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FUNCTIONALITIES OF FRBR-BASED INFORMATION VISUALISATION IN LIBRARY BIBLIOGRAPHIC RECORDS

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ABSTRACT

This study explores the potential of the Functional Requirements for Bibliographic Records (FRBR) model as a tool for information visualisation in bibliographic control. This research aims to investigate how FRBR can be employed to enhance the visualisation of bibliographic data, examine the impact of FRBR on information organisation and retrieval, and identify and analyse the challenges associated with FRBR implementation. The researchers applied thematic analysis, where the study has three main phases. The process started with designing the review and then conducting the review. Lastly, analyse and organise the review. The analysis of the study is gained through reviewing existing literature through thematic analysis; thus, three main aspects, which contain four themes, have been presented within the study. It is important to note that the study makes a significant contribution as it focuses on library interface interaction along with the stress on relationships of entities between static and interactive bibliographic records.

Keywords: FRBR, Information Visualization, Library Interface, Bibliographic Records.

BACKGROUND

FRBR stands for Functional Requirements for Bibliographic Records. The FRBR is a helpful cataloguing standard vital in library and information science. FRBR is a conceptual model developed by the International Federation of Library Associations and Institutions (IFLA) to provide a framework for organising and describing bibliographic resources (Merčun et al., 2012). Meanwhile, Zavalin and Miksa (2021) stated that information visualisation is the practice of portraying facts in a meaningful, visual manner that people can readily absorb and understand by people who use the library system, known as the Online Public Access Catalogue (OPAC). OPAC here refers to the search engine utilised by libraries for

library staff and users for various fields (Eserada & Okolo, 2019). Hence, these three main terms are interrelated with one another. FRBR provides a conceptual framework that informs bibliographic control practices, including the organisation and description of visual information. By incorporating FRBR principles into bibliographic control workflows, librarians and cataloguers can enhance access to and discover visual resources within library catalogues and other information systems.

Presently, the FRBR model is used in many modern library projects worldwide because it creates relationships between entities in the first group, known as work, expression, manifestation, and items. It also can reduce duplicate data and integrate multiple titles and editions of the same work under one record, increasing user satisfaction and improving search results (Yushiana & Sharifah Nur Amirah, 2015). The FRBR approach is expected to be widely adopted, as major library suppliers are already experimenting with using FRBR on enormous bibliographic database datasets. These attempts have aided in identifying parameters that contribute to the appropriate modelling of FRBR in present and future bibliographic databases.

Consequently, Arias Silveira (2020) explained that adopting the FRBR model in the reference section of a library has the potential to enhance the organisation, accessibility, and usability of reference materials. It aligns reference services with user-centred principles and improves the overall user experience, making it easier for library patrons to find and utilise reference resources effectively. The link between reference work and cataloguing has emphasised the significance of integrating the cataloguing librarian's work with the reference librarian's duties to provide compelling user service. Meanwhile, FRBR supports library cataloguing practices that are consistent. This standardisation promotes interlibrary collaboration and resource sharing, which benefits library users who require items from numerous libraries.

Although the importance of bibliographic information systems for identifying and exploring library resources, some of the essential functionality that should be given to assist users in their information-seeking process is still lacking. As for today, finding accurate and valuable information in such a dynamic environment, frequently referred to as big data, becomes increasingly challenging as the volume of recorded knowledge continues to rise rapidly. From this point of view, this study aims to achieve the following:

- 1) To study the implementation of FRBR-based interfaces within libraries that can enhance the library interface and users' experience.
- 2) To examine the impact of FRBR on information organisation and retrieval in the cataloguing process.
- 3) To identify and analyse the challenges associated with FRBR implementation.

The study findings will rebound to benefit the library and information science field and the broader academic and professional communities. It helps libraries enhance their services and operations, enabling them to identify best practices, adopt new technologies, and develop innovative approaches to meet the evolving needs of users. In addition, it aids libraries in understanding user behaviours, preferences, and information-seeking habits, as this knowledge exposure leads to the creation of user-centric services, improved library interfaces, and better user experiences.

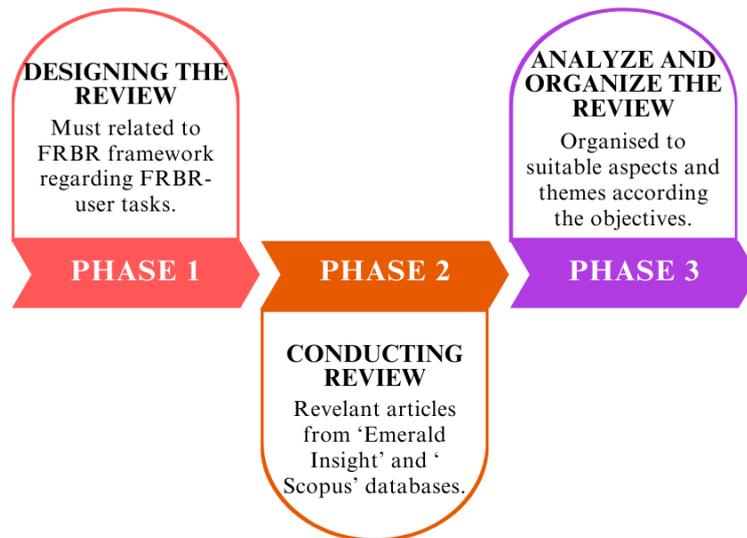
METHODOLOGY

The methodology of the study is based on thematic analysis. Three phases of process implementation will be carried out in this research, as portrayed in Figure 1. The methodology was adopted, and changes were

made based on previous research conducted by Yushiana Sharifah Nur Amirah (2015) concerning FRBR frameworks.

Figure 1

The process of thematic analysis on FRBR.



Phases 1: Designing the review.

The research articles related to the FRBR framework or concept are identified for this review. Another focus that the researcher integrated within the research is on FRBR user tasks, which touch upon finding, identifying, selecting, and obtaining digital resources for users' needs (München, 1998)

Find: To find something in a database based on a user's search where the entities match the user's provided search criteria (i.e., to locate a single entity in a database because of a search using an entity attribute).

Identify: To identify an entity (that is, to check that the entity described matches the entity sought or to differentiate between two or more entities having comparable features).

Select: To choose an entity appropriate for the user's needs (that is, to choose an entity that fits the user's requirements in terms of content and physical format or to reject an entity as improper for the user's needs). Entity selection is crucial as it must meet the user's expectations.

Obtain: To receive ownership of or access to the mentioned entity (e.g., by purchase, loan, etc.).

Phases 2: Conducting the review.

'The Emerald Insight' database, 'Scopus' database and 'Google Scholar' database were selected to find the relevant articles. All the databases above provide suitable and correlated with the search matter. Thus, these three database platforms make a relevant search for the FRBR framework implementation within libraries' displays and are being used to gain an understanding of the topic. Most of the articles were searched by using a combination of keywords as the following terms: "FRBR," "Functional Requirements

for Bibliographic Records," "library cataloguing," "information organisation," "user experience," and "information visualisation."

Phases 3: Analyse and organise the review.

Then, the articles selected will be organised based on the title, methodology, findings, and literary arguments. Within this study, 20 articles have been selected from the databases. As a result, the analysis can cover various aspects of FRBR, such as its conceptual framework, implementation, impact on information organisation, and challenges faced in its adoption, which will be arranged according to appropriate themes that defeat the study's objectives. Review the search results and select relevant articles and other sources that address the research questions. The researchers also used inclusion and exclusion criteria to filter the literature. These criteria could include publication date, type of source, and relevance towards FRBR framework and user tasks. By conducting a literature analysis on FRBR, researchers can gain insights into the theoretical foundations, practical applications, and challenges associated with this influential bibliographic framework, as portrayed in Table A.

Table A

Existing literature that illustrates all the three component objectives.

Research Objectives	Existing Literature
To study the implementation of FRBR-based interfaces within libraries that can enhance the library interface and users' experience.	Merčun et al. (2016), Kadyan (2018), Kiryakos & Sugimoto (2019), Salaba & Merčun (2020), Alvite-Diez (2021), Arastoopoor (2022), Chen (2023).
To examine the impact of FRBR on information organisation and retrieval in the process of cataloguing.	Haji Zeinolabedini (2017), Salaba et al. (2018), Possemato (2018), Tallerås et al. (2018), Aalberg (2019), Beene et al. (2020), Cao et al. (2021), Chen (2023).
To identify and analyse the challenges associated with FRBR implementation.	Gaona-Garcia et al. (2017), Ndungu (2017), Kiryakos & Sugimoto (2018), Rahimi et al. (2018), Koh & Muthupalaniappen (2018), Beene et al. (2020), Alvite-Diez (2021), Zavalin & Miksa (2021).

RESULTS

This section highlights and summarises the review in Table A as follows:

Research Objective 1

To study the implementation of the FRBR interface within libraries that can enhance the library interface and users' experience.

Enhanced Library Interface Using FRBR Model

The research articles above indicate several interface prototyping and experimenting to help users use the FRBR interface. A study by Merčun et al. (2016) stated that bibliographic information systems, bibliographic data, and information visualisation aspects brought the improvement of the interface together in designing a better prototype: another explanation for the hierarchical display of FRBR. FRBR-based

interfaces often present a hierarchical view of bibliographic entities, allowing users to navigate through works, expressions, manifestations, and items, as shown in Figure 2. This hierarchical display, illustrated in Figure 3, helps users understand the relationships between different versions and formats of a resource and enables more precise resource selection.

Figure 2

Hierarchical display of FRBR

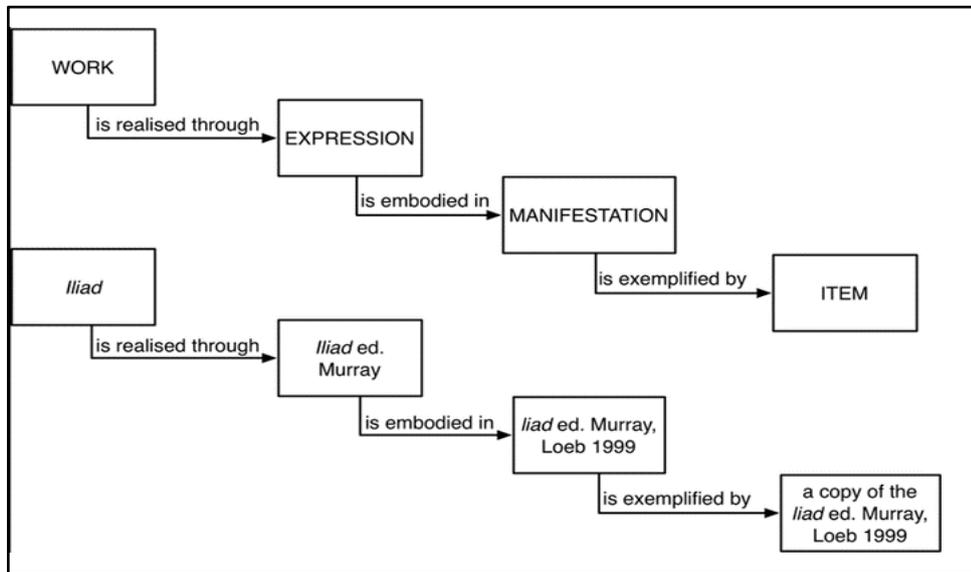
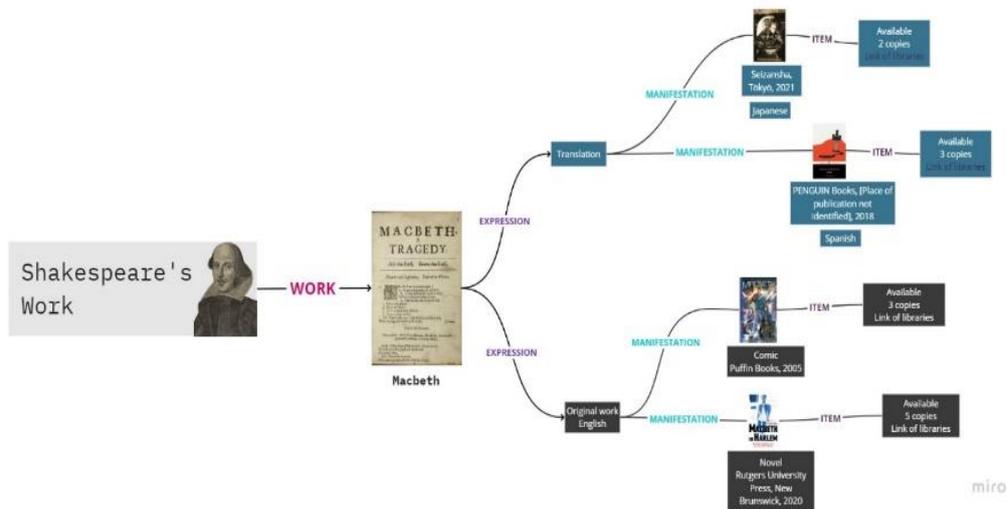


Figure 3

FRBR-based implementation towards Shakespeare's (Work Source: Syahirah (2023))



Using suitable tools can illustrate an interactive FRBR model, as shown above, one of Shakespeare's works according to Figure 3. The findings showed that applying FRBR-based design using an entity-relationship model can assist users in finding, identifying, selecting, and obtaining Shakespeare's works, for example, from Work Level to Item Level.

1. Work Level:

Create a central canvas and label it as "Work Level." Add text boxes representing different Shakespearean plays (Works) around the canvas. For example, place "Macbeth" within the text box. Connect these text boxes to a central point to represent the concept of different Works.

2. Expression Level:

On a new section of the canvas, label it as "Expression Level." For each Shakespearean play, create branches from the Worktext box, leading to different text boxes representing Expressions. These Expression text boxes indicate variations like translations, adaptations, and editions. For instance, for "Macbeth," you might show "Original Text" and "Translation" as Expressions.

3. Manifestation Level:

Move to another section of the canvas labelled "Manifestation Level." From each Expression text box, create branches representing different Manifestations. In these Manifestation text boxes, include publication year, publisher, format, and other relevant information. For example, for the "Original Text" Expression of "Macbeth," you might show different published editions.

4. Item Level:

Proceed to the "Item Level" section. From each Manifestation text box, create branches representing different Items. These Item text boxes can include details specific to individual copies or instances, such as library call numbers, physical location, and condition.

In addition, Kadyan (2018) and Chen (2023) reported that, according to librarians, FRBR is critical for library metadata. Linked Data catalogues' distinctive features enhance resource discovery and exploration compared to traditional catalogues, providing users with more comprehensive and interconnected. In a nutshell, FRBR presented a new perspective on the application of constructing various catalogues and providing improved services with access to bibliographic data in a digital environment.

Users Experience with FRBR Information Visualization

Meanwhile, a study by Kiryakos Sugimoto (2019) illustrated the users' feedback and experience using different visualisation interfaces. The outcomes were positive as it was systematic and easy to search the sources they wanted. Responsive design is essential in creating an effective and impactful interface for the librarian and the users. FRBR-based interfaces are designed to be responsive, adapting to different devices and screen sizes to ensure a consistent and user-friendly experience. In addition, users can locate similar papers they require by searching and locating (Salaba & Merčun, 2020). It also shows that users completely comprehend the hierarchical linkages, but further study is needed to understand users' enjoyment of networked methods of visualising bibliographic families. This approach supports serendipitous discovery and encourages exploration of related resources.

Other than that, Arastoopoor (2022) explained that catalogue designers are faced with a significant quandary, which refers to the flexibility in searching for information sources. They must utilise a hierarchical strategy to depict the bibliographic family to fulfil the consumers' holistic vision. As a result,

using a hierarchical strategy in generating bibliographic family visualisations is unlikely to satisfy most users, and an ontological approach may be a suitable choice. Indeed, catalogue designers face challenges when presenting coherent and user-friendly bibliographic information. User-friendly bibliographic family" likely refers to a collection of related items or resources within a catalogue, such as books by the same author, editions of a particular work, or multiple volumes of a series. In the meantime, Alvite-Diez (2021) stated that the present state of development of linked open data (LOD) bibliographic portals, including their functions, contributions, value-adds, and user experience, is examined in this paper. According to the study, distributing LOD via visual interfaces increases information enrichment, contextualisation, and user experience.

Research Objective 2

To examine the impact of FRBR on information organisation and retrieval in the cataloguing process.

Advancement of Cataloguing Efforts

It is undeniable that FRBR has had a significant impact on the field of library science and information organisation. First and foremost, pathways for identifying components (Haji Zeinolabedeni, 2017). FRBR introduced a new way of thinking about bibliographic records by emphasising the relationships between entities such as works, expressions, manifestations, and items. This conceptual shift has helped librarians and information professionals better understand and represent the relationships between different versions, editions, and translations of a work, leading to improved access and navigation of library collections. Haji Zeinolabedeni (2017) further adds the impact of FRBR, which increases the quality and effectiveness of joint cataloguing efforts while making upkeep easier. Thus, FRBR has significantly improved the interoperability of bibliographic data across different library systems and platforms.

Furthermore, as Beene et al. (2020) stated, exhibition catalogues can be valuable resources for research and teaching purposes. Scholars often rely on exhibition catalogues to study and analyse specific exhibitions, artists, or art movements. These catalogues provide detailed artwork information, including descriptions, images, and provenance. On the other hand, for teaching, exhibition catalogues can be used to enhance critical information and visual literacy instruction. They provide students with visual and textual materials to analyse and evaluate, fostering discussions about authority, authorship, bias, audience, and inclusion/exclusion.

On top of that, easier cataloguing and circulation for librarians are stated by Cao et al. (2021) within the paper. FRBR promotes a user-centric approach to information retrieval by focusing on the user's tasks and goals. It encourages the creation of user-friendly interfaces and systems that allow users to find, select, and obtain the specific version or format of a resource they need more quickly. FRBR's influence can be seen in developing user-friendly library catalogues and discovery systems that offer better search capabilities and more intuitive browsing experiences.

Another point is that the FRBR model aids in improving cataloguing efforts where FRBR's hierarchical structure enables more efficient browsing and exploration of library collections (Talleras & Pharo, 2018). Users can start with a work and navigate through related expressions, manifestations, and items to find the specific resource they are interested in. This approach enhances serendipitous discovery and supports exploring related resources, fostering a more comprehensive understanding of a subject area. In addition, Chen (2023) believed that Linked Data catalogues from the FRBR-based framework enhance serendipitous discovery by providing unexpected connections and associations between entities through URI-based linkages, contextual information pathways, and keyword recommendations. This allows users to explore and discover new connections and insights within the LD catalogue.

Based on Salaba et al. (2018), the FRBR-based approach performs better for tasks involving related works and works by or about the author. According to studies, the FRBR-based system, notably the FRBR-based visual prototype, outperforms typical library catalogue displays in assisting with these activities. Compared to standard displays, users regarded the FRBR-based system as more efficient, effective, and user-friendly for these specific activities. Applying RDA through FRBR also aids information institutions in the cultural heritage sector, enhances the quality of data produced, promotes open access to knowledge, and fosters collaboration and cooperation among institutions (Possemato, 2018). It enables a shift from a record-oriented approach to an entity-oriented vision, revolutionising information creation, sharing, and consumption.

Research Objective 3: To identify the challenges associated with FRBR implementation.

While FRBR has brought significant advancements to library science and information organisation, it also poses several challenges. FRBR must develop cataloguing rules in line with FRBR (Gaona-Garcia et al., 2017). FRBR provides users with a new viewpoint on the structure and connection of bibliographic and authority data and a more precise vocabulary to assist future cataloguing rule authors and system designers in addressing user expectations. Although FRBR has been widely recognised and endorsed by library organisations, its adoption has been uneven across different libraries and regions. Some libraries have embraced FRBR and implemented it in their systems and cataloguing practices, while others have been slower to adopt or have only partially implemented its concepts. Lack of widespread adoption and standardisation can hinder the sharing and exchanging biographic data across libraries. Beene et al. (2020) also commented on the same issue: the lack of a uniform cataloguing standard for cultural heritage artefacts among libraries and museums complicates exhibition catalogue description practices. Moreover, the swift progression of information and the mismatch between conventional library systems and linked data create hurdles for digital preservation and the incorporation of emerging digital media into exhibition catalogues. The combination of restricted print quantities and the complexity of acquiring self-published or homemade catalogues further complicates the task of amassing and sustaining extensive collections.

Besides, Ndungu (2017) stressed a need to address FRBR-based record structures, record encoding standards and frameworks for FRBR implementations. It is undeniable that FRBR introduces a more complex conceptual model compared to traditional bibliographic models. Its hierarchical structure and emphasis on relationships between entities require a thorough understanding and expertise in applying the model correctly. Due to that, it may require significant training and resources for library staff and cataloguers. Implementing FRBR can impact traditional cataloguing workflows and require significant adjustments in cataloguing practices. Cataloguers must adapt their processes to capture and represent the various entities and relationships FRBR defines. This may involve additional time and effort in cataloguing, training cataloguers, and ensuring consistency in applying FRBR principles. According to the report by Rahimi et al. (2018), health librarians and academics should utilise digital library assessment models to examine and identify the strengths and limitations of health digital libraries. Hence, appropriate evaluation methods should be established to handle the distinct characteristics that can fit with health digital libraries. Nonetheless, Koh et al. (2018) suggested that future researchers find the FRBR gradual and interactive rather than sequential in execution by concentrating on information relevance.

Another critical challenge is developing FRBR-oriented authority work standards for FRBR implementations, which Zavalin and Miksa (2021) mentioned in their article. This is related to system compatibility and interoperability. Integrating FRBR into library systems, catalogues, and discovery platforms can be challenging. Existing systems may not be designed to accommodate the entity-based model of FRBR, requiring significant modifications or even redevelopment of the systems. Achieving interoperability between library systems and platforms while maintaining consistency with the FRBR

model can be complex. When it comes to flexibility, FRBR is argued to be lacking in it as Kiryakos & Sugimoto (2018) explained that current depictions of franchise-level entities on the web, such as Wikipedia articles, suggest that users develop their own FRBR entities to collocate resources belonging to a single franchise. Thus, this shows FRBR needs improvements in terms of intuitive interface, customisation possibilities, user communication, and experimental areas for data reuse are required.

CONCLUSION

It is noticeable that FRBR helps the library provide better user services through the interface. After creating multiple prototypes, FRBR has had a transformative impact on the organisation and description of bibliographic resources. Nevertheless, FRBR still has certain aspects that need to be improved to utilise the model to the fullest. FRBR has had a transformative impact on the organisation and description of bibliographic resources. It has paved the way for user-centric information retrieval systems, improved resource discovery, facilitated data exchange, and influenced cataloguing practices. The model continues to shape the library science and information organisation field, supporting the evolving needs of library users in the digital age.

The limitation of the study is that the researchers only focus on the FRBR framework in the aspect of interactive visual information that corresponds to user tasks (i.e., find, identify, select, and obtain). Other than that, the study only touches on several themes derived from selected research papers, which tend not to explain some aspects of FRBR. Despite these limitations, library and information science research remains critical for advancing the profession, improving library services, and contributing to the broader understanding of information access, organisation, and dissemination.

It is recommended that upcoming researchers do more research regarding the FRBR framework in improving the display of libraries as it would benefit many sides, such as library staff, cataloguer, and users in finding, identifying, selecting, and obtaining resources (FRBR user tasks). Future studies in these areas can contribute to the continued growth and development of the field and its ability to serve diverse communities and information needs.

Another important note is related to improving Functional Requirements for Bibliographic Records in making a better interactive display. Firstly, FRBR scalability inside the system. FRBR undeniably was built to handle traditional bibliographic items like books and periodicals. However, with the rising digitalisation of resources and the advent of new media formats, it is necessary to broaden the scope of FRBR to handle diverse forms of digital and multimedia resources efficiently. It is, secondly, extending linguistic and cultural diversity. FRBR must handle the issues raised by multilingualism and cultural diversity in bibliographic data. This includes supporting non-Roman scripts, different metadata standards and practices across languages and cultures, and promoting cross-lingual and cross-cultural search and discovery.

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