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The functional requirements for community information
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Abstract

Purpose – The purpose of this paper is to consider the nature of community information (CI) and proposes a data model, based on the entity-relationship approach adopted in the Functional Requirements for Bibliographic Records (FRBR), which may assist with the development of future metadata standards for CI systems.

Design/methodology/approach – The two main data structure standards for CI, namely the element set developed by the Alliance of Information and Referral Systems (AIRS) and the MARC21 Format for CI, are compared by means of a mapping exercise, after which an entity-relationship data model is constructed, at a conceptual level, based on the definitions of CI found in the literature.

Findings – The AIRS and MARC21 data structures converge to a fair degree, with MARC21 providing for additional detail in several areas. However, neither structure is systematically and unambiguously defined, suggesting the need for a data model. An entity-relationship data modelling approach, similar to that taken in FRBR, yielded a model that could be used as the basis for future standards development and research. It was found to effectively cover both the AIRS and MARC21 element sets.

Originality/value – No explicit data model exists for CI, and there has been little discussion reported about what data elements are required to support CI seeking.

Keywords Metadata, FRBR, MARC21, AIRS, Community information, Data models

Paper type Conceptual paper

1. Introduction

Community information (CI) provision has been a function of public libraries and other local government agencies for many years. Although people are now able to seek out CI independently by searching on the websites of community organisations themselves, libraries and other gatekeepers of CI still play an important role in facilitating the use of community services. For example, people do not always know enough about particular services to conduct an effective "Google" search; even when they do, search engines will not always rank the most relevant websites highly enough. Searchers have been assisted, in some cases, by the building of "community networks" that comprise websites for various services located in particular communities, but such networks still have to be managed and navigated. Thus the provision of aggregated CI continues to be recognised as an important responsibility of local government. For instance, the document, Beyond a Quality Service: Strengthening the Social Fabric – Standards and Guidelines for Australian Public Libraries (Australian Library and Information Association, 2011, p. 29) stipulates that "appropriate community information database/s are [to be] developed and/or used for information service delivery." Similarly, the Knight Commission on the Information Needs of Communities in a Democracy (2009, p. xiii) observed that "information flow improves when people have not only direct access to information, but the benefit also of credible intermediaries to help discover, gather, compare, contextualise, and share information."

Aggregated CI provision is no longer solely the domain of libraries and citizen's advice bureaux, however. Other government agencies, and many non-government agencies, also serve as intermediaries. Some concentrate on particular topic areas

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(e.g. health), some target a particular client group (e.g. an ethnic community), while others aim for a more general coverage. In Australia alone, there are hundreds of organisations aggregating and disseminating CI, from those covering a handful of services to those covering many thousands (Hider *et al.*, 2014). Unfortunately, most of the databases and directories that these organisations have made available are not integrated, and many do not conform to common data standards.

Nevertheless, data standards for CI do exist. Among libraries, the main standard is part of the MARC (Machine Readable Cataloguing) family of data exchange formats, and more specifically the MARC21 formats maintained by the Library of Congress and implemented by most library management systems across North America and the rest of the English-speaking world. The MARC21 Format for CI (www.loc.gov/marc/community) is not used as extensively as are the MARC21 Formats for Bibliographic and Authority Data, but if a library management system has a module for managing CI it is likely to be based on this format. Outside of the library world, however, the MARC21 format is rarely used for CI provision. Instead, the standards most likely to be followed are those developed by the Alliance of Information and Referral Systems (AIRS), a membership organisation whose mission is "to provide leadership and support to our membership and affiliates to advance the capacity of a Standards driven Information and Referral industry that brings people and services together" (www.airs.org). The AIRS standards 7-12 pertain to databases of CI, with the equivalent of the MARC21 format being specified in standard 8, Data Elements (Alliance of Information and Referral Systems, 2013).

The adoption of the AIRS or MARC standards by more CI providers could benefit both aggregators and searchers. If service providers offered information in a standardised format, it could be readily harvested by aggregators and uploaded into their systems with minimal intervention. If these systems all used the same format, they could be interrogated simultaneously through a common protocol. In other words, end-users could perform federated searches (and far more targeted ones than they can on general search engines such as Google). Furthermore, it might be possible, ultimately, to provide data about community services that can be linked in a systematic way to other data as part of the Semantic Web (Yoose and Perkins, 2013). In the future, this may greatly enhance the accessibility of CI.

This paper compares the AIRS and MARC element sets and discusses their potential for wider application. It also proposes a preliminary data model, at a conceptual level, that could be used, as a starting point, for the evaluation of CI standards, based on the approach taken in the Functional Requirements for Bibliographic Records (FRBR) report (International Federation of Library Associations and Institutions, 2009). The FRBR data model has been subject to extensive review and adaptation since it was first proposed in the late 1990s, and this paper makes no attempt to analyse which iteration of the "FRBR family" of models (Smiraglia *et al.*, 2013) might be a best suited for adaptation to CI. Rather, the paper aims to demonstrate that a FRBR-like approach can be profitably taken with CI, so that a similar process of review and modification might occur in this field as it has in bibliographic organisation.

2. Literature review

Research into CI needs and provision has been sparse, although there has been growing interest in the related field of community informatics, which investigates the use of information and communication technologies in the development of communities. A summary of CI research and practice has been published by Day (2007). As she notes, CI is often disseminated through informal, unstructured channels, such as word of mouth,

but it is also provided, in both structured and unstructured forms, by organisations such as local councils, public libraries and citizen's advice bureaux, as well as by the service providers themselves. Day (2007, p. 103) considers the functions of CI, ultimately, are to help "people to deal with daily life problems and to participate in the life of their community." These two functions are represented in various definitions of CI, including the definition by Pettigrew (1996, p. 351) that Day cites: "Any information that helps citizens with their day to day problems and enables them to fully participate as members of their democratic community." To some extent, the two functions may be considered to overlap: a citizen can participate more in their community (it is assumed) if their day-to-day problems have been solved. Further, the use of CI typically leads to the use of community services, which in itself is participatory, at least in a passive sense. There is thus a strong emphasis among CI providers of "connecting" people with services and the community at large (Day, 2007).

However, the participatory function of CI involves notions of "democracy" and "citizenship" that may represent activities that go beyond solving the day-to-day problems of individuals. Thus in an early definitional discussion, Donohue (1976, p. 126) identifies two "strands" of CI, namely, "survival information" and "citizen action information." Similarly, Bunch (1982) discusses how the term "community information" represents both "community" and "information" aspects: in some cases, the emphasis is on helping the disadvantaged in a given community, in other cases, on daily problem solving and improving the quality of lives more generally. Stilwell (1999) traces the theoretical foundations of CI services with reference to similar concepts.

While these discussions have shed light on what CI is for, they have been less enlightening when it comes to the question of what CI is about. What is it that CI describes? In theory, all sorts of information could help people in their daily lives and strengthen communities, as Pettigrew and Wilkinson (1996) pointed out when they explored the interplay between three different, though overlapping, categories of CI: information from the community, about the community and useful to the community. An indication of the nature of CI may be obtained by considering how related terms have been used. In North America, CI has often been managed by "information and referral" services, which facilitate "the link between a person with a need and the resource or resources outside the library which can meet that need" (Childers, 1984, p. 1). This echoes the "connecting" concept attributed to CI providers, though it begs the question: what resource is the person being connected to? Childers (1984, p. 1) elaborates thus: "any service, activity, individual, organisation, information, or advice that may fulfill a need."

While this definition may focus on the problem-solving purpose of CI (as Durrance (1984) points out), it is still very broad. The order of resources in the list, however, is instructive: information and referral agencies tend to point clients to services more than, say, documentary information. A similar list, covering also the "community" aspect of CI, is offered by Pettigrew (1996, p. 351), in an elaboration of her initial definition: "It is information pertaining to the availability of human services such as health care, financial assistance, housing, transportation, education and childcare services; as well as information on recreation programmes, clubs, community events, and information about all levels of government." Of a similar vintage, the definition used for the USMARC CI format (the precursor of the MARC21 format) focusses even more strictly on referral, as one might expect of a library-oriented standard: "programmes, services, organisations, single and ongoing events, and individuals (e.g. experts, public officials) about which people in a community might want information" (Bruns, 1992, p. 387).

Although, as Bunch (1982) points out, citizen's advice bureaux in the UK tended to place more emphasis, than did the information and referral services in the USA, on solving their clients' problems directly (as opposed to referring them to other services), CI in the UK is also very often about local services and organisations, especially when managed by public libraries. While other kinds of information, such as local history, are sometimes included in discussions of CI, both the professional and research literature tends to focus on the kinds of entity, especially services, covered in the Pettigrew definition, which has in fact been cited, and used, by several researchers since it was first proposed.

Most CI studies have examined either the way in which people seek information about community services in every-day life, often as part of investigations into information seeking more generally, or how CI can be disseminated through various systems and networks. Pettigrew, Durrance and Unruh (2002, p. 896) found that the internet had enabled public libraries to provide richer and wider-ranging CI, and that end-users "equally represent men and women, a distributed range of age groups, and a diverse range of occupations." However, they also identified several barriers to its dissemination, including poor interface design and poor organisation. Lambert (2010) highlighted the importance of site design in his analysis of search queries on two CI sites in Canada, that served the same community but produced significantly different user behavior. The study also showed users' wide variety of information needs, across a vast spectrum of "conceptual categories."

A case study of CI system development is described by Baaske and Zschernitz (2006), who report on the use of XML-based software (Community-in-a-Box) by public libraries to create their own community directories, while maintaining a consistent "look and feel," as well as consistent metadata, within a larger network (NorthStarNet). Applications included community subject headings (to index the individual services), calendars, blogs and "cafes" (i.e. discussion forums). The construction of the more sophisticated kinds of CI "portal," however, requires significant resources and expertise which many agencies do not have (Musgrave, 2004), explaining, at least in part, the counter-trend of centralisation, whereby dedicated units coordinate the aggregation of information across multiple communities. Such arrangements can provide not only a more sophisticated interface, but also a more up-to-date and sustainable system (Harrison and Zappen, 2005). An example of this trend is Connecting Up (www.connectingup.org), an organisation and site that represents large numbers of community services and charities across Australia.

Discussion around standards to support CI systems has been fairly limited, extending little beyond the documentation pertaining to the standards themselves. Given that CI has often been managed by libraries, it is not surprising that one of the main data structure standards for CI originates from one developed principally for bibliographic information: the MARC21 Format for CI will be described further in Section 4. Another related standard is the Government Information Locator Service element set (www.archives.gov/records-mgmt/policy/gils.html), which is also a bibliographic standard, but pertains to what is sometimes regarded as a form of CI. As mentioned earlier, the other main data structure standard for CI was developed by the AIRS. Its element set was first published in 2000 (AIRS, 2013) and is described further in the next section. Various vocabularies have been employed to describe certain data elements featured in the MARC21 and AIRS standards, particularly the subject element. Again, some of these vocabularies, such as the Library of Congress Subject Headings (www.loc.gov/aba/publications/FreeLCSH/freelcsh.html), come from librarianship, while others have been developed specifically for CI, such as the Community Information Thesaurus (Community Information Victoria, 1999).

While the literature around CI data standards is sparse, bibliographic standards, on the other hand, have been the subject of considerable discussion for many years. One outcome of this discussion has been the wide acceptance and adoption of the so-called "FRBR model" for bibliographic data (International Federation of Library Associations and Institutions (IFLA), 2009), which describes (at least in its original iteration) the entities, and relationships between the entities, represented by bibliographic information, that need to be described in order for the various "user tasks" (functions) of the library catalogue to be satisfied. The model is outlined in Section 6.

3. AIRS data element set

The AIRS Standard 8, Data Elements, divides CI into that which pertains to "agency/main site," "additional sites (locations/branches)" and "service/service group and service site." The standard is part of a set of standards for information and referral systems, which provide "information about opportunities and services available in their communities" (AIRS, 2013, p. 64). Standard 8 also distinguishes between those elements that are "required" and those that are "recommended" (i.e. optional). The elements are listed in Table I.

For any given service, any of the elements listed in Table I may be recorded: those for the service itself, and those for the provider of the service, i.e. agency, and, in some cases, a particular site, or branch, of the agency. AIRS allows for the description of both "programmes" named by the service agency and "service groups" identified as such by the describing agency. In AIRS, all community groups are agencies offering one or more services.

4. MARC21 format for CI

The USMARC Format for CI was established by the Library of Congress, on the advice of the CI Section of the Public Library Association, in the early 1990s (Bruns, 1992). Now known as the MARC21 Format for CI, it is a record format comprising a large number of data fields and subfields, along with the codes which identify these fields and subfields, and which instruct the computer system to index and display them in particular ways. As mentioned earlier, the format was designed for records that describe "programmes, services, organisations, single and ongoing events, and individuals (e.g. experts, public officials) about which people in a community might want information" (Bruns, 1992, p. 387).

Most of the fields, and their codes, mirror those found in the other MARC21 formats, and many are more applicable to those entities (e.g. library materials) covered by the other formats. However, the format is also based on a "standardised list", compiled by a committee of the Public Library Association, of data elements used by (American) libraries specifically to describe their CI; some of these elements were not represented in the existing MARC formats (Bruns, 1992).

For the purposes of this discussion, only the fields specified by the format, and not their subfields, are listed below. They are prefixed by their respective field numbers (e.g. 001 for Control Number) and suffixed by an indication of their repeatability (i.e. R = repeatable and NR = non-repeatable):

001 – CONTROL NUMBER (NR).
003 – CONTROL NUMBER IDENTIFIER (NR).
005 – DATE AND TIME OF LATEST TRANSACTION (NR).
007 – PHYSICAL DESCRIPTION FIXED FIELD (NR).
008 – FIXED-LENGTH DATA ELEMENTS (NR).
010 – LIBRARY OF CONGRESS CONTROL NUMBER (NR).
016 – NATIONAL BIBLIOGRAPHIC AGENCY CONTROL NUMBER (R).

Element	Required or Recommended
Agency/main site data elements	
Unique ID number	Required
Record ownership code	Required
Agency name	Required
AKA (Also known as) names	Required
Street/physical address	Required
Mailing address	Required
Website(s)/URL(s)	Required
E-mail address(es)	Required
Phone number(s) including extensions, phone types (e.g. Voice, TTY/TDD), and phone functions (administration, intake)	Required
Agency description: a brief narrative describing the agency's main purpose or role	Required
Main site description	Required
Administrative hours/days of operation	Required
Legal status	Required
Date of last complete update	Required
Date of last interim modification/partial update	Required
Contact for updating purposes	Required
Name and title of the director or administrator	Recommended
Federal employer identification number (EIN/FEIN)	Recommended
Year of incorporation	Recommended
Licenses or accreditations	Recommended
IRS status	Recommended
Travel information	Recommended
Physical access	Recommended
Other addresses	Recommended
Additional sites (locations/branches) data elements	
Unique ID number	Required
Site name	Required
AKA names (also known as)	Required
Street/physical address	Required
Mailing address	Required
Phone number(s) including extensions, phone types (e.g. Voice, TTY/TDD), and phone functions (administration, intake)	Required
Site description	Required
Travel information	Recommended
Physical access	Recommended
Other addresses	Recommended
Website(s)/URL(s)	Recommended
E-mail address(es)	Recommended
Administrative hours/days of operation	Recommended
Name and title of the site manager	Recommended
Service/service group and service site data elements	
Unique ID number for the service group	Required
Unique ID number for the service site	Required
Programme name(s) for the service group	Required
AKA (also known as) names for programme names	Required
Service group name	Required

Table I.
AIRS element set

(*continued*)

Element	Required or Recommended
Service group description	Required
Phone number(s) including extensions, phone types (e.g. Voice, TTY/TDD), and phone functions (administration, intake) for specific services in the service group	Required
Eligibility	Required
Target populations	Required
Geographic area served	Required
Documents required	Required
Application/intake process	Required
Fee structure	Required
Languages other than English	Required
Hours of service	Required
Taxonomy term(s)	Required

Table I.

035 – SYSTEM CONTROL NUMBER (R).
040 – RECORD SOURCE (NR).
041 – LANGUAGE CODE (R).
043 – GEOGRAPHIC AREA CODE (NR).
046 – SPECIAL CODED DATES (R).
050 – LIBRARY OF CONGRESS CLASSIFICATION NUMBER (R).
052 – GEOGRAPHIC CLASSIFICATION (R).
060 – NATIONAL LIBRARY OF MEDICINE CLASSIFICATION NUMBER (R).
066 – CHARACTER SETS PRESENT (NR).
070 – NATIONAL AGRICULTURAL LIBRARY CLASSIFICATION NUMBER (R).
072 – HUMAN SERVICES CODE (R).
073 – TYPE OF PROGRAM OR ORGANIZATION CODE (R).
080 – UNIVERSAL DECIMAL CLASSIFICATION NUMBER (NR).
082 – DEWEY DECIMAL CLASSIFICATION NUMBER (R).
084 – OTHER CLASSIFICATION NUMBER (R).
100 – PRIMARY NAME – PERSONAL (NR).
110 – PRIMARY NAME – CORPORATE (NR).
111 – PRIMARY NAME – MEETING (NR).
245 – TITLE (NR).
246 – VARYING FORM OF TITLE (R).
247 – FORMER TITLE (R).
270 – ADDRESS (R).
303 – SUBORDINATE ENTITIES (R).
307 – HOURS, ETC. (R).
311 – MEETING ROOMS AND FACILITIES AVAILABLE (R).
312 – EQUIPMENT AVAILABLE (R).
440 – SERIES TITLE (R).
500 – GENERAL NOTE (R).
501 – CURRENCY OF INFORMATION NOTE (R).
505 – PROGRAMS NOTE (R).
511 – PARTICIPANT OR PERFORMER NOTE (R).
520 – DESCRIPTION NOTE (R).

521 – TARGET GROUP NOTE (R).
522 – GEOGRAPHIC COVERAGE NOTE (NR).
531 – ELIGIBILITY, FEES, PROCEDURES NOTE (R).
536 – FUNDING SOURCE NOTE (R).
545 – BIOGRAPHICAL OR HISTORICAL NOTE (R).
546 – LANGUAGE NOTE (R).
551 – BUDGET NOTE (R).
570 – PERSONNEL NOTE (R).
571 – VOLUNTEERS NOTE (R).
572 – AFFILIATION AND OTHER RELATIONSHIPS NOTE (R).
573 – CREDENTIALS NOTE (R).
574 – TRANSPORTATION AND DIRECTIONS NOTE (R).
575 – ACCOMMODATIONS FOR THE DISABLED NOTE (R).
576 – SERVICES AVAILABLE NOTE (R)
581 – PUBLICATIONS NOTE (R).
587 – OTHER INFORMATION AVAILABLE NOTE (R).
600 – SUBJECT ADDED ENTRY – PERSONAL NAME (R).
610 – SUBJECT ADDED ENTRY – CORPORATE NAME (R).
611 – SUBJECT ADDED ENTRY – MEETING NAME (R).
630 – SUBJECT ADDED ENTRY – PUBLICATION TITLE (R).
648 – SUBJECT ADDED ENTRY – CHRONOLOGICAL TERM (R).
650 – SUBJECT ADDED ENTRY – TOPICAL TERM (R).
651 – SUBJECT ADDED ENTRY – GEOGRAPHIC NAME (R).
653 – INDEX TERM – UNCONTROLLED (R).
654 – SUBJECT ADDED ENTRY – FACETED TOPICAL TERMS (R).
656 – INDEX TERM – OCCUPATION (R).
657 – INDEX TERM – FUNCTION (R).
658 – INDEX TERM – CURRICULUM OBJECTIVE (R).
700 – ADDED ENTRY – PERSONAL NAME (R).
710 – ADDED ENTRY – CORPORATE NAME (R).
711 – ADDED ENTRY – MEETING NAME (R).
720 – ADDED ENTRY – UNCONTROLLED NAME (R).
730 – ADDED ENTRY – PUBLICATION TITLE (R).
856 – ELECTRONIC LOCATION AND ACCESS (R).
880 – ALTERNATE GRAPHIC REPRESENTATION (R).
883 – MACHINE-GENERATED METADATA PROVENANCE (R).

Unlike for other MARC21 formats, there is no "minimal record level" for CI specified in the official MARC21 documentation, and so there are no "required" fields or subfields as such. However, it is clear that some fields would often be used (e.g. 245 for a service or programme and 110 for an organisation), while others would hardly ever be used (e.g. 010 for an LCCN). In addition to the fields in the CI format, some of the fields in the MARC21 Format for Authority Data are likewise relevant here, as they also represent data elements about entities such as organisations and meetings, including, potentially, those providing community services. Indeed, the MARC21 authority records are, in theory at least, the primary place for information about service providers; the MARC21 CI records describe, primarily, the services themselves. In practice, however, a CI MARC21 database may well contain only records in the CI format, just as a library catalogue may comprise solely bibliographic records, and no authority file.

5. AIRS-MARC mapping

In order to compare the AIRS and MARC21 schemas, a mapping exercise was undertaken, whereby an attempt was made to map each AIRS element onto at least one MARC21 field (a more detailed mapping would drill down to the MARC21 subfields). The AIRS documentation does not explicitly state which of its elements can be repeated, though it does indicate that plural values can be used at least in certain cases (e.g. "E-mail Address(es)"); for the purposes of this exercise, it shall be assumed that repeatability across the two schemas is, or can be, consistent. Table II shows the AIRS-MARC21 mapping. In some cases, there is more than one possible MARC21 field (hence the multiple columns). Where the field number is given in parentheses, this indicates an approximate mapping only. For clarification, in some cases the relevant subfield has been specified using a dollar sign followed by the subfield code.

From Table II, we can see that the MARC21 format covers more or less all the AIRS elements, with only a few elements covered generically, perhaps most notably, Legal Status and IRS Status. The Contact for Updating Purposes does not map perfectly to the MARC21 570 Personnel Note field, as the contact might not be a member of "personnel", though they are likely to be. There are several MARC21 fields that have no equivalent in the AIRS schema, including:

312 – EQUIPMENT AVAILABLE (for use outside of the site).
511 – PARTICIPANT OR PERFORMER NOTE.
536 – FUNDING SOURCE NOTE.
551 – BUDGET NOTE.
571 – VOLUNTEERS NOTE.
572 – AFFILIATION AND OTHER RELATIONSHIPS NOTE.
581 – PUBLICATIONS NOTE.
587 – OTHER INFORMATION AVAILABLE NOTE.

The mapping indicates, therefore, that the MARC21 format covers CI more broadly. It was likewise found that overall the MARC21 format covers CI in more depth, with several of the AIRS elements broken down further into different MARC21 subfields. For example, "Site Description" is covered more specifically by certain subfields in field 311, such as $d (capacity) and $e (equipment available), while "Application/Intake Process" is covered by the additional subfields in field 311 of $e (waiting list) and $f (waiting period). Likewise, a distinction is made in MARC21 between agencies that are organisations and those that are people.

Both schemas, however, exhibited areas of ambiguity. For instance, the AIRS element "AKA Names" may or may not cover former names. Similarly, "Service Group Description" may or may not cover the description of programmes. In MARC21, the name of a meeting could be entered in 111 or 245. This lack of precision reduces the standards' interoperability, and limits their potential application by, for example, Semantic Web technologies (Coyle, 2012).

6. Toward an "FRCI" model

Greater definitional precision, and a framework for the future development of the AIRS and MARC21 standards, could be introduced by means of an entity-relationship data model for CI, similar to the FRBR model adopted by the new bibliographic code, Resource Description and Access (RDA; Joint Steering Committee for Development of RDA, 2013). Accordingly, a "FRCI" (Functional Requirements for CI) model could help identify the elements needed to support the use of CI systems, just as the FRBR model

AIRS element	MARC21 FIELD #1	MARC21 FIELD #2	MARC21 FIELD #3
Agency/main site data elements			
Unique ID number	024 field in linked authority record	(001)	
Record ownership code	003		
Agency name	110 (if an organisation)	100 (if a person)	
AKA (also known as) names	410 field in linked authority record	400 field (if a person) in linked authority record	
Street/physical address	270		
Mailing address	270		
Website(s)/URL(s)	856		
E-mail address(es)	270		
Phone number(s) including extensions, phone types (e.g. Voice, TTY/TDD), and phone functions (administration, intake)	270		
Agency description: a brief narrative describing the agency's main purpose or role	520		
Main site description	311 $a		
Administrative hours/days of operation	307		
Legal status	(500 General note)		
Date of last complete update	501		
Date of last interim modification/partial update	005		
Contact for updating purposes	(570)		
Name and title of the director or administrator	270 $p/q	570	
Federal employer identification number (EIN/FEIN)	(570)		
Year of incorporation	545		
Licenses or accreditations	573		
IRS status	(500 General note)		
Travel information	574		
Physical access	575	007	
Other addresses	270		
Additional sites (locations/branches) data elements			
Unique ID number	024 field in linked authority record	(001 if its own record)	
Site name	110 $b if its own record	111 $e if its own record	303
AKA names (also known as)	410 $b in linked authority record	411 $e in linked authority record	
Street/physical address	270	303	
Mailing address	270		

Table II.
AIRS-MARC21 mapping

(*continued*)

AIRS element	MARC21 FIELD #1	MARC21 FIELD #2	MARC21 FIELD #3
Phone number(s) including extensions, phone types (e.g. Voice, TTY/TDD), and phone functions (administration, intake)	270		
Site description	311		
Travel information	574		
Physical access	007 if its own record	575	
Other addresses	270		
Website(s)/URL(s)	856		
E-mail address(es)	270 $m		
Administrative hours/days of operation	307 if its own record	270 $r	303
Name and title of the site manager	270 $p/q	570	303 $p
Service/service group and service site data elements			
Unique ID number for the service group	024 field in linked authority record	(001 if its own record)	
Unique ID number for the service site	024 field in linked authority record	(001 if its own record)	
Programme name(s) for the service group	245 if its own record	303	111 or 110 $e (if a meeting, etc.)
AKA (also known as) names for programme names	246 if its own record	411 or 410 $e (if a meeting, etc.) in linked authority record	
Service group name	245 if its own record	303	
Service group description	520	505	
Phone number(s) including extensions, phone types (e.g. Voice, TTY/TDD), and phone functions (administration, intake) for specific services in the service group	270		
Eligibility	531 $a		
Target populations	521		
Geographic area served	522	043	
Documents required	531 $d		
Application/intake process	531 $c		
Fee structure	531 $b		
Languages other than English	546	041	
Hours of service	307 if its own record	303	
Taxonomy term(s)	650 (with $2taxhs)	codes in 072 (with $2taxhs)	

Table II.

allows for the identification of data elements needed in bibliographic records (IFLA, 2009). However, FRBR's approach is followed here not merely because it employs a well-established modelling methodology, but also because the functions it identifies for bibliographic data appear to fit closely with the purposes of CI as well, namely, to find, identify, select and obtain (access to) information, or in the case of CI,

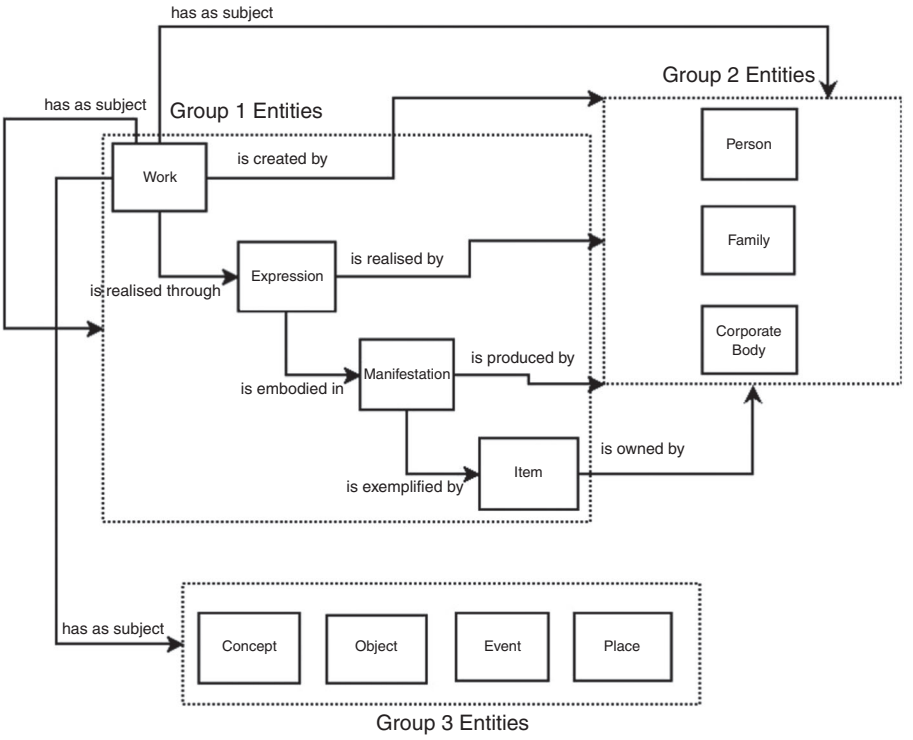
community resources. A full model of CI and its various data elements should be based on such functional requirements. The FRBR approach was, in addition, adopted for practical reasons: many of those involved, or potentially involved, in the design, and maintenance, of CI systems (e.g. public librarians) are already familiar with FRBR and its application to bibliographic systems; likewise many CI systems articulate with bibliographic systems that employ FRBR, through RDA, as an underlying data model.

Although the (original) FRBR model is based on an early version of entity-relationship modelling (principally from Martin, 1982), it can be (and has been) readily embellished by a more contemporary treatment (e.g. via Kroenke and Auer, 2010 or Mannino, 2012). Some of these more advanced considerations (e.g. cardinality) are mentioned below, but it should be emphasised that the model proposed here is intended to be no more than preliminary, and that a similar iterative process that has occurred in the bibliographic field, toward a more sophisticated and detailed model, or set of models, ought to take place among designers of CI systems. It may be that an object-oriented approach to data modelling, as represented by "$FRBR_{OO}$" (International Working Group on FRBR and CIDOC CRM Harmonisation, 2015), is ultimately preferred to the entity-relationship approach, as represented by the original FRBR model. The "sibling" models of FRAD (Functional Requirements for Authority Data; International Federation of Library Associations and Institutions (IFLA), 2013) and (Functional Requirements for Subject Authority Data; International Federation of Library Associations and Institutions (IFLA), 2010) are also acknowledged as potential contributors to a FRCI model, although the FRBR model would seem a better starting point, given the conceptual proximity of information/bibliographic and community resources.

Figure 1 provides a diagrammatic overview of the FRBR model (i.e. FRBR entity-relationship model, as opposed to $FRBR_{OO}$), which includes three groups of entities: the information resources, at four levels of abstraction, i.e. works, expressions, manifestations and items ("WEMI," or group 1); entities that have (potentially) a "responsibility" relationship with information resources, divided into corporate bodies, individuals and families (group 2); and entities with (potentially) a subject relationship with information resources, divided into what might be termed "facets", i.e. concepts, objects, events and places (group 3; group 1 and 2 entities are treated as additional subject facets).

To develop a "FRCI" model, using the (original) FRBR approach, we start by identifying the entities which are, to adopt FRBR's phrase, the ultimate "objects of interest" to CI database users, i.e. the resources that will satisfy their needs. We noted previously the list of resources provided by Pettigrew (1996, p. 351), which itself was derived from previous lists: "human services such as health care, financial assistance, housing, transportation, education and childcare services; as well as information on recreation programmes, clubs, community events, and information about all levels of government." The entities in this list, it is contended, which are usually those of interest, ultimately, to CI users are services, programmes and events. Generally, users want to know less about the "government" *per se*, than about services, programmes and events organised by government agencies. Likewise, it is the programmes of activities organised by "clubs" that are of primary interest to the user.

The CI literature does not consistently distinguish between the concepts of service, programme and event. However, it may be supposed that a community programme or event necessarily offers something of potential interest to members of a community. This is often a service, though not always. People may join in a programme of activities, instead of receiving a service. This alternative reflects the two fundamental aspects of CI highlighted earlier: problem-solving and participation. Of course, "activities" could



Source: www.frbr.org/files/entity-relationships.png

Figure 1.
FRBR group 1, 2 and 3 entities and their relationships

be defined more broadly, to cover the activities involved in the provision of services (e.g. health check-ups), but we shall use it here in a narrower, participatory sense, for want of a better term, so that the distinction between "joining" and "receiving" a community resource is made.

However, while services and activities are considered to be the basic components of community resources, their level of abstraction poses similar problems to that of "work" in the FRBR model. When does a particular service or activity become a different service or activity? When does a service or activity become a group of services or activities? As community services and activities are dependent on those who offer them, it is the organisers who are best placed to answer these questions, and it is here that the concepts of programme and events prove useful, as formal "containers" of services and activities. That is, services and activities are formally offered to communities as programmes and events. Although named "services" and "activities" may sometimes be included as part of a "programme" or "event" in everyday parlance, in the proposed FRCI model they are also regarded as programmes or events, so that programmes and events can have whole-part relationships with each other.

While the terms "programmes" and "events" both tend to be included in lists of community resources, such as Pettigrew's, suggesting a distinction, some instances of community resources can be, and are, referred to as both. A film festival, for example, can be a "programme" of films as well as an "event" spanning a particular period. However, the use of the two terms in ordinary language would suggest that

people can attend an event on just one occasion, but a programme on multiple occasions. For practical considerations, this means that offerings limited to a day or less tend to be thought of as events (not returned to), whereas offerings that extend beyond several weeks tend to be thought of as programmes (not stayed at; some programmes might even extend indefinitely, i.e. they have no planned end). Festivals, including film festivals, often run across several days or weeks, but not many weeks, hence the mixed labelling. (It is possible that increases in online community offerings may challenge this "rule of thumb" in the future). Notwithstanding borderline cases, this distinction between events and programmes, based on single or multiple entries, will be made in our preliminary FRCI model, as offerings that can be attended only once are likely to require different sorts of metadata from those that provide people with multiple opportunities to attend. Programmes and events are thus the entities included in group 1 of the model, equivalent to the "WEMI" entities of FRBR group 1.

There is, however, a further complication around programmes and events. Not only can programmes be part of larger programmes, and events part of larger events, but events can be part of programmes; one might even argue that programmes can be part of events. For example, a programme of particular soccer matches consists of a series of events, while a village fete (event) may include a programme of prize draws at a particular stall that the fete goers can attend on and off throughout an afternoon. The preliminary FRCI model offered here does not annotate relationships between entities in the same group, but the interplay between programmes and events should nevertheless be recognised.

As well as sometimes seeking particular programmes and events, users of CI may sometimes seek particular types of services and activities offered. Thus, for example, the "Healthy Seniors" programme might offer certain health check-ups. The "type" concept is amply represented in Pettigrew's list, as in *health care, financial assistance, housing, transportation, education and childcare* services and *recreation* programmes (my italics). Although programmes and events would not normally be said to be "about" types of services and activities, the relationship is somewhat akin to the subject relationship between group 1 and group 3 entities in the FRBR model, in as much as services and activities are the content of the programmes and events. It is not surprising, therefore, that subject headings and thesauri used in bibliographic databases are often also used to represent (types of) services and activities in CI systems. To incorporate service and activity types into the FRCI model, it is proposed that they are similarly placed in their own group, to represent entities offered by the programme and event group 1 entities. The FRBR group 3 entities, expressing the subject facets of concept, object, place and event (among others), could be specified, perhaps, as attributes of the FRCI group 3 entities (e.g. cancer (object) testing (concept), Margate (place) local history (concept), World War 1 (historical event) commemorations (concept)).

The remaining concepts from the Pettigrew list, namely government and clubs, were noted above: they are agents, or organisers, of community programmes and events, along with various other entities, such as charities, societies, associations, and, in some cases, individuals. These categories tend to overlap, but they may be usefully divided in the same way as the group 2 entities are categorised in the FRBR model, as persons, corporate bodies and families (although not in the FRBR report, "family" has been added as a group 2 entity in later extensions of the model, e.g. in FRAD (IFLA, 2013)). Again, the agency relationship is similar to the relationship between group 1 and group 2 entities in FBBR, which represents "responsibility" (creation of works, production of manifestations, etc.). While corporate bodies, of many different kinds (including governments and clubs), will usually be responsible for organising programmes and

events, even families, as well as individuals, might occasionally host an event or provide a service (e.g. a family may host a reunion for all extended relatives).

All elements of Pettigrew's list of community resources have been covered by these three groups of entities, which are thus considered sufficient for a rudimentary, preliminary model for CI. As it happens, the groups match the FRBR groups exactly in number and quite closely in nature, but it should be stressed that this is a somewhat superficial comparison, and that the attributes of, and relationships between, the entities might differ markedly. All of these need to be identified, as data elements, according to CI's functional requirements. Important relationships will need to be recorded within groups, as well as between groups. As was noted earlier, group 1 entities may have whole-part relationships with each other, while in group 2, persons, for example, may have a particular role in a corporate body. Likewise, relationships between instances of the same entity may be important (referred to as "recursive" relationships in entity-modelling parlance): for example, programmes might succeed earlier programmes, corporate bodies might merge with other corporate bodies, and an activity might be a kind of another activity.

Figure 2 provides an outline of the proposed FRCI model, at a conceptual level, showing the groups of entities and the inter-group relationships by means of the simple notation used in the original FRBR report. A more sophisticated notation could show that these relationships are both many-to-many (instances of group 1 entities may be organised by more than one group 2 entity and offer more than one group 3 entity; conversely, more than one group 1 entity may be organised by an instance of a group 2 entity and offer the same group 3 entity instance); and that the relationships are also optional-to-optional (a group 1 entity need not be associated with any group 2 entity, e.g. if the organiser is unknown, or any group 3 entity, if no particular activity or service is specified, etc.).

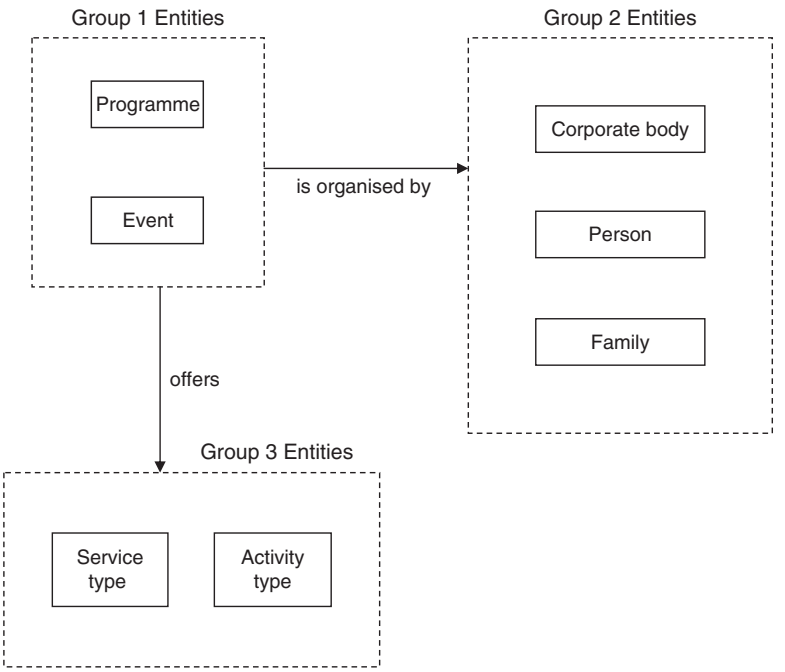


Figure 2.
Proposed FRCI model

While the model might provide for data elements not found in existing CI schemas, we would expect most of the elements in a given schema to be covered by the model. In the case of the AIRS standard, we noted earlier that its elements pertained to, and thus could be considered attributes of, "agency/main site", "additional sites (locations/branches)" and "service/service group and service site". "Agency" here translates to the corporate body entity in the model, while "main site" refers to an agency's main location, which thus can itself be considered an attribute of the agency (just as e.g. "place of publication" is an attribute of publishing corporate bodies in the FRBR model). "Additional sites (locations/branches)" are either more attributes (locations) of the agency, or subordinate units of the agency (branches), i.e. subordinate corporate bodies. "Service" and "service group" map to programme, as they are instances rather than categories, while "service site" would be an attribute (location) of the programme. It would appear, then, that the AIRS elements should translate quite well to the model, but to verify this, another mapping exercise was undertaken.

Table III presents the mapping, with "A" indicating that the element could be considered an attribute of the corresponding entity. Where A is specified together with "(R)," this indicates that an element could be expressed as an attribute of an entity in combination with a specific relationship between the entity and another entity. The mapping confirms the applicability of the model, with just three elements not covered, namely Record Ownership Code, Date of Last Complete Update, and Date of Last Interim Modification/Partial Update, all of which refer to the resource description itself. It also points to possible weaknesses in the AIRS schema, including the stress on programmes at the expense of events, and on services at the expense of (participatory) activities, and on corporate bodies at the expense of individuals.

For the MARC21 format, we noted how it aimed to describe "programmes, services, organisations, single and ongoing events, and individuals." We shall not attempt to map all the fields here (bearing in mind that some of the fields were carried over from other formats with little expectation that they would be much used), but instead translate the foregoing list, as presented in Table IV. Again, the fundamental entities in the MARC21 format appear to be covered adequately by the model. It is also noticeable how the format covers more of the model than does AIRS, reflecting our earlier conclusions about the broader scope of the library standard. The only two FRCI entities not covered in the high-level mapping, namely service type and activity type, are covered (if perhaps imperfectly) by various classification and "subject" MARC21 fields.

The construction of a list of data elements based on the proposed model is outside the scope of this paper, but to complete the approach taken by FRBR, the elements in the existing AIRS schema were mapped to the user tasks of finding, identifying, selecting and obtaining (access to) the programme entity in the FRCI model. (They were not mapped to the event entity given its lack of coverage by the AIRS schema). Those elements considered highly, or at least moderately, useful for supporting the four tasks are identified with an "X" in Table V.

From Table V, we can see that many of the AIRS elements are very useful to CI seekers, and that each of the four proposed basic functions of CI is supported by a range of elements. It also suggests that some elements are considerably more useful than others, as is the case with the RDA elements' support of the FRBR user tasks (Hider and Liu, 2013). Further analysis, utilising both expert opinion and empirical methods, is needed to gauge more precisely the degree to which the AIRS elements, and other elements, are functionally required by users of CI systems.

AIRS element	Programme	Event	Corporate body	Person	Family	Service type	Activity type
Agency/main site data elements							
Unique ID number			A				
Record ownership code							
Agency name			A				
AKA (also known as) names			A				
Street/physical address			A				
Mailing address			A				
Website(s)/URL(s)			A				
E-mail address(es)			A				
Phone number(s) including extensions, phone types (e.g. voice, TTY/TDD), and phone functions (administration, intake)			A				
Agency description: a brief narrative describing the agency's main purpose or role			A				
Main site description			A				
Administrative hours/days of operation			A				
Legal status			A				
Date of last complete update							
Date of last Interim modification/partial update							
Contact for updating purposes			A				
OR			(R)	A			
Name and title of the director or administrator			A				
OR			(R)	A			
Federal employer identification number (EIN/FEIN)			A				
Year of incorporation			A				
Licenses or accreditations			A				
IRS status			A				
Travel information			A				
Physical access			A				
Other addresses			A				
Additional sites (locations/branches) data elements							
Unique ID number			A				
Site name			A				
AKA names (also known as)			A				
Street/physical address			A				
Mailing address			A				
Phone number(s) including extensions, phone types (e.g. Voice, TTY/TDD), and phone functions (administration, intake)			A				

(*continued*)

Table III.
AIRS elements as attributes and relationships

AIRS element	Programme	Event	Corporate body	Person	Family	Service type	Activity type
Site description			A				
Travel information			A				
Physical access			A				
Other addresses			A				
Website(s)/URL(s)			A				
E-mail address(es)			A				
Administrative hours/days of operation			A				
Name and title of the site manager			A				
OR			(R)	A			
Service/service group and service site data elements							
Unique ID number for the service group	A						
Unique ID number for the service site	A						
Programme name(s) for the service group	A						
AKA (also known as) names for programme names	A						
Service group name	A						
Service group description	A						
Phone number(s) including extensions, phone types (e.g. Voice, TTY/TDD), and phone functions (administration, intake) for specific services in the service group	A						
Eligibility	A						
Target populations	A						
Geographic area served	A						
Documents required	A						
Application/intake process	A						
Fee structure	A						
Languages other than English	A						
Hours of service	A						
Taxonomy term(s)						A	A

Table III.

MARC21 entity	FRCI entity
Programme	Programme
Service	Programme
Organisation	Corporate body
Single event	Event
Ongoing event	Programme
Individual	Person

Table IV.
MARC21-FRCI entity mapping

AIRS element	Finding	Identifying	Selecting	Obtaining
Agency/main site data elements				
Unique ID number				
Record ownership code				
Agency name	X	X	X	
AKA (also known as) names	X	X	X	
Street/physical address			X	X
Mailing address				X
Website(s)/URL(s)			X	X
E-mail address(es)				X
Phone number(s) including extensions, phone types (e.g. Voice, TTY/TDD), and phone functions (administration, intake)				X
Agency description: a brief narrative describing the agency's main purpose or role			X	
Main site description			X	
Administrative hours/days of operation			X	X
Legal status				
Date of last complete update				
Date of last interim modification/partial update				
Contact for updating purposes				
Name and title of the director or administrator				
Federal employer identification number (EIN/FEIN)				
Year of incorporation				
Licenses or accreditations			X	
IRS status				
Travel information			X	X
Physical access			X	
Other addresses				
Additional sited(location/branches) data elements				
Unique ID number				
Site name	X	X		
AKA names (also known as)	X	X		
Street/physical address			X	X
Mailing address				X
Phone number(s) including extensions, phone types (e.g. Voice, TTY/TDD), and phone functions (administration, intake)				X
Site description			X	
Travel information			X	X
Physical access			X	
Other addresses				
Website(s)/URL(s)			X	X
E-mail address(es)				X
Administrative hours/days of operation			X	X
Name and title of the site manager				
Service/service group and service site data elements				
Unique ID number for the service group				
Unique ID number for the service site				
Programme name(s) for the service group	X	X	X	X

(*continued*)

Table V.
AIRS elements and user tasks

AIRS element	Finding	Identifying	Selecting	Obtaining
AKA (also known as) names for programme names	X	X	X	X
Service group name			X	
Service group description			X	
Phone number(s) including extensions, phone types (e.g. Voice, TTY/TDD), and phone functions (administration, intake) for specific services in the service group				X
Eligibility			X	
Target populations			X	
Geographic area served	X		X	
Documents required				X
Application/intake process				X
Fee structure			X	
Languages other than English			X	
Hours of service			X	X
Taxonomy term(s)	X		X	

Table V.

7. Conclusions

The AIRS and MARC21 data structures for CI converge to a fair degree, with the latter providing for additional detail in several areas. However, neither structure is systematically defined, with the boundaries of certain elements being unclear. To address this, an entity-relationship data model for CI is proposed, in which data elements are defined as attributes of, and relationships between, particular fundamental entities. This model could be used as the basis to rigorously determine, and define, the elements needed to support the finding, identifying, selecting and obtaining access to community resources, that is, the functional requirements for CI. Logical and empirical analysis may reveal elements not explicitly included in either the AIRS or MARC21 standard; in any case, the analysis would produce a schema that would, potentially, better support Linked Data and would be more amenable to Semantic Web applications, in the same way that the RDA elements sets can (Coyle, 2014; Howarth, 2013).

A root-and-branch review of CI data standards would be particularly timely given the Bibliographic Framework Transition Initiative (www.loc.gov/bibframe) currently being undertaken by the Library of Congress. Although the Initiative focusses on bibliographic data, it looks set to lead to the overhaul of the MARC21 standard more broadly. While this might threaten the future of the MARC21 Format for CI, it would also represent an opportunity for CI providers to establish a new schema that helps connect people to services more effectively.

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