



Domain-specific extension of BIBFRAME for regional music: conceptual modeling and expert validation

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Abstract: This applied-developmental research aimed to develop a model for expanding the Bibliographic Framework in describing regional music. The research was conducted in four main steps, including identifying regional music data elements through text analysis and interviews with experts (which led to the identification of 41 information elements), qualitatively matching these elements with Bibliographic Framework classes and properties using Resource Description Framework triples, achieving an expanded model, and final evaluation based on five structural and content criteria (layer appropriateness, property adequacy, lack of conceptual overlap, class-property compatibility, and the need for development). The evaluation results showed that the Bibliographic Framework is adequate in describing the classical bibliographic dimensions and technical characteristics of musical resources, but has three fundamental conceptual gaps in describing regional music: the inability to represent “performance knowledge” as an independent semantic layer (Music-as-Performance versus Music-as-Object), ontological bias towards Western musicology (Western Music Ontology Bias), and cultural context compression. The findings indicate that elements such as vocal style, performance style, improvisational level, playing technique, non-Western musical systems (position, pitch, rhythmic cycle), and performance identity features (gender, dialect) require targeted conceptual development, while the proposed model, as a complementary and compatible development with the original Bibliographic Framework, increases the descriptive capacity of the model without creating structural inconsistencies and is considered a step towards bringing the “library-based resource” paradigm and the “performance-culture-based” paradigm closer together in the linked data environment.

Keywords: BIBFRAME, regional music, domain-specific extension, conceptual modeling

1 Introduction

The Bibliographic Framework Initiative (BIBFRAME) was initiated by the Library of Congress with the goal of migrating from the MARC format to enhance the interoperability and sharing of bibliographic data on the Web. BIBFRAME transforms library metadata into linked data, enabling the integration and sharing of structured data. Using this model transforms digital catalogs into active knowledge repositories (Hawkins, 2015; Tharani, 2015). BIBFRAME uses the principles of linked data to provide richer access for users and to provide control points of inequality that improve the user search and retrieval experience (Ávila-Barrientos, 2020). In addition, the model is designed to be compatible with other data standards and models, such as the Resource Description and Access (RDA) and European Data Model (EDM), ensuring seamless interoperability and data exchange (Zapounidou; Sfakakis; Papatheodorou, 2014, 2017).

Because the BIBFRAME model is evolving, it is capable of being extended across subject domains. Based on the specific needs of subject domains, the model can be extended. One of the extensions of BIBFRAME is the ArtFrame project. This project was developed based on the need for extensions to fit the specific metadata practices of art museums and libraries, and is part of the Linked Data for Production (LD4P) collaboration. This project provided an extension to the Art and Rare Materials (ARM) ontology to better serve catalogers of art resources (O’keefe; Wacker; L’ecuyer-Coelho, 2019). Another project has also used BIBFRAME extensions to better represent bibliographic features of older materials that are not adequately covered by current metadata standards (Park; Lee, 2025). Indeed, extensions of BIBFRAME are essential to respond to the specific needs of each subject domain, improve the user experience, support community-driven innovation, and increase interoperability. BIBFRAME extensions enable the full potential of this model as a standard for bibliographic description and exchange in the future of the library community .

BIBFRAME extensions, the Performed Music Ontology (PMO), were developed by the Library of Congress in collaboration with the Music Librarianship Association (MLA) within the framework of the “Linked Data for Production” (LD4P) project. This ontology fills gaps in the BIBFRAME model

for describing performed music resources. The extension introduces two key concepts, “Declared Medium” and “Performed Medium,” and the distinction between them. The PMO structure includes specialized classes for describing types of musical events (such as recording sessions, concerts, initial performances, and rehearsals) and the relationships between instruments and performers and the components of the medium (Szeto, 2022)

The second edition of the Performed Music Ontology (PMO) is a revision of the modeling approach. In this edition, the complex structure of the first edition was simplified, and many concepts were transformed into controlled vocabulary lists. In December 2025, the Library of Congress released BIBFRAME 3.0, which added properties and classes for the Performed Music Ontology to BIBFRAME. The integration of PMO into the original BIBFRAME marks their unification and the deprecation of PMO as an independent extension (Library of Congress, 2025; Szeto, 2022).

The tendency of digital archives and specialized libraries to use BIBFRAME and their movement towards the Semantic Web has created the need to revisit this model for resources in subject domains such as the music domain (Raimond *et al.*, 2007). Although PMO is an extension of BIBFRAME for modeling musical data in connected environments (Performed Music Ontology, 2025), this extension is focused on the technical aspects of classical notation and performance and does not have the potential to describe the complexities of regional music. Regional music, as a type of intangible heritage that carries cultural contexts, native instruments and the closeness of transmission, has not been seen in general music modeling (UNESCO, 2003). Regional music represents an important part of cultural identity, reflecting the history, traditions and customs of different ethnic groups. This music plays an important role in preserving cultural diversity and cultural heritage (Dahlig, 2013; Hui, 2023; Yang, 2024).

The lack of semantic depth and reduced accuracy in the retrieval of regional music works is due to the lack of components for describing the characteristics of regional music in the BIBFRAME model (Library of Congress, 2020). Accordingly, considering the characteristics of regional music and

expanding the BIBFRAME model in the thematic field of regional music seems necessary to preserve the authenticity of the treasury of ethnic and cultural musical works and improve their accessibility. Also, according to specialized ethnomusicological research, regional music data face serious challenges in semantic retrieval and interoperability due to the lack of ontological models and metadata standards (Hofmann *et al.*, 2021). Therefore, there is a conceptual gap between the current BIBFRAME model and the descriptive needs of the regional music domain; this gap indicates the need to provide a specialized extension based on the semantic, cultural, and performance characteristics of regional music. Providing thematic extension creates the possibility of increasing effective discoverability and a more accurate representation of musical knowledge in linked data-based environments.

2 Research background

Jin, Hahn and Croll (2016), in their paper titled “BIBFRAME Transformation for Enhanced Discovery”, address the issue of implementing and enriching e-book metadata based on Bibframe. In this study, nearly 300,000 MARC records at the University of Illinois were transformed into BIBFRAME linked data using Library of Congress XQuery tools to generate BIBFRAME RDF/XML and then automatically enriched with open linked data URIs via Python scripts. The researchers identified challenges in the need for stable workflows and issues related to API reliability. They emphasized that successful BIBFRAME implementation requires careful consideration of resources and robust enrichment processes (Jin; Hahn; Croll, 2016).

Folsom and Kovari (2016) in a study titled “Ontology Assessment and Extension: A Case Study on LD4L and BIBFRAME” examine the strategic alignment between the LD4L ontology and BIBFRAME 2.0. This study was conducted in collaboration with the Linked Data for Libraries-Labs and Linked Data for Production teams from Cornell and Harvard universities. The researchers state that the reason for the LD4P ontology project was the observed gaps in existing bibliographic ontologies and that the release of BIBFRAME 2.0 required a comprehensive assessment of the semantic alignment between the two

frameworks. The assessment of this alignment includes an analysis of the architectural principles of BIBFRAME, the reuse of ontological models, and the examination of semantic structures for improving the LD4P ontology and enhancing BIBFRAME. This study shows how community-based assessment can improve and enhance BIBFRAME and provide targeted extensions (Folsom; Kovari, 2016).

Lee (2017) in his study titled “A Study on the Considerations in Constructing BIBFRAME by Analyzing BIBFRAME 2.0” analyzes the structural changes of BIBFRAME 2.0 and the results of modeling bibliographic data based on it. This study examines the evolution process of BIBFRAME 1.0 to 2.0 and focuses on three main areas: the lack of preferred name and title mechanisms, the incomplete alignment of BIBFRAME with RDA, and the lack of an Expression entity in BIBFRAME. The researcher states that BIBFRAME 2.0 has improved the relationships compared to the previous version by introducing the Item layer, but the Work and Expression levels are still merged in BIBFRAME, which leads to a deviation from the structure of the FRBR model. Lee shows that the provision of properties such as *bf: expression Of* and *bf: has Expression* manages Expression-level relationships in the Work layer, but the lack of a separate Expression entity creates ambiguity in practical implementation. This study points out the gaps in the adaptation of RDA elements to Bibframe and considers it necessary to create clear guidelines for titles and preferred names (Lee, 2017).

McCallum (2017) in paper entitled “BIBFRAME Development,” reviews the evolution of the bibliographic framework initiative and the Library of Congress’s decade-long exploration of linked data. The author traces the emergence of BIBFRAME in the late 1990s through the “On the Record” report in 2007. He also explains how the Library of Congress’s Linked Data Service was established in 2009, and BIBFRAME was introduced in 2011. The paper details the BIBFRAME 2.0 pilot project in 2015 and emphasizes BIBFRAME’s relationship with RDA. The researcher also points out key challenges, such as trust in external links, storage decisions, and the adaptation of multiple reference files, and emphasizes the involvement of vendors and the professional community

in realizing the potential of linked data in bibliographic control using BIBFRAME (McCallum, 2017).

Kovari *et al.* (2018) present a framework for extending BIBFRAME to describe art and rare materials resources in their paper, “Modeling and Application Profiles in the Art and Rare Materials BIBFRAME Ontology Extension”. The research was published in the Proceedings of the International Conference on Dublin Core and Metadata Applications and is a collaboration between the RBMS Bibliographic Standards Committee, the Linked Data for Production Project (LD4P), and the ARLIS/NA Cataloging Advisory Committee, with funding from the Andrew W. Mellon Foundation. The researchers explain that BIBFRAME is purposefully under-modeled for domains outside the core bibliographic description, and that it is necessary for specialist communities to provide extensions for their specific needs. ARM facilitates extension using modular ontologies that include core, history, award, and measurement components (Kovari *et al.*, 2018).

O’Keefe, Wacker and L’Ecuyer-Coelho (2019), in their paper “The Outcome of the ArtFrame Project: A Domain-Specific BIBFRAME Exploration” examines the ArtFrame project as part of Linked Data for Production (LD4P). The project is an extension of BIBFRAME that addresses the subject domain of museums and art libraries and provides a specialized ontology based on BIBFRAME. The ontology is the result of a collaboration between ARLIS/NA and major art institutions. The researchers documented the project’s phases, including OWL modeling and VitroLib testing, the generation of controlled vocabularies, and application profiles based on specialized linked data for art and rare materials (O’keefe; Wacker; L’ecuyer-Coelho, 2019).

Hahn and Possemato (2023) propose an extension of BIBFRAME in their study titled “The Share-VDE ontology: a BIBFRAME extension for linked data discovery” to increase interoperability and interoperability between bibliographic models such as Resource Description and Access (RDA) and the IFLA ontology model (LRM). In this paper, they use a set theory approach that addresses the challenges of linking different bibliographic conceptual models (Hahn; Possemato, 2023).

Hahn, Ahnberg and Serra (2024) evaluated the Share-VDE discovery system in a study titled “A Comparative Evaluation of the Share-VDE Search System.” This system is designed based on BIBFRAME. The researchers compare the performance of this system with traditional catalogs designed based on MARC. The results of the study confirm the potential benefits of linked data for improving resource discovery and increasing user satisfaction. The study also examines the technical and structural challenges of converting data from MARC to BIBFRAME and suggests solutions to increase interoperability between these formats and the systems designed based on them (Hahn; Ahnberg; Serra, 2024).

The ACRL/RBMS-SAA Joint Task Force (2024) reviewed the Art and Rare Materials (ARM) ontology in a report titled “Second Revision of the Art and Rare Materials (ARM) BIBFRAME Ontology Extension.” The ontology uses the BIBFRAME format. The project was conducted in 2019-2021 and focused on modeling aggregates, part-of relationships, and other areas for the development and updating of ARM. The joint task force collaborated with the Society of American Archivists (SAA) and the ACRL Rare Books and Manuscripts Section to critique existing models. As a result of this critical review, recommendations were made for improving and promoting ARM’s compatibility with BIBFRAME. In addition to introducing the PCC application profile, the report also outlined long-term strategies for the maintenance and continued development of ARM (ACRL/RBMS-SAA Joint Task Force, 2024).

Shieh (2025) discusses the challenges faced by Smithsonian Libraries & Archives in implementing ShareFamily based on BIBFRAME in a paper titled “Smithsonian Libraries & Archives: BIBFRAME Linked Data Experiment with the ShareFamily Technology”. The project was carried out in collaboration with the Share-VDE network to convert traditional MARC-based data to BIBFRAME format and to exploit the Share-VDE ontology to enhance the discovery and accessibility of cultural and artistic resources. The author focuses on the specific challenges of art data, such as modeling archival collections and rare works, and shows how extensions of BIBFRAME meet the needs of art subject domains (Shieh, 2025).

A review of the research literature shows that BIBFRAME has evolved from a general bibliographic model to an extensible framework based on subject domains in the last decade. The research reviewed ranges from aligning BIBFRAME with bibliographic conceptual models and its structural limitations to converting MARC-based data to BIBFRAME and implementing linked data in practice to increase user satisfaction and meet the needs of specialized subject domains by introducing various extensions. Projects such as ArtFrame, ARM and PMO show that specialized communities are trying to address the semantic gaps of BIBFRAME in subject areas such as art, cultural heritage and rare resources by providing subject ontology extensions. Studies conducted on the evaluation of ontologies show successful extensions that are based on a systematic analysis of the needs of subject domains and a conceptual evaluation of the BIBFRAME framework. Overall, the research literature shows that providing subject extensions to BIBFRAME is not only an ad hoc measure but is an accepted approach in specialized and scientific communities to address the limitations of the basic model. So far, the main focus of developments has been on the areas of art and rare resources and the alignment and collaboration of bibliographic models, and the description of regional music as a subject domain with complex performance and cultural characteristics has not been examined theoretically and structurally. The aim of the present study is to examine, explain and close this gap.

3 Methodology

This research is of an applied type, and its purpose is development. The research method is defined according to the research steps. In each step, the appropriate method has been used. In fact, mixed-methods research has been conducted.

Step One: Identifying the data elements of regional music:

- a) part one - in this section, it was necessary to identify and define the data elements related to regional music. To carry out this step, two methods of text analysis and interviews were used. Reference texts and sources related to regional music were reviewed, and music databases were examined. The music metadata that was produced in these databases represented the

data elements that were intended for a piece of music. By examining this metadata, some data elements related to regional music were identified;

- b) part two - in this section, interviews were conducted with two regional music experts who were also familiar with music metadata. Based on the analysis of the interview texts, other elements were added to the elements of the first section.

Finally, 41 information elements for regional music were obtained from the first step, and the definitions of these elements were determined based on the information obtained from the sections of the first step.

Step Two: Mapping Data Elements with BIBFRAME. In this step, using the qualitative mapping method, the data elements were mapped with the BIBFRAME model, and each element was described using the RDF triple combination of classes and properties of the BIBFRAME model. According to the definition of each element that was specified in the previous step, the method and purpose of their use were specified, and the position of each of them in the BIBFRAME model was analyzed and inferred. In fact, at this stage, combinations of BIBFRAME classes and properties were achieved that represented information elements. The use of classes and properties existing in the model and the extension of PMO were prioritized for describing data elements. If a class or property was not in the model and was required to describe a data element, a proposal was made to extend the model.

Step Three: Obtaining an extended model. In this step, based on combinations of classes and properties of the BIBFRAME model, as well as extensions that were necessary to describe some of the data elements of regional music, an extended model of the BIBFRAME model for regional music was obtained.

Step Four: Evaluating the Extended Model. Part One: To achieve the method of evaluating the extended model, criteria for evaluation were needed, and accordingly, the text analysis method was used. In this way, specialized articles related to the evaluation of metadata models and ontologies were reviewed, and finally seven articles were selected. By reviewing the text of these articles, five

criteria for the structural and content evaluation of the extended model were obtained. These criteria were considered as C1-C5.

Chart1 - Extended model evaluation criteria

Criteria	Name of criteria	Definition
C1	Layer Appropriateness	Placing the element in the correct class (Work/Instance/Item)
C2	Property Sufficiently	Adequacy or coverage of properties in the model
C3	Non- Overlap	Conceptual differentiation of elements or avoidance of overlap
C4	Semantic Consistency	Correctly conveying the meaning of the element by the selected Property
C5	Extension Necessity	The need or necessity of extensions

Source: Drawn up by the author.

Chart 2 - Presents the articles used to determine the evaluation criteria along with the criteria mentioned in their text

N.	Literature Source	Derived Evaluation Approach	Related Criteria (C1–C5)
1	Brank et al. (2005). A Survey of Ontology Evaluation Techniques	Survey of Ontology Evaluation Methods	C1, C2, C3, C4, C5
2	Obrst et al. (2006). The Evaluation of Ontologies (NIST)	Systematic Ontology Evaluation Principles	C1, C2, C3, C4
3	Duque-Ramos et al. (2014). Evaluating GoodOD with OQuaRE	ISO/SQuaRE-based Quality Evaluation of Ontologies	C2, C3, C4, C5
4	Bandeira et al. (2016). FOCA: A Methodology for Ontology Evaluation	Goal-Question-Metric (GQM) Ontology Evaluation	C2, C4, C5
5	Metric Based Ontology Quality Evaluation (2019). Ravi & John	Metric-Based Ontology Evaluation	C2, C3, C4
6	Iyer et al. (2021). A framework for syntactic and semantic quality evaluation of ontologies	Syntactic and Semantic Quality Evaluation Framework	C2, C3, C4
7	Roldán-Molina et al. (2021). Ontology Knowledge Inspection Methodology	Quality Assessment and Improvement Methodology	C2, C3, C4, C5

Source: Drawn up by the author.

Each of the 41 data elements identified in the first step was evaluated based on a combination of BIBFRAME classes and properties obtained in the second and third steps, based on the five evaluation criteria. Finally, the result of the evaluation and evaluation of the expanded model was obtained as the final result of the research.

4 Findings

Based on the research methodology, using specialized texts and articles related to music, as well as interviews with two regional music experts who were also familiar with descriptive music metadata, 41 data elements were obtained. These elements are introduced in Chart 3, and the definition of each data element is written against them.

Chart 3 - Information elements of a regional music piece

N.	Element	Definition
1	Title of Musical Work	The official or commonly recognized name of the musical piece. Example: “Scarborough Fair”
2	Alternative Title	Any other name the piece is known by, including informal or local titles. Example: “Traditional Ballad”
3	Place of Origin	The geographical area where the music originated. Example: Yorkshire, England
4	Ethnic Group / Community	The ethnic or cultural community traditionally associated with the musical piece. Example: English folk tradition
5	Performer(s)	Individuals or groups who perform the musical work. Example: Paul Simon; Art Garfunkel
6	Composer / Creator	The person who originally composed or created the piece, if known. Example: Traditional (anonymous)
7	Date of Creation	Approximate or known date when the piece was composed. Example: Approx. medieval period (exact date unknown)
8	Date of Performance / Recording	Date of the specific recording or performance. Example: 1966
9	Language of Lyrics	The language in which the lyrics are sung. Example: English
10	Dialect or Accent	Specific regional variant of the language used in the lyrics. Example: Northern English folk pronunciation
11	Recording Place	Location where the piece was recorded. Example: United States (studio recording)
12	Occasion / Social Function	Purpose or context of the performance. Example: Folk storytelling and entertainment
13	Specific Ritual / Cultural Practice	Associated ritual or cultural activity. Example: None (general folk tradition)
14	Gender of Performers	Whether the music is traditionally performed by men or women. Example: Male performers
15	Performance Mode	How the music is performed. Example: Duo performance
16	Musical Mode / System	Traditional musical system or scale. Example: Western folk tonal system
17	Maqam Name	Name of the specific mode or maqam used. Mode or Maqam means the arrangement of sounds and distribution of intervals in a musical scale. Example: Minor mode (modal folk scale)
18	Pitch Scale	Specific scale steps or intervals used. Pitch Scale means a structure of notes with fixed intervals that organizes a melodic ascent or descent within an octave range, without being bound to a specific root note or melodic path. Example: Natural minor scale
19	Improvisation Level	Amount of improvisation in performance. Example: Minimal improvisation

N.	Element	Definition
20	Rhythm Type	Indicates whether the musical piece follows a regular metrical structure (metric) or a free, non-metrical rhythmic flow. Example: Free, metric
21	Time Signature	Meter of the piece. Example: 3/4 meter
22	Tempo	Speed of performance, often in beats per minute. Example: Moderate tempo (approx. 90 beats per minute)
23	Rhythmic Cycle / Pattern Name	Specific rhythm pattern name. Example: Simple triple folk rhythm
24	Instruments Used	Instruments played in the piece. Example: Acoustic guitar
25	Instrument Category	Type of instrument. Example: String instrument
26	Playing Technique	How instruments are played. Example: Fingerpicking guitar style
27	Vocal Style	Style of singing. Example: Soft folk singing with close harmony
28	Original Lyrics Text	Lyrics in the original language. Example: "Are you going to Scarborough Fair ..."
29	Translated Lyrics	Lyrics translated into another language. Example: Spanish translation of the original text
30	Poetic Structure	The form of the lyrics. Example: Ballad verse form
31	Narrative / Story Content	Story or theme underlying the music. Example: A lover asks impossible tasks of a former beloved.
32	Historical Background	Historical context of the piece. Example: Medieval English folk tradition
33	Mythological / Cultural References	References to myths, rituals, or local beliefs. Example: Symbolic medieval imagery
34	Performance Duration	Length of the performance. Example: Approximately 3 minutes
35	Digital Format / Encoding	Digital file format, if available. Example: MP3, WAV (in digital archives)
36	Sampling Rate	Audio sampling frequency used in a digital recording. Example: 44.1 kHz, 48 kHz (in digital audio files).
37	Bit Depth	Audio resolution indicating the number of bits used to represent each audio sample. Example: 16-bit, 24-bit (in digital audio files).
38	Recording Type	Type of recording. Example: Studio recording of a traditional folk song
39	Transmission Method	How the music was passed down. Example: Originally oral tradition, later written and recorded
40	Authenticity / Provenance	Whether the piece is original, reconstructed, or adapted. Example: Traditional song with modern arrangement
41	Subject / Topical Tags	Keywords describing the content or theme. Example: Love, longing, folk tradition, medieval imagery

Source: Drawn up by the author.

In the second step, a comparison was made between the regional music data elements with the BIBFRAME classes and properties and each of the elements was described using them. In some cases, the classes and properties available in BIBFRAME and PMO were not sufficient to describe a data element and it was necessary to describe that data element using an extended class or property. For this reason, these extensions were made.

The following Chart lists the classes, properties, and extensions used to describe the data elements of the music region. In the first column opposite the element, the layer associated with the element is written, in the next column, the property(ies) used are written, in the next column, the class(es) used are written. In the next two columns, the properties and classes that have been extended and proposed are introduced. In addition, in the last column, if there is a description for the element, it is written. For some elements, a literal value must be used instead of the class, which is written in the description field, and the word literal is also used in the class column.

Chart 4 - Regional music descriptive elements, along with classes, and properties mapped with them

N.	Element	Layer	BIBFRAME Property	BIBFRAME Class	Extension Property	Extension Class	Description
1	Title of Musical Work	Work	bf:title	bf>Title			
2	Alternative Title	Work	bf:title	bf:VariantTitle			
3	Place of Origin	Work	bf:originPlace	bf:Place			
4	Ethnic Group / Community	Work	bf:note/ bf:noteType	Literal			using type of note: EthnicGroup
5	Performer(s)	Work	bf:Contribution				using performer for role
6	Composer / Creator	Work	bf:Contribution				using composer or creator for role
7	Date of Creation	Work	bf:originDate	Literal			
8	Date of Performance / Recording	Work	bf:capture/bf:date	bf:Capture/ literal			
9	Language of Lyrics	Work	bf:language	bf:Language			
10	Dialect or Accent	Work	bf:language	bf:Language	hasDialect	Dialect	
11	Recording Place	Work	bf:capture/bf:place	bf:Capture/ bf:Place			
12	Occasion / Social Function	Work	bf:note/ bf:noteType	Literal			using type of note: Occasion or SocialFunction

N.	Element	Layer	BIBFRAME Property	BIBFRAME Class	Extension Property	Extension Class	Description
13	Specific Ritual / Cultural Practice	Work	bf:note/ bf:noteType	Literal			using type of note: SpecificRitual
14	Gender of Performers	Work	bf:Contribution/ bf:agent	bf:Contribution/ bf:Person	bf:gender	Literal	
15	Performance Mode	Instance	bf:provosionA ctivity		bf:hasMode	bf:Perform ane/ bf:Perform anceMode	
16	Musical Mode / System	Work	bf:mode	bf:Mode			
17	Maqam Name	Work	bf:mode	bf:Mode	bf:maqam	bf:Maqam	
18	Pitch Scale	Work			bf:pitchScale	bf:PitchSc ale	
19	Improvisation Level	Work			bf:improvisation Level	bf:Improvi sationLeve l	
20	Rhythm Type	Work			bf:rhythmType	bf:Rhythm Type	
21	Time Signature	Work			bf:timeSignatur e	bf:TimeSig nature	
22	Tempo	Work	bf:tempo	bf:Tempo			
23	Rhythmic Cycle / Pattern Name	Work			bf:rhythmicCycl e	bf:Rhythm icCycle	
24	Instruments Used	Work	bf:instrument	bf:MusicInstrume nt			
25	Instrument Category	Work	bf:instrument	bf:MusicInstrume nt	bf:instrumentCa tegory	bf:Instrum entCategor y	
26	Playing Technique	Work	bf:instrument	bf:MusicInstrume nt	bf:playingTechn ique	bf:Playing Technique	
27	Vocal Style	Work			bf:vocalType	bf:VocalT ype	
28	Original Lyrics Text	Work	bf:hasPart	bf:Work			
			bf:expression Of	bf:Work			
29	Translated Lyrics	Work	bf:hasPart/bf:t ranslationOf	bf:Work			
			bf:expression Of/ bf:translation	bf:Work			
30	Poetic Structure	Work	bf:hasPart/ bf:genreForm	bf:Work/ bf:GenreForm			

N.	Element	Layer	BIBFRAME Property	BIBFRAME Class	Extension Property	Extension Class	Description
			bf:expression Of/ bf:genreForm	bf:Work/ bf:GenreForm			
31	Narrative / Story Content	Work	bf:subject	bf:Topic			
32	Historical Background	Work	bf:historyOfW ork	Literal			
33	Mythological / Cultural References	Work	bf:subject	bf:Topic or bf:Event or bf:Agent			
34	Performance Duration	Instance	bf:duration	Literal			
35	Digital Format / Encoding	Instance	bf:digitalChar acteristic	bf:EncodingForm at			
36	Sampling Rate	Instance	bf:digitalChar acteristic/ bf:noteType	bf:Note			note type= Sampling Rate
37	Bit Depth	Instance	bf:digitalChar acteristic/ bf:noteType	bf:Note			note type= Bith Depth
38	Recording Type	Work	bf:capture	bf:Capture	bf:captureType	bf:Recordi ngType	
39	Transmission Method	Work	bf:note/ bf:noteType	bf:Note			note type= Transmission Method
40	Authenticity/Pro venance	Work	bf:note/ bf:noteType	bf:Note			note type= Provenance
41	Subject/ Topical Tags	Work	bf:subject	bf:Topic or bf:Event or bf:Agent or bf:Work			

Source: Drawn up by the author.

The evaluation of the BIBFRAME model extension for regional music is carried out using the information in Chart 5, which introduces the evaluation criteria based on the relevant articles. All 41 elements are listed in the Chart

below, along with the five evaluation criteria, and an evaluation has been made on them.

Chart 5 - Descriptive elements of regional music mapped with BIBFRAME, with evaluation criteria

N.	Element Name	C1: Layer fit	C2: Sufficiency of property	C3: No overlap	C4: Class and property compatibility	C5: Necessity of extension
1	Title of the Musical Work	Work	It is enough.	No overlap	Compatible with the Work	No expansion required.
2	Alternative Title	Work	It is enough.	No overlap	Compatible with the Work	No expansion required.
3	Place of Origin	Work	It is enough.	No overlap	Compatible with the Work	No expansion required.
4	Ethnic Group / Community	Work	It is enough.	No overlap	Compatible with the Work	No expansion required.
5	Performer(s)	Work	It is enough.	No overlap	Compatible with the Work	No expansion required.
6	Composer / Creator	Work	It is enough.	No overlap	Compatible with the Work	No expansion required.
7	Date of Creation	Work	It is enough.	No overlap	Compatible with the Work	No expansion required.
8	Date of Performance / Recording	Work	It is enough.	No overlap	Compatible with the Work	No expansion required.
9	Language of Lyrics	Work	It is enough.	No overlap	Compatible with the Work	No expansion required.
10	Dialect or Accent	Work	It is not enough.	No overlap	Compatible with the Work	expansion required.
11	Recording Place	Work	It is enough.	No overlap	Compatible with the Work	No expansion required.
12	Occasion / Social Function	Work	It is enough.	No overlap	Compatible with the Work	No expansion required.
13	Specific Ritual / Cultural Practice	Work	It is enough.	No overlap	Compatible with the Work	No expansion required.
14	Gender of Performers	Work	It is not enough.	No overlap	Compatible with the Work	expansion required.

N.	Element Name	C1: Layer fit	C2: Sufficiency of property	C3: No overlap	C4: Class and property compatibility	C5: Necessity of extension
15	Performance Mode	Instance	It is not enough.	No overlap	Compatible with the Instance	expansion required.
16	Musical Mode / System	Work	It is enough.	No overlap	Compatible with the Work	No expansion required.
17	Maqam Name	Work	It is not enough.	No overlap	Compatible with the Work	expansion required.
18	Pitch Scale	Work	It is not enough.	No overlap	Compatible with the Work	expansion required.
19	Improvisation Level	Work	It is not enough.	No overlap	Compatible with the Work	expansion required.
20	Rhythm Type	Work	It is not enough.	No overlap	Compatible with the Work	expansion required.
21	Time Signature	Work	It is not enough.	No overlap	Compatible with the Work	expansion required.
22	Tempo	Work	It is enough.	No overlap	Compatible with the Work	No expansion required.
23	Rhythmic Cycle / Pattern Name	Work	It is not enough.	No overlap	Compatible with the Work	expansion required.
24	Instruments Used	Work	It is enough.	No overlap	Compatible with the Work	No expansion required.
25	Instrument Category	Work	It is not enough.	No overlap	Compatible with the Work	expansion required.
26	Playing Technique	Work	It is not enough.	No overlap	Compatible with the Work	expansion required.
27	Vocal Style	Work	It is not enough.	No overlap	Compatible with the Work	expansion required.
28	Original Lyrics Text	Work	It is enough.	No overlap	Compatible with the Work	No expansion required.
29	Translated Lyrics	Work	It is enough.	No overlap	Compatible with the Work	No expansion required.
30	Poetic Structure	Work	It is enough.	No overlap	Compatible with the Work	No expansion required.
31	Narrative / Story Content	Work	It is enough.	No overlap	Compatible with the Work	No expansion required.

N.	Element Name	C1: Layer fit	C2: Sufficiency of property	C3: No overlap	C4: Class and property compatibility	C5: Necessity of extension
32	Historical Background	Work	It is enough.	No overlap	Compatible with the Work	No expansion required.
33	Mythological / Cultural References	Work	It is enough.	No overlap	Compatible with the Work	No expansion required.
34	Performance Duration	Instance	It is enough.	No overlap	Compatible with the Instance	No expansion required.
35	Digital Format / Encoding	Instance	It is enough.	No overlap	Compatible with the Instance	No expansion required.
36	Sampling Rate	Instance	It is enough.	No overlap	Compatible with the Instance	No expansion required.
37	Bit Depth	Instance	It is enough.	No overlap	Compatible with the Instance	No expansion required.
38	Recording Type	Work	It is enough.	No overlap	Compatible with the Work	No expansion required.
39	Transmission Method	Work	It is enough.	No overlap	Compatible with the Work	No expansion required.
40	Authenticity / Provenance	Work	It is enough.	No overlap	Compatible with the Work	No expansion required.
41	Subject / Topical Tags	Work	It is enough.	No overlap	Compatible with the Work	No expansion required.

Source: Drawn up by the author.

Before analyzing the proposed model, a process of defining and operationalizing it was carried out, and then a systematic analytical framework was used to evaluate it.

To transform the conceptual analysis process into a transparent and repeatable procedure, an evaluation analytical framework was used to make decisions based on specific indicators that are not based on individual judgments. The analytical framework used for each of the descriptive elements of regional music has five analytical criteria as follows:

- a) fit with the conceptual layer of the framework (C1);
- b) adequacy of existing properties to explain meaning (C2);
- c) no semantic overlap (C3);
- d) compatibility between property and class (C4);
- e) necessity of structural or conceptual development (C5).

In the following, an interpretive analysis is presented, far from the researcher's subjective perceptions and based on the patterns observed in the evaluation results. The two evaluation criteria "inadequacy of BIBFRAME properties" and "need for expansion" in elements related to the cultural context, characteristics of regional music performance, indicate structural limitations in BIBFRAME, and this limitation is not simply related to the way BIBFRAME is applied to a specific example, but is related to the level of its conceptual framework. Therefore, based on the evaluation data obtained, gaps have been identified that have been interpreted at the theoretical level. In this approach, analysis as an evidence-informed process provides the ability to review, reproduce, and critically evaluate, and the methodological validity of the results is guaranteed by this process.

The evaluation of the proposed model based on the five criteria shows that the proposed model is highly coherent in terms of semantic, ontological, and structural aspects. The proposed developments are a direct response to the shortcomings of the BIBFRAME model and not the result of conceptual redundancy. A clear pattern of conceptual adequacy and inadequacy in the BIBFRAME model has been obtained based on the evaluative analysis, which can be explained at several levels.

First: The model evaluation based on the layer fit criterion (C1) shows that the descriptive elements of regional music are correctly placed at the Work and Instance conceptual levels. Elements such as ethnic group, social function, musical system, cultural origin that are related to the abstract identity of the work, as well as the semantic features of the work, are modeled at the Work level, and features such as digital format, sampling rate, runtime, and bit depth that are related to a specific realization of the work are placed at the Instance level. The proposed model is consistent with the BIBFRAME conceptual levels and does

not cause confusion between abstract and representational levels. Since many modeling errors are due to attributing features to unrelated levels, separating elements at conceptual levels is important in describing musical resources.

Second, the evaluation of the model based on the BIBFRAME property adequacy criterion (C2) introduces the most important finding of the research. The analysis results show that the BIBFRAME model performs well in describing the general characteristics of musical resources and classical bibliographic elements. Elements such as language, subject, title, author, historical background and digital technical characteristics such as sampling rate, bit depth and file format did not need to be developed and were modeled using the BIBFRAME basic model, which shows the maturity and efficiency of BIBFRAME in the field of media and information object description. At the same time, BIBFRAME does not have adequate adequacy for elements that are cultural, ethnographic and performance-oriented in nature. Elements that are related to the elegance of performance lack accurate representation in the structure of the BIBFRAME basic model. Examples of these elements include performance style, degree of improvisation, playing technique and vocal style. In the proposed model, elements related to non-Western musical systems, such as the structure of the vocal palate and cyclical patterns of rhythm and the name of the position need conceptual development. Also, performance identity features such as dialect and accent and gender of performers, which play an important role in regional music, are not supported in the BIBFRAME model. The proposed model shows that BIBFRAME is limited not at the level of library description but in the description and representation of musical and cultural knowledge.

Third, the evaluation of the model based on the conceptual non-overlap criterion (C3) confirms that none of the proposed elements has semantic overlap with each other. Each element has a distinct semantic domain, and the proposed extension does not cause ontological inflation or conceptual duplication. This achievement is of particular importance because many thematic extensions of metadata models lead to semantic ambiguity or redundancy.

Fourth, the evaluation of the proposed model based on the property and class compatibility criterion (C4) showed that no semantic inconsistency occurred

at the Resource Description Framework (RDF) level, and all elements are compatible with the conceptual scope of the target class. This result indicates that the proposed extensions are based on the semantic logic framework of the BIBFRAME model, and their interoperability in the linked data environment is considered.

Fifth, the evaluation of the proposed model based on the criterion of necessity of expansion (C5) showed that only a part of the elements need to be expanded, and most of the elements are covered using the existing structure of the basic BIBFRAME model. This result indicates that the present study aims to identify points of the BIBFRAME structure that have real gaps for describing and representing elements of regional music. The important point is that the items that need expansion are among the specific characteristics of regional music, such as ritual dependence, the central role of performance, the diversity of sound systems and oral transmission.

5 Analysis

The results of the study and evaluation of the proposed model show that the BIBFRAME model is sufficient for describing and representing the technical and bibliographic features of regional music resources, but it needs a targeted conceptual expansion to describe and represent the cultural and performance features of regional music. Accordingly, the proposed model is considered a complementary and compatible extension of the basic BIBFRAME model, which increases the descriptive potential of the model without being structurally incompatible with it. In analyzing the results, it is worth mentioning several gaps in the BIBFRAME model based on the descriptive needs of regional music features. The evaluation results showed that the need to expand BIBFRAME is rooted in three fundamental conceptual gaps and is not simply due to the lack of a few elements for description. These gaps indicate epistemological limitations in BIBFRAME because BIBFRAME was originally designed to describe library resources and was then generalized to the subject domain of music.

Gap One - Music as an Object vs. Music as Performance: In the BIBFRAME model, music is usually modeled as an information object. However,

regional music is a performance phenomenon. In the BIBFRAME framework, a musical work is defined as an abstract entity that has different instances, but in reality, the semantic features of regional music are mainly formed at the moment of performance. Elements such as the degree of improvisation, the technique of playing, the manner of performance, and the vocal style cause part of the meaning of regional music to be ignored in the description based on the basic BIBFRAME model. Therefore, the first gap is the inability of the model to represent the performance features as a semantic layer.

Gap two - Western Music Ontology Bias: The conceptual elements of BIBFRAME are implicitly more compatible with Western music concepts. Concepts such as tempo, instrumentation, and tonal system are well modeled using BIBFRAME, but complex rhythmic cycles, indigenous instrument classifications, and non-Western modal systems lack accurate representation. Elements such as pitch scale, rhythmic cycle, and maqam, which were identified as needing expansion in this study, indicate that the basic BIBFRAME model is not able to cover the diversity of non-Western musical systems. This indicates an ontological bias in the conceptual structure of BIBFRAME because it is largely aligned with a specific musical tradition.

Gap Three - Compressing Cultural Context: Cultural context in regional music is part of the identity of a work, but in BIBFRAME, cultural context is considered as thematic, contextual, or peripheral information of a work. Elements related to the social function of the work, rituals, dialect, and gender of the performers show that meaning is formed in the interaction between culture and music. The lack of a mechanism for structured modeling of cultural context means that elements related to cultural context are compressed into thematic tags or notes and are not described as tacit knowledge of a regional music work.

The gaps raised show that BIBFRAME has limitations in describing regional music, which are due both to the lack of vocabulary and to the difference between the two descriptive paradigms: the “performance-culture-oriented” paradigm versus the “library-source-oriented” paradigm. The extension proposed in the present study is an attempt to bring these two paradigms closer together.

An attempt that preserves the original structure of BIBFRAME while expanding the representational capacity of this model for regional music knowledge.

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Desenvolvimento de um modelo de expansão do BIBFRAME para a descrição da música regional: modelagem conceitual e validação por especialistas

Resumo: Esta pesquisa aplicada de caráter desenvolvimental teve como objetivo desenvolver um modelo de expansão do *Bibliographic Framework* para a descrição da música regional. A pesquisa foi conduzida em quatro etapas principais: identificação dos elementos de dados da música regional por meio de análise textual e entrevistas com especialistas, que resultaram na identificação de 41 elementos informacionais; correspondência qualitativa desses elementos com as classes e propriedades do *Bibliographic Framework*, utilizando triplas do *Resource Description Framework*; desenvolvimento de um modelo expandido; e avaliação final com base em cinco critérios estruturais e de conteúdo – adequação das camadas, adequação das propriedades, ausência de sobreposição conceitual, compatibilidade entre classes e propriedades e necessidade de desenvolvimento. Os resultados da avaliação demonstraram que o *Bibliographic Framework* é adequado para a descrição das dimensões bibliográficas clássicas e das características técnicas dos recursos musicais, mas apresenta três lacunas conceituais fundamentais para a descrição da música regional: a incapacidade de representar o “conhecimento de performance” como uma camada semântica independente (Música como Performance versus Música como Objeto); o viés ontológico em favor da musicologia ocidental (Viés Ontológico da Musicologia Ocidental); e a compressão do contexto cultural. Os resultados indicam que elementos como estilo vocal, estilo de performance, nível de improvisação, técnica instrumental, sistemas musicais não ocidentais (posição, altura e ciclo rítmico) e características identitárias da performance (gênero e dialeto) requerem desenvolvimento conceitual específico. O modelo proposto, concebido como uma extensão complementar e compatível com o *Bibliographic Framework* original, amplia sua capacidade descritiva sem introduzir inconsistências estruturais e constitui um passo em direção à aproximação entre o paradigma de “recurso baseado em biblioteca” e o paradigma “baseado na cultura da performance” no contexto dos dados vinculados.

Palavras-chave: BIBFRAME; música regional; extensão específica de domínio; modelagem conceitual

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Data availability statement

The entire dataset supporting the results of this study has been published within the article itself.

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