al., 2015). The written media make it possible to identify not only the most widespread architectural productions but also the reception that these experimented in the specialized critic or in the public opinion (Woods, 1989).

However, print-based media have not been the only platforms for the dissemination of the twentieth-century architectural culture. Such is the case of the architectural exhibitions that have increased significantly in museums in the USA and Europe since the 1960s (Cohen, 1999). In Latin America, the proliferation of architectural colloquia was a unique phenomenon in the region in the last decades of the twentieth century (Gutiérrez et al., 2007). In countries such as Mexico, Cuba, Venezuela, Colombia, Ecuador, Peru, Chile, Uruguay, and Brazil, a series of biennials, congresses, meetings, and seminars were undertaken by academic, governmental, and professional institutions, encouraged by the desire to overcome the situation of cultural isolation produced during the period of military dictatorships that most Latin American countries went through (Eliash, 1989). In 1973, the Architectural Biennial of Sao Paulo and the Andean Regional Group Assembly of Architects began. These were followed in 1977 by the Architectural Biennial of Chile and in 1985 by the Architectural Biennial of Buenos Aires and the Latin American Seminars of Architecture (SAL).

Despite their pre-eminence in the architectural evolution of Latin America, the colloquiums of architects have rarely been studied in the history of modern architecture. However, they constitute an unexplored documentary source of knowledge circulation networks on a transnational scale, a spatial dimension infrequent in historiographical studies carried out in

the region (Lara-Betancourt and Rezende, 2019). To a large extent, this gap is the result of the inaccessibility of primary documentary sources due to the short or sporadic trajectory of some of these events or, in other cases, due to the organizing institutions being unable to implement institutional archives (Gutiérrez, 2015). Yet, in recent years, an initial wave of studies has appeared in Latin America. In 2007, the Pan-American Archive Federation of Architects in Montevideo made possible the publication of the book *Congresos Panamericanos de Arquitectos 1900-2000. Aportes para su historia* (Pan-American Congresses of Architects from 1900-2000. Contributions to its history) (Gutiérrez et al., 2007). In 2011, in Buenos Aires and in 2013 in Bogota, two books were published, respectively: *Seminarios de Arquitectura Latinoamericana. SAL. Haciendo camino al andar 1985-2011* (Seminars of Latin American Architecture. SAL. Making the road as you go) (Gutiérrez, 2011) and *Las huellas que devela el tiempo (1985-2011). Seminarios de Arquitectura Latinoamericana* (Foodprints Revealed by Time, 1985-2011. Seminars of Latin American Architecture) (Ramírez Nieto, 2013). Both publications worked with archives from the Centre of Latin American Art and Architecture Documentation or CEDODAL for its initials in Spanish. In 2014, the book *Bienal Internacional de Arquitectura de Buenos Aires. 1985-2011 26 años de historia* (International Biennial of Architecture of Buenos Aires. 1985–2011. 26 years of history) was published (Rodriguez et al., 2011). Lastly, in 2017, the project '*Des-inventario de un Archivo en Uso*' (Dis-inventory of an Archive in Use) critically analysed the trajectory of the Biennial of Chile using local periodicals (Loyola, 2018).

These seminal works highlight that, unlike historiographical research using written media, the analysis of architectural colloquia is supported by archival material. In this sense, documentary accessibility in the recent 'digital revolution' has transformed the dimension of archival practices and the methodological tools of historiography (Harris, 2015). This is not the case in the field of architecture, where the quantitative scrutiny of documentary corpus has been underestimated to the detriment of qualitative analysis (Esteban-Maluenda et al., 2019). This situation has been reversed in recent years in several academic areas. In 2018, the meeting 'Architectural and Planning Cultures Across Regions. Digital Humanities Collaboration Toward Knowledge Integration' held in Tokyo communicated research projects developed in Spain, Italy, Brazil, and France that have incorporated the use of digital tools in processing dissemination of the vast amount of information contained in architectural publications (Caramellino, 2018). The project 'Mapping 20th century periodicals as platform for architectural and urban knowledge' by the Polytechnic University of Milan analysed magazines from seventeen countries published between 1920 and 1960. The project 'Architext Mining: Spanish Modern Architecture through its texts, 1939-1975' by the Polytechnic University of Madrid digitized all Spanish journals produced during the Franco dictatorship (Esteban-Maluenda et al., 2019). The enhancement of the architectural heritage of the twentieth century requires an interdisciplinary perspective of analysis in which heritage conservation, historiography, archival science, and documentary management converge. It has been widely recognized that the proper conservation and documentary accessibility of modern architecture guarantees the study and dissemination necessary for the enhancement of the heritage value of these buildings (DoCoMoMO, 2014).

In Ecuador, the BAQ archive offers the possibility of analysing from a transnational perspective the framework of discussion elaborated upon by the Quito architects' guild regarding architectural production in the 1970s and 1980s. Although this reading represents the official discourse produced by intellectual elite of professionalized work, it constitutes an interesting starting point for re-evaluating the cultural meanings that these productions may have experienced in a broader social and temporal context. The study of underlying relationships between professional discourses and architectural practice could improve approaches towards appropriate policies for the protection of modern architecture as cultural heritage. Moreover, it could contribute to the insertion of objects of historical and cultural value in contemporary urban dynamics.

3 Methodology

In this section, we present as essential the inclusion of technical and qualitative approaches for data

extraction from the BAQ archive. We used a criterion for unpublished information related to the understanding of modern architecture in Ecuador during the 1970s and 1980s. Once these data were extracted, the network was modelled by weighting the connectivity of pairs of documents or key terms by aggregating the different occurrences in the database according to annual dossiers.

3.1 Data collection and organization

Historical research is increasingly being digitized, processed, and analysed as methods of knowledge dissemination. This article presents a set of documents from the first eight BAQ editions, with over 13,000 documents that have been retrieved and available in a keyed format and modelled using optical character recognition (OCR) and bipartite networks. The unpublished archive presents different types of documents—from newsletters to conferences, advertisements to jury verdicts, meeting records to photographs, and so on, allowing one to examine the productions and dissemination of ideas and discourses related to modern architecture in Ecuador during the 1970s and 1980s.

For this purpose, we used an archive collected from 1976 to 1992 and held by CAE. This institutional archive included administrative paperwork, as well as legal and organizational documents related to this organization's activities. We matched the documentary typologies into two information categories: administrative and technical. The first group incorporates memos, reports, letters, meeting proceedings, newsletters, correspondence, telegrams, covenants, instructions, manuals, regulations, list of participants, and programmes. The second group refers to conferences, speeches, discourses, unpublished articles, technical studies, jury verdicts, competition regulations, photography, legislative plans, and project memories. In addition, this category includes materials of diffusion such as press, posters, books, and periodicals.

The archive consists of 13,251 written scripts and printed documents on industrial paper and, to a lesser extent, newspapers, photographic paper, cardboard, and other items. These documents were cleaned, disinfected, and repaired where necessary due to tears, rips, kinks, torn, and/or oxidation. Subsequently, the archive was classified into thirty-nine volumes, presented as bounds A4 books, containing ten files corresponding to the years: 1976, 1977, 1978–79, 1980–

81, 1982–83, 1984–85, 1986–87, 1988–89, 1990–91, and 1992–93. This classification conserved the original BAQ editions' chronological structuring, in which the documents were issued, received, and stored by CAE until their recovery in 2018. From this point, it was necessary to digitalize the archive to preserve the hitherto unpublished texts. The digital collection consists of ten folders containing 12,487 images in A3, A4, A5 sizes, which were formed into seventy-eight PDF documents, as described in Table 1.

The digital archive has a total size of 3.6 GB total size. In addition, the standards in capturing and processing images are as follows: Depth: twenty-four colour bits; Resolution: 300 dpi; Format: uncompressed PDF; Optical Character Recognition (OCR); ISO 13028 standard coding. It was necessary to include metadata to make it possible to access and recover information and generates the index file for offline searches.

The documentary analysis is contained in a dynamic database in nine fields: code, title, author, year, place, number of pages, notes, and descriptors, as detailed in Table 2. These fields comply with the double purpose of extracting both bibliographical notes and qualitative and quantitative data related to the research questions. The field *code* indicates the biennial edition; *title* indicates the documents' typology; *author* identifies private and institutional authors; the fields *year* and *place* show the temporality and the spatial scale of the information interrelations; *notes* adds physical descriptions about the materials and data that were not specified in the former fields; and finally the field *descriptors* undertakes a qualitative analysis of the archive contents based on 141 keywords, which have been assigned to each one of the analysed documents and collections. These

Table 1. Database summary

Dossiers	BAQ edition	Year	Set of documents	Pages
3		1976–77	3	438
2	I	1978	2	599
16	II	1980	99	2,420
3	III	1982	53	2,015
5	IV	1984	82	960
7	V	1986	136	1,985
2	VI	1988	24	503
30	VII	1990	30	2,648
10	VIII	1992	43	701

descriptors refer to the documentary typologies, actors, topics, and the scope of discourses circulation.

In this database, there are 469 records, seventy-eight of them comprise the ten folders that form the archive. Furthermore, this project analysed 390 documentary units, presenting information related to BAQ and modern architecture heritage in Ecuador.

The information contained in Table 2 can be manipulated in two ways according to the diagram in Fig. 2, which shows a schematic representation of some variables present in the database. A wide format is shown in Fig. 2-left (on the left), representing each column in the aforementioned table, with the ID column followed by a group of miscellaneous columns, in grey, for example, *Author* and *Title*. The keywords' information can be split from the original *Keywords* column, with each unique value transformed into dummy binary columns, with a 1 (or 0) representing that the keyword is present in the corresponding documentary group identified by ID (or not). These miscellaneous columns can be used to summarize information according to their categorical values, for instance, 'year' is used to summarize the data following the BAQ timeline. A long format transformation of the data is shown in Fig. 2 (in the middle). The long format of the data gathers common attributes together as a single variable (*var* column), collapsing the multiple *key!* columns and collapse them into the *var*-value pairs, duplicating columns as needed. The long format can be grouped and filtered accordingly to the analysis one wishes to perform. For instance, it can be grouped by *Year* and *var* and filtered by *value==1*, relating the year in which a document was published with the document-identified keywords. The next subsection outlines how the data

representations can be interpreted as a bipartite network.

3.2 Network construction and characterization

Many systems are naturally modelled as bipartite networks, particularly social and document networks (Newman, 2003). A bipartite network is a graph whose nodes are divided into two disjoints and independent sets U and V, and only the connection between two nodes in different sets is allowed (Zhou et al., 2007).

A binary table relating documents to key terms, can be presented as a bipartite network, where the binary table can be considered as an incidence matrix A, expressed according to the following Equation (1):

$$A_{ij} = \begin{cases} 1, & \textit{if the document has the key term,} \\ 0, & \textit{otherwise.} \end{cases} \quad (1)$$

The dimensions of the matrix **A** are $(d \times k)$, where k is the number of keywords (columns) and d is the number of documents (rows) present in the incidence tables. The relationship between key terms contained within a document is represented as a (1), and no relationship is marked as a (0) in the incidence matrix **A**. The **A** matrix data are processed as a two-part network (Zhou et al., 2007; Larremore et al., 2014), where the relationships can occur between documents and the key terms, but not between elements of the same type. That is, it does not relate documents to each other or key terms to each other.

The adjacency (incidence) matrix **A** can be observed directly from the data wide format in Fig. 2 (left), where each document set (ID) is related

Table 2. Description of variables

| Item	Description	Type
ID	Documentary group code	Alphanumeric
Title	Documentary group title	Text
Year	Publication year	Date
Personal Author	Documentary author	Text
Corporate Author	Corporate author	Text
Place	Place of issue	Text
Number of pages	Number of pages in dossier	Number
Notes	Notes describing the document	Text
Keywords	Keywords describing the document	Text
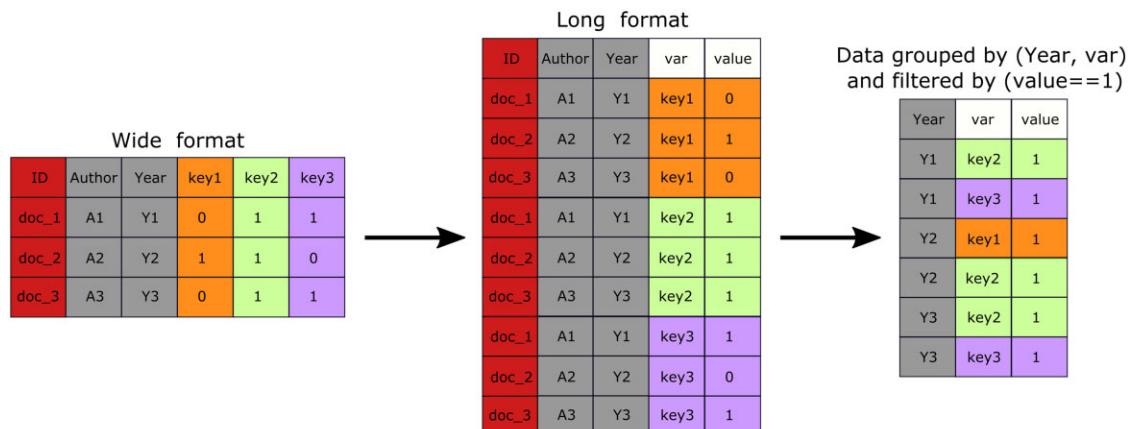
Fig. 2 Data representation formats. Left: wide format (adjacency matrix). Middle: long format (edge list). Columns in grey are miscellaneous ones used for grouping. Right: data grouped (by Year and var) and filtered (by value==1)

to a key term (*key1, key2, key3, . . .*). That would be equivalent to a matrix with row names indicated by the ID column and column name: *key1, key2, key3, . . .*, with each cell filled by the binary content of those columns. The long format in Fig. 2 (right) can be interpreted as an edge list, where every document set ID would be equivalent to a *from* node and is related to a key in the *var* column, which would indicate the *to* node, with the *value* column representing a binary *weight* (*value*∈{*1, 0*}), indicating if there is a relation between the document and the keyword, or not. Note that this relationship is interpreted as non-directed in the bipartite network.

Graphs that are fundamentally bipartite are studied by projecting them down onto one set of vertices or the other, resulting in the so-called one-mode projections (Newman, 2003). The two projections that are possible according to the incidence matrix **A** in Equation (1), result in the matrices **D** and **K**:

$$D = A \times A^T, \qquad K = A^T \times A \qquad (2)$$

K is a matrix of size $(k \times k)$ that correlates key terms (nodes), where the weighting of connections is given by the number of documents in common between each pair of terms, and **D** (of size $d \times d$) correlates documents (nodes), where the weighting is given by the number of terms in common that implement them. The projected information is then summarized according to particular information present in the documents and terms, such as year of publishing, and key terms grouped by affinity.

The one-mode projection **K** of the bipartite network establishes the relationship between key terms. This projection relates terms that are common to a number of documents, and this number gives a weighting to the edges that connect terms according to their common elements. The projection **D** of the bipartite network discovers the relationship between the documents according to the key terms in common. This relates to documents that have common key terms, and the number of terms in common gives the weighting to the edges that connect them, which is a clear measure of the existing strength of the relationship between documents according to the common key terms present in them.

Figure 3 depicts the BAQ archive bipartite network that can be extracted from the data formats in Fig. 2 in the middle panel within the dashed rectangle. The green nodes representing the year of the document can also be represented as a partite set connected to the documents. Note that the resulting representation is a multipartite graph, which is a structure that emerges in social/documentary hierarchy (Baetz, 2015). In a multipartite graph the set of nodes *N* can be partitioned into an arbitrary number of independent sets (so-called partite sets or parts) such that every node shares a link with nodes outside of its own set but not inside the set it belongs to, as in Fig. 3. The two
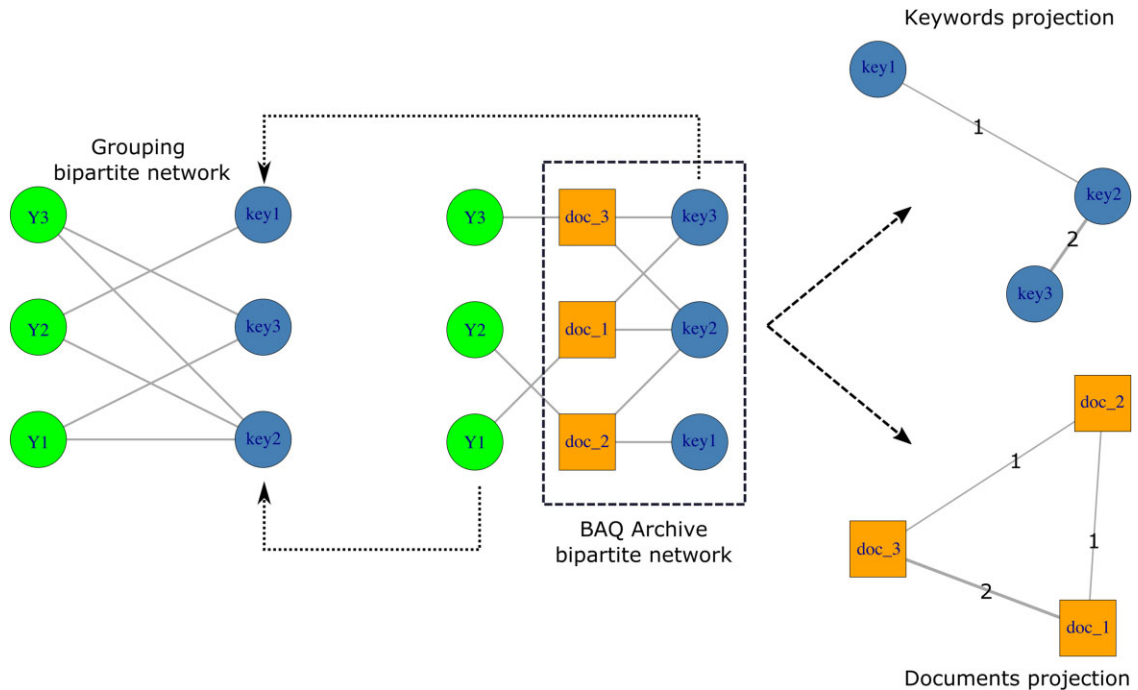
Fig. 3 Archive network representation. One-mode projection from bipartite network and grouping network by category

possible projections from the BAQ archive bipartite networks are depicted in the top right-hand panel of Fig. 3, where the Documents and Keywords projections are observed. The Keywords network results from the documents in common, for instance, *key2* and *key3* nodes share a connection with *doc 1* and *doc 3* resulting in an undirected edge (*key2* and *key1*), with a weight of 2 (the common documents). The documents projections are built similarly and are depicted in the right-bottom panel of Fig. 3. The summarizing process (grouping and filtering) depicted in Fig. 2 (right) panel, can be represented as a bipartite network, as shown schematically in Fig. 3 (left) panel, with the resulting bipartite network relating years (green circle nodes) to keywords (circle blue nodes) through the connecting documents (square orange nodes), which are an intermediary (pivot) in the grouping process.

Based on the possible projections and summarizing by the additional attributes present in the data, such as year of publishing or grouping of key terms, the relationships between elements (documents or terms) are represented as graphs (Newman, 2003) or as chord diagrams (Jalali, 2016). These relationships are discussed in the following section.

4 Results

In this section, we present the main relationships between key terms and topics resulting from the bipartite projections of the BAQ-Archive data. We start describing the data that gives origin to the bipartite relationship between documents and key terms, the most frequent terms identified. Then a bipartite relation is described, summarized by the year of the document and its relationships with key terms. One-mode projections of the bipartite network are described for key terms groups, and, finally, a distance-based cluster analysis is discussed.

4.1 Data and key terms statistics

Figure 4 depicts the incidence matrix connecting key terms (rows) with documents (columns). It can be appreciated that the incidence matrix is sparse, i.e. there is a low density of ones (yellow tiles). The

frequency of the key terms can be inferred from the incidence matrix from a sum of the rows. This frequency is depicted in Fig. 5, where the top fifty most frequent key terms are plotted. Here, based on the association analysis, the figure reflects that administrative documents related to the Biennial organization and outcomes are the highest in numbers, while technical documentation stands in the top ten most frequent key terms. The bipartite network is constructed from Fig. 4 which relates documents with key terms. A subsection of the summary bipartite network grouped by year and for selected key terms is shown in Fig. 6. The bipartite network displays the years represented as red squares, with the size of the square indicating their importance in terms of its degree of connectivity. The selected key terms are in circles and in colours. Groups are indicated by affinity of terms, such as personalities in grey, countries in yellow, and topics in cyan.

From Fig. 5, the second and fourth most frequent key terms suggest that the administrative work was concentrated on making the biennial international, by inviting foreign guests who were at the time, relevant personalities and actors in the field of architecture. These relationships are especially clear from 1980

to 1984 and from 1990 to 1992, which can also be reflected in Fig. 6 and substantiated in Fig. 4. Upon testing the fifty most frequent key terms, Fig. 5 measures instances broadly related to that administrative work, and relegated topics and discourses proposed by the different BAQ editions. Hence, it corroborates that the different speeches and discussions revolved around the foreign guests and critics rather than the proposed agenda by BAQ. In the top ten frequent key terms, the main links are outlined by organizations, especially between BAQ and governmental institutions, such as the National Housing Board (*Junta Nacional de la Vivienda*) or Quito's Municipal Planning Management Office, rather than with academic or professional organizations like the Ecuadorian Chamber of Construction (*Cámara de la Construcción de Ecuador*) or the Pan-American Federations of Architects' Association (FPAA). This situation is seen in the first eight BAQ editions, which differed from the foundational interests of this organization namely, to strengthen relationships with the international community and reach cultural exchanges with other Latin American countries (Moya and Peralta, 1979). Instead, the results of these

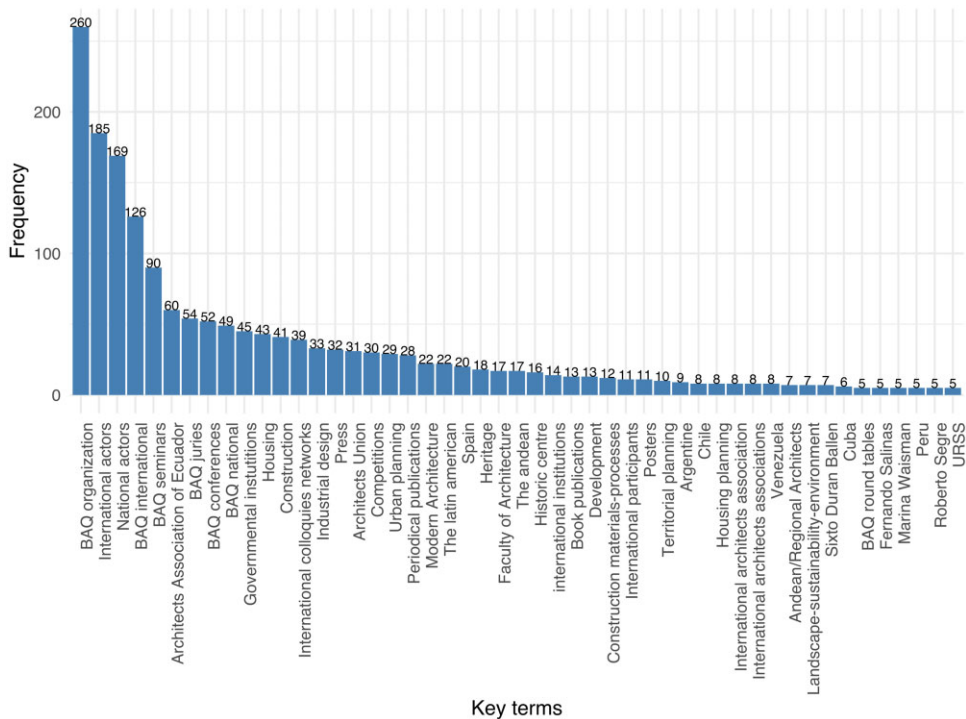**Fig. 4** BAQ incidence matrix data relating key terms (rows) with documents (columns)

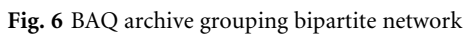**Fig. 5** The top fifty key terms in the BAQ archive

editions flagged the local context from public institutions to construction and urban planning sectors, exposing the division between the topics discussed as intellectual presentations, and the consequent projects developed on a national level.

4.2 Bipartite network, one-mode projections, and clustering analysis

The summary bipartite network in Fig. 6, groups *discourses*, *actors*, *countries*, and *years*. This bipartite network reflects the dissonance shown in Fig. 5, in which some BAQ editions focused on international and relevant personalities in the field of architecture, but Fig. 6 also indicates that in certain other editions, the topics for discussions had a more central role. In 1992, the VIII BAQ edition had a grouped network with a solid connection, mainly with personalities from overseas recognized within the Latin American architecture scene, such as Antonio Roca Fernández, Cristian Fernández Cox, Ricardo Legorreta, Eladio Dieste, Clorindo Testa, and Abraham Zabludovoski. Nonetheless, in 1980 during the II BAQ edition, it

was the seminars the ones that consolidated and formed the main space for discussion. In this case, topics such as housing, industrial design, and urban planning had an important presence, producing consequently an input of intellectual and rational discourse. These topics remained present in the following three biennials, but in addition to the administrative strategy, it was also a reflection of the national economic situation. The 1984 international crisis eroded the national scope and subsequently reduced the CAE's resources, linked directly to real estate activities and taxes collected from the construction sector.

While the relationship between BAQ editions, discourses and personalities identify the underlying grasp of each biennial, there are many diverse instances in which Fig. 6 makes visible the international connections. Although the strongest connection is with other Hispanic-American countries, there is a significant presence of countries such as the URSS, USA. Belgium, Holland, Sweden, Germany, and Bulgaria. In some cases, the BAQ was interested in bringing in

Fig. 6 BAQ archive grouping bipartite network

globally recognized individuals like Robert Venturi, Reyner Banham, and Manfredo Tafuri, which could have had an additional impact on personal networks. In other cases, the local academy had geopolitical interests in bonding with architectural debates from Eastern European countries.

For Fig. 9, the bipartite network is projected by obtaining the **K** matrix that relates key terms. **K** is a weighted matrix where each pair of related key terms has a weight value, indicating the coincidences in the original incidence matrix **A**. Such weighted relations can be grouped by topics and summarized as depicted in Fig. 7. The **T** matrix relating key terms, and grouped by topics can also be summarized for the items present in the BAQ archive, as depicted in Fig. 8. The projected **T** can be considered as a similarity matrix where the weights linking each pair of key terms can be interpreted as a similarity measure between them. Thus, the similarity matrix **T** can be written as a distance matrix:
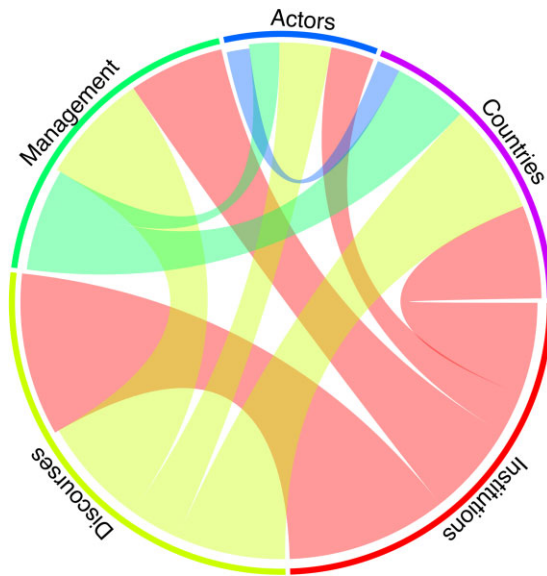
Fig. 7 Groups related by documents in the topics one mode network from projected matrix **K**

$$\mathbf{T}^{\mathbf{D}=1^-} max(\mathbf{T}),$$

where each entry *Dij* is scaled between 0 and 1. Once the distance matrix was calculated for every pair of key terms, a hierarchical clustering was performed by using **D** matrix distance affinity and Ward linkage. Figure 9 depicts the results for two and three clusters.

Figure 7 describes the different relationships occurring primarily between institutions and actors, countries, management, and discourses throughout the BAQ editions. From Fig. 7, we can also identify the dissemination of information displayed in Fig. 5, in which the *discourses* category seems to be unconnected to the most frequent key terms. This figure visualizes the close relationships between CAE and the governmental and public institutions and how much influence these institutions had on these biennials. However, we need to consider that this was the time in which the Military Junta institutionalized its agenda, backed up by the oil boom that hit the economic sector at the beginning of the 1970s and rapidly declined in the early 1980s. Ecuador began the process of returning to democracy from 1978 onwards. The 1970s officialism had an indisputable impact on the corresponding BAQ editions, influencing not only the intellectual

discourse but also the professional one, delegating the architectural scope to the institutional space.

While the institutionalization of this agenda was in motion, there was also a clear intention to bond the links with international institutions, actors, and organizations in the architectural sphere. Figure 8 relates to what Fig. 5 establishes as connections between discourses and the institutions' agenda from 1978 to 1992. The government's development agenda in the 1970s seemed to influence CAE and BAQ interests, especially in terms of social housing, industrial design, and urban planning, which were non-existent fields in architectural professional practices before the oil boom development.

Furthermore, the importance of the key term 'Colegio de Arquitectos Internacionales' (International Architects Associations), shortened to CAE, in Fig. 8 suggests that these topics were part of a shared agenda between it and other regional unions. The frequency of the key terms 'arquitectura moderna' (modern architecture) and 'patrimonio' (heritage) in Fig. 8 was two of the fourteen key terms in Fig. 9. This highlights one of the most relevant moments in architecture, which coincided simultaneously with the architectonic modernization in Quito during the 1970s and 1980s. In addition, the creation of the I BAQ in 1978 coincided with UNESCO's declaration of the architectural historic centre as a World Heritage Site, displaying that the preservation and protection of the colonial heritage that also shaped the discourse of modern architecture in Quito. Consequently, BAQ established itself as the main international platform for contemporary architectural projects exhibitions from the 1970s onwards.

5 Conclusions on Modern Architecture in the Professional Discourse

This work demonstrated that the use of dynamic databases to structure quantitative and qualitative information proved to be effective for exploring the contents of large documentary corpora. The analysis of these data through the use of bipartite networks made it possible to establish interrelationships that
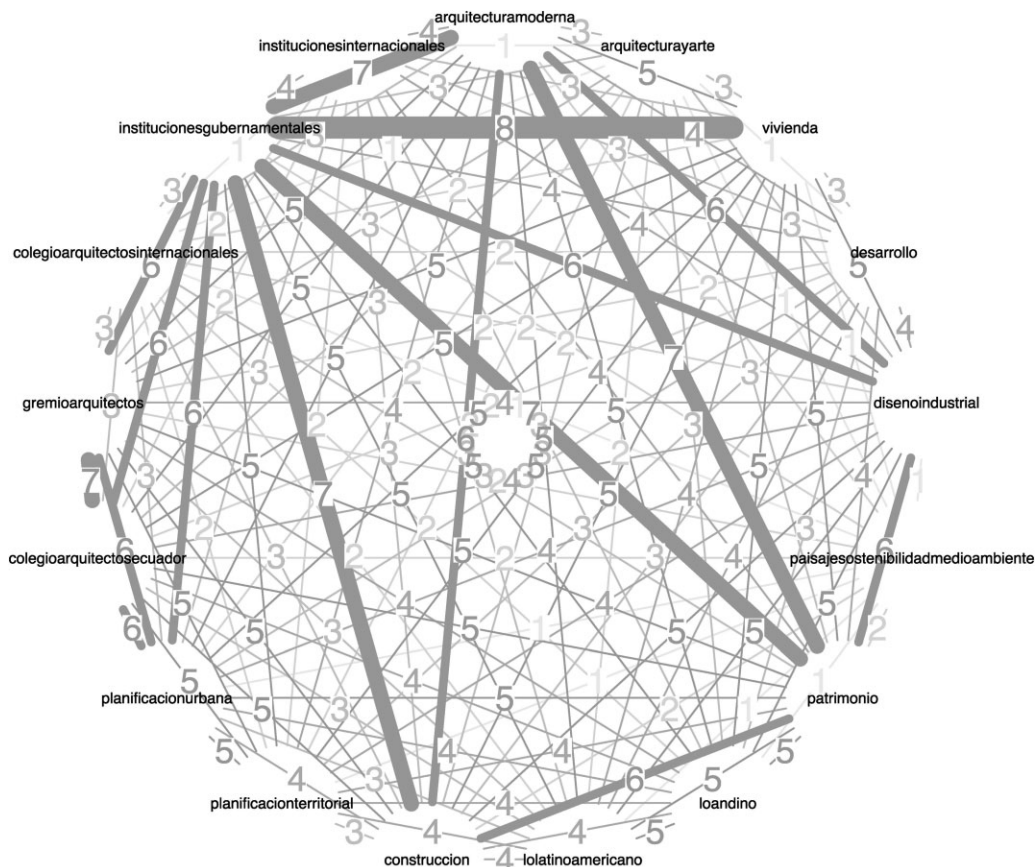
Fig. 8 Items related by documents in the topics one mode network from projected matrix **T**

could be plotted and interpreted in the field of architectural historiography.

The local and regional context of the 1980s made the BAQ a platform of interest for the analysis of the professional discourse on the architectural and critical productions of modern architecture in Ecuador. In accordance with the proposed objectives, we investigated the spectrum of discussion articulated in the editions published between 1978 and 1992 from the interrelationships between the topics discussed, the preponderant actors and institutions, and the internationally traced channels, considering the temporality and intensity of these connections.

The discussion shows that despite being a platform managed by a civil association, the BAQ did not act outside the state. This justifies including within the professional discourse surrounding modernity topics such as development, social housing, industrial design, and planning, which are in line with the developmental modernization process experienced by Ecuador during the oil boom. This agenda was shared with other regional professional associations and platforms that interacted with the BAQ from 1978 to 1992. The internationalization of this platform was consistently articulated towards other Latin American countries. Based on the proposal of common interests, the BAQ articulated a space for professional sociability among local and foreign architects, technicians and bureaucrats. The imminent expansive vocation of the BAQ presents the architects' guild as a group of people engaged in the production, dissemination and exchange of knowledge.

This BAQ archive allows us to analyse a significant part of the professional discourse surrounding modern architecture in Ecuador during the decades under study. However, being an institutional archive, it
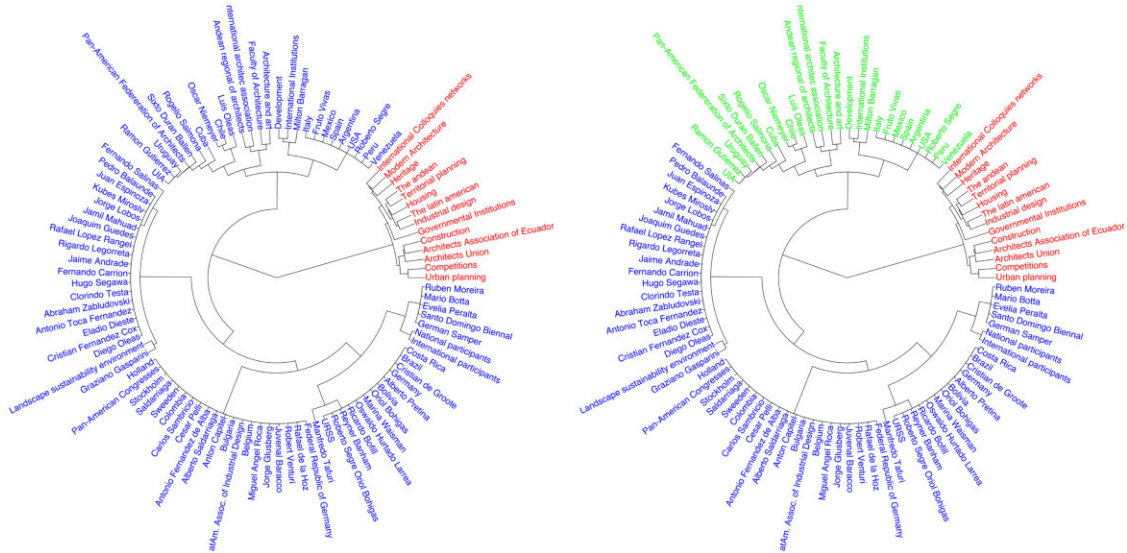
Fig. 9 Items clustering by distance (inverse of weight connection in one-mode projected network): two and three clusters (left and right, respectively)

cannot be forgotten that the identification of the actors and prevailing topics is as important as making visible gaps, absences or omissions that may have operated in this documentary collection and, even more so, in the BAQ project *per se* (Hendon, 2020). The use of digital humanities tools complements but does not replace the heuristic methods of historiography. Following on from this, the results obtained will be contrasted with other sources such as interviews, student magazines, and press cuttings, which could reveal other topics, actors, and channels of knowledge dissemination about modern architecture. In addition to the quantitative analysis through bipartite networks, we will analyse significant documents for the topic of study that have been identified in the BAQ archive and that remain unpublished, including lectures, speeches, jury verdicts, and reports.

Notes

1. *Abbreviated to CAE (Colegio de Arquitectos del Ecuador) with headquarters in Pichincha.*
2. This documental collection is located in the library of the University of the Americas (*Universidad de Las Américas*), Ecuador.

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