ISSN: Transitioning to linked data

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ISSN: Transitioning to linked data

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Abstract:

ISSN numbers reliably identify all types of continuing resources worldwide: in 2007, the scope of the standard, originally limited to serials, was extended so as to also include ongoing integrating resources. Bibliographic records describing resources identified by an ISSN are produced by ISSN national centres – there are also in charge of their updates. ISSN records are regularly sent to the ISSN Register, a bibliographic database which currently contains more than 1.9 million records. The Register is maintained by the ISSN International Centre, which is also in charge of providing access to its bibliographic information through innovative tools and services.
The ISSN International Centre sees linked data principles and tools as a prominent way to distribute information from its own Register; and more generally bibliographic information about continuing resources. It seeks also to harness the tremendous opportunities of re-using data from other organizations, belonging or not to the library world, in order to enhance its knowledge on its own data, and to propose better services.
The ISSN International Centre has therefore launched several projects related to that domain. On one hand, it has participated to the development of $PRESS_{OO}$, an extension of the $FRBR_{OO}$ ontology for continuing resources. On the other hand, it has launched ROAD, the Registry of Open Access Resources, which disseminates bibliographic information on open access publications in the web of data.
These two experiments have helped the ISSN International Centre to start setting up its linked data policy – or policies: various data models will be designed to fit the needs of the different users; different services and tools will be provided to free users and to customers of the ISSN Portal.

Keywords: ISSN, Linked Open Data, Serials, $FRBR_{OO}$, $PRESS_{OO}$

1 THE ISSN: AN IDENTIFIER FOR CONTINUING RESOURCES

The ISSN standard, first established in 1975 as ISO 3297, is one of the oldest and most widely used identifier systems in the bibliographic domain. ISSN numbers reliably identify all types of continuing resources worldwide: in 2007, its scope, originally limited to serials, was extended so as to also include ongoing integrating resources. Therefore, not only periodicals and monographic series, but also blogs, databases or websites are eligible for ISSN numbering[1].

ISSN are assigned to continuing resources, irrespective of their medium, print or digital – a new ISSN is required for each different version. There is no distinction regarding the status of the publication: current or ceased resources are eligible as well. The scope of ISSN is very large because its very essence is to link resources: for example, the different medium versions of the same title, the predecessors and the successors of a publication over time. These relationships are stated in the ISSN record.

When a continuing resource is registered, several tasks have to be carried out: assigning a number to the resource, establishing a unique key title[2], and producing a bibliographic record. This record provides on one hand descriptive information such as the name of the publisher, the publication dates, a classification of the content… And it may contain on the other hand a wealth of links between resources: besides those already mentioned, there are the links to other language editions, to local editions (especially for newspapers), to special editions or issues, etc.

ISSN may be assigned upon request from publishers, as part of legal deposit duties, or upon request from third-parties (libraries, digitization agencies…). The assignment process is carried out by ISSN national centres in their respective countries. There is a network of eighty-nine national centres, one per country[3]. These centres are generally hosted in national libraries, academic libraries or book chambers. They are in charge of initial cataloguing but also of the regular updates, whenever necessary, of the ISSN record. From the bibliographic and organizational points of view, the network of national centres is coordinated by the ISSN International Centre[4].

ISSN records newly produced or updated by national centres are regularly sent to the ISSN Register. This bibliographic database currently contains more than 1.9 million ISSN records, with an increase of around 75 000 new records per year. The Register is maintained by the ISSN International Centre, which is also in charge of providing access to its bibliographic information through innovative tools and services. There are presently several ways to access ISSN Register:

[1] For blogs, websites and databases, the scope of ISSN assignment has been restricted to scholarly resources, or at least resources presenting a strong editorial content – as judged by the assigning institution. This restriction of scope has been decided because comprehensive registration of all online continuing resources wasn't an achievable goal. For inclusion and exclusion criteria, see *ISSN Manual*, January 2015, section 0.3.2: http://www.issn.org/wp-content/uploads/2013/09/ISSNManual_ENG2015_23-01-2015.pdf.

[2] The key-title, the other identifier of a continuing resource, is similar to the title proper of the resource when it is unique in the Register. Otherwise, the key-title is composed by the title proper and qualifiers to make it unique. See *ibid.*, section 2.

[3] Countries without national centres are covered by the ISSN International Centre, which is also responsible for the assignment of ISSN to resources published by international organizations.

[4] The ISSN International Centre, or CIEPS, is an intergovernmental organization established in 1975 by a treaty between UNESCO and the French government. It is located in Paris.

- through the “Virtua” cataloguing software, only for professionals working within national centres[5];
- by a search on the “ISSN Portal”;
- by retrieving the “datafile” (i.e. a bulk download of the Register) and its annual updates;
- through other tailored services, e.g. OAI-PMH.

Except for national centres, the access is restricted to customers paying a fee to the ISSN International Centre.

As an organization in charge of providing bibliographic information, the ISSN International Centre has shown a great interest in the recent development of linked data technologies. It is now demonstrated that these technologies will have a critical importance for the discovery, retrieval, exchange and even automated generation of metadata. Several libraries, including many members of the ISSN Network, have played a pioneering role in the experimentation with linked data based tools and services, while they were at the same time publishing datasets in the web of data.

The ISSN International Centre sees linked data principles and tools as a prominent way to distribute information from its own Register; and more generally bibliographic information about continuing resources. It seeks also to harness the tremendous opportunities of re-using data from other organizations in order to enhance its knowledge on its own data, and to propose better services. However, the linked data policy of the ISSN International Centre – still under definition – needs to be closely related to the overall ISSN strategy; as it will need a resolute support from the ISSN network and will have strong impacts on its business model. We propose to present the past achievements of the ISSN International Centre and the ISSN network as a whole in that domain; its current objectives and projects, and the tools it intends to develop to reach its goals.

2 FIRST ISSN INTERNATIONAL CENTRE EXPERIMENTS TOWARDS LINKED DATA

The ISSN International Centre has quickly recognized, in linked data principles and objectives, the same motivations that resulted in the creation of the ISSN system forty years ago: the need to support the discovery, acquisition and exchange of content:

- through unique, universal and trusted identifiers;
- by establishing links between resources;
- by providing, at the same place, access to the identifier of the resources and metadata about the resources.

The ISSN International Centre, and the ISSN Network as a whole, started first to work on data modelling issues. It has a long-standing mission of representing the “voice” of continuing resources within bibliographic standardisation bodies. It is notably active in the IFLA Cataloguing section and has established formal relationships with the ISBD review group, the FRBR review group, and with the RDA Steering Committee (formerly Joint Steering Committee for RDA)[6].

[5] Virtua is a library software developed by Innovative Interfaces Inc. See https://iii.com/products/vtls-virtua.

[6] See for example the “Protocol between the RSC and the ISSN International Centre”, revised in January 2016: http://www.rda-rsc.org/RSC/Chair/13.

Continuing resources present indeed modelling challenges, especially as the high-level international model for bibliographic resources, FRBR (or "$FRBR_{ER}$"[7]), does not fit well with their specific nature. These problems were notably stated during a harmonization meeting held between representatives of ISBD, RDA and ISSN in 2011[8]. The three parties agreed that the hierarchical aspect of the Work/Expression/Manifestation relationships, in $FRBR_{ER}$, is conflicting with the dynamic character of continuing resources. For example, an "expression" of a specific serial work (e.g. a variant linguistic edition of a newspaper) may suddenly become a new "work" (if it starts publishing content that is not available in the edition in the original language). The same entity being successively an expression and a work is not conceivable in $FRBR_{ER}$; but it frequently happens to be true for continuing resources…

Application of FRBR to these kinds of resources needed therefore to be investigated again. It quickly appeared that $FRBR_{OO}$, the object-oriented version of FRBR, could provide a solution[9]. $FRBR_{OO}$[10], which was approved in June 2009, is an extension of the CIDOC Conceptual Reference Model (CIDOC CRM[11]). As an event-based model, it was better able to express the changing nature of serials and integrating resources. And as an object-oriented model, it offered a wealth of classes and properties for modelling seriality.

A working group was set up at the end of 2012, with representatives of the ISSN International Centre and the Bibliothèque nationale de France, with the support from experts of other national centres, to work on the extension of $FRBR_{OO}$ to serials and integrating resources. The working Group started in January 2013 to draft $PRESS_{OO}$, "a formal ontology intended to capture and represent the underlying semantics of bibliographic information about continuing resources[12]". The version 1.0, endorsed by the IFLA FRBR Review Group, was released in June 2014. It was been submitted to a world-wide review for an endorsement by IFLA cataloguing section. The current version, the 1.2, has just been submitted to the Committee on Standards so as to be released as an official IFLA standard.

The work performed for many years by the ISSN Network, and expressed in the ISSN Manual, greatly supported the construction of $PRESS_{OO}$. Each information, each metadata field of the ISSN Manual was reviewed to be mapped into CIDOC CRM and $FRBR_{OO}$ classes or properties; whenever it was not possible, specific classes or properties of $PRESS_{OO}$ were declared. $PRESS_{OO}$ is therefore able to finely describe the specific characteristics of continuing resources (frequency, medium...), but also the changes that affect them over time (continuations, absorptions, splits...) and the relationships they may have with other continuing resources (other linguistic editions, local editions...).

$PRESS_{OO}$ may appear as a complex ontology. On one hand, it inherits its complexity from the CIDOC-CRM, which deals with a huge domain – the whole range of cultural

[7] $FRBR_{ER}$ or "FRBR Entity-relationships" is the original version of FRBR, as defined by the *Functional Requirements for Bibliographic Records. Final report*, published in 1998 and revised in 2009. See http://www.ifla.org/files/assets/cataloguing/frbr/frbr_2008.pdf.

[8] See Joint Steering Committee for Development of RDA, IFLA ISBD Review Group, ISSN Network, "JSC/ISBDRG/ISSN Outcomes", 3-4 November 2011, Glasgow (UK): http://www.ifla.org/files/assets/cataloguing/isbdrg/JSC_ISBD_ISSN_Outcomesfinal.pdf.

[9] Le Bœuf, Patrick and Pelegrin, François-Xavier, "FRBR and serials: the $PRESS_{OO}$ model". Paper presented at: IFLA WLIC 2014 – Lyon – Libraries, Citizens, Societies: Confluence for Knowledge in Session 86 – Cataloguing with Bibliography, Classification & Indexing and UNIMARC Strategic Programme. In: IFLA WLIC 2014, 16-22 August 2014, Lyon, France: http://library.ifla.org/838/.

[10] See the *FRBR, object-oriented definition*, version 2.2., March 2015: http://www.ifla.org/files/assets/cataloguing/frbr/frbroo_v2.2.pdf.

[11] On CIDOC CRM, see http://www.cidoc-crm.org/.

[12] See *$PRESS_{OO}$. Extension of CIDOC CRM and $FRBR_{OO}$ for the modelling of bibliographic information pertaining to continuing resources*, version 1.2, January 2016, "Introduction", p. 8: http://www.ifla.org/files/assets/cataloguing/PRESSoo/pressoo_v1.2.pdf.

heritage. This complexity comes also from the ambition of $FRBR_{OO}$: offering a model able to describe any situation occurring in the bibliographic domain, whereas $FRBR_{ER}$ cannot always cover all cases. However, this complexity should be viewed as a strength: the richness of this model offers many usage opportunities.

First, $PRESS_{OO}$ should be considered as a high-level standard against which more practical rules dealing with continuing resources (e.g. cataloguing rules) could be assessed. For example, the RDA working group on Aggregates, whose mandate is to review the bibliographic treatment of every type of aggregates (augmentations, anthologies, collections, serials, etc.) intends to compare RDA and $PRESS_{OO}$[13].

Second, as $PRESS_{OO}$ has been built from the list of bibliographic information of the ISSN Manual, it provides a complete set of classes and properties that may be used in conjunction with other bibliographic ontologies to describe continuing resources. $PRESS_{OO}$ is even very flexible, as it offers a choice between an object-centric and an event-centric modelling. For example, if one wants to state that resource "B" comes from the split of resource "A":

- adopting an object-centric modelling, it will consider the split as a property relating two instances of the "serial work" class:
    - F18 Serial Work {instance A} *Y32 was split into* F18 Serial Work {instance B};
- adopting an event-centric description, it will focus on the split event itself (an instance of the class "Serial Transformation"):
    - F18 Serial Work {instance A} *Y5 was split through* Z1 Serial Transformation *Y6 initiated* F18 Serial Work {instance B}.

The former solution represents a shortcut of the latter.

Finally, $PRESS_{OO}$ may be used, in conjunction with CIDOC-CRM and $FRBR_{OO}$, as the main ontology to publish a linked dataset. This kind of implementation provides all solutions to finely express any kind of bibliographic information that is considered worthy of publication. However, even in that case, there are several implementation choices; and shortcuts may sometimes be deemed necessary to simplify the model.

An opportunity to implement $PRESS_{OO}$ was offered when the ISSN International Centre, with the support of UNESCO, developed ROAD, the Directory of Open Access scholarly Resources. This service, launched in December 2013, provides a free access to a subset of the ISSN Register: all the bibliographic records which describe the scholarly resources in open access, worldwide and in all disciplines. This subset presently gathers around 15,000 bibliographic records. A broad range of continuing resources are covered: journals, conference proceedings, monographic series, academic repositories and scholarly blogs. ROAD innovative concept is that ISSN bibliographic records are enhanced with external information aggregated from data sources such as indexing and abstracting services, journal indicators and registries.

For example, ROAD is able, for each resource it indexes, to provide its impact factor, as calculated by SCOPUS[14]. It can at the same time indicate if it is referenced in the DOAJ[15]

[13] See the "Terms of reference for the RSC Aggregates Working Group", January 2016: http://www.rda-rsc.org/sites/all/files/RSC-Chair-9.pdf; and "RDA and $FRBR_{OO}$ treatment of aggregates", August 2015: http://www.rda-jsc.org/sites/all/files/6JSC-AggregatesWG-1.pdf.

[14] Currently, two impact factors are provided: SNIP (Source Normalized Impact per Paper) and SJR (SCImago Journals and country Rank). SCOPUS is one of the largest citation database of peer-reviewed literature. See http://road.issn.org/en/contenu/scopus, http://road.issn.org/en/contenu/snip and http://road.issn.org/en/contenu/sjr.

or if it is preserved in one or several long-term repositories (through cross-checks with the Keepers registry[16]). The objectives of ROAD are indeed to help scholars and research organizations not only to discover open access resources on a specific topic, but also to assess them, thanks to the compilation of various information sources. This cross-checking is made possible by the common use of the ISSN by all partners providing source data.

In that sense, the development of ROAD represented for the ISSN International Centre a chance to experiment out how to use ISSN to link information from various databases. But ROAD was also an opportunity to test the use of linked data on the publishing side. ROAD information is provided as linked open data. First, each record corresponds to a single webpage. This webpage is uniquely identified by a URL containing its ISSN number, following the model "http://road.issn.org/issn/[ISSN-NUMBER][17]". Its HTML code embeds bibliographic information encoded as Microdata, following the schema.org ontology. Second, the whole ROAD dump is downloadable. Two formats are proposed: MARC XML (the XML equivalent of the original MARC21 record), or RDF/XML.

The RDF/XML serialization is based on CIDOC-CRM, $FRBR_{OO}$ and $PRESS_{OO}$ ontologies. In that serialization, each continuing resource, identified by its URI (corresponding to the URL of the ROAD webpage), is an instance of the "F18 serial work" class. Various classes and properties from the above ontologies are used to describe the characteristics of each resource.

However, a dedicated ontology, specific to ROAD, was also designed to override some complexities inherent to the $PRESS_{OO}$ model. For example, $FRBR_{OO}$ frequently relies on the "subtyping" of properties. Many features of a continuing resource (medium, frequency…) are declared in $PRESS_{OO}$ as subtypes of the property "Y20 Foresees type". As sub-properties do not exist in RDF, these sub-properties needed to be declared as full properties in the ROAD ontology (for example, http://road.issn.org/ontology/frequency or http://road.issn.org/ontology/physicalMedium).

The drafting of the ROAD ontology is one of the outcomes of the ROAD project in terms of linked data experimentation – even though this ontology may be ultimately superseded by the "expert" ISSN model that should be developed by the ISSN International Centre (see below). This example, among others, demonstrate that the lessons learned through that project will be precious for the future ISSN International Centre achievements in the field of linked data.

3 DEFINING LINKED DATA POLICY(IES)

In the recent years, there has been within ISO a tremendous activity of creation of new standard identifiers, or revision of older ones. We may mention, for the single year 2012, the standardisation of the Digital Object Identifier system (standard version of the already existing DOI[18]) or the International Standard Name Identifier (ISNI[19]), for "public entities of parties", i.e. physical or moral persons. Besides, other unique identifier systems, outside of the ISO sphere, gained momentum, such as the Archival Resource Key (ARK)[20].

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[15] The DOAJ is Directory of Open Access Journals the See http://road.issn.org/en/contenu/doaj and https://doaj.org/.

[16] See http://road.issn.org/en/contenu/keepers-registry and http://thekeepers.org/registry.asp.

[17] Alternatively, the pattern "http://road.issn.org/issn/[ISSN-NUMBER-KEY-TITLE]" can be used.

[18] *ISO 26324:2012 Information and documentation -- Digital object identifier system*, May 2012: http://www.iso.org/iso/home/store/catalogue_tc/catalogue_detail.htm?csnumber=43506.

[19] ISO 27729:2012. Information and documentation -- International standard name identifier (ISNI), March 2012: http://www.iso.org/iso/home/store/catalogue_tc/catalogue_detail.htm?csnumber=44292.

[20] On ARK, see https://wiki.ucop.edu/display/Curation/ARK.

This growing interest for identifiers is to be related with the emerging popularity of linked data. Associated with a namespace, standard identifiers may be used as URIs of resources. However, to be used in the linked open data, not only identifiers, but also information about identifiers, should be freely accessible. Moreover, it is critical that these URIs originate from an authoritative source which ensures their uniqueness, their persistence and their reliability.

A strategic objective of the ISSN International Centre, and of the ISSN Network as a whole, is to promote the ISSN number as one of the reference identifiers in the web of data. The ISSN International Centre should however make a difference between its linked data and linked *open* data policies. As stated above, the access to most data and services of the ISSN International Centre (apart from ROAD) is subject to payment of fees. Providing a free consultation of the whole ISSN Register would therefore prevent the ability of the ISSN International Centre to continue developing new services and tools. ISSN International Centre needs therefore to draw a clear line between what should be released as freely accessible and reusable data (e.g. under a Creative Common license), i.e. linked open data; and what should be proposed to customers or partners under linked data formats.

The linked open data policy of the ISSN, on one hand, intends to make it possible, legally as well as technically, for every person or organization that produces, publishes or retrieves information in the web of data, to use the ISSN as the reference identifier of continuing resources. This encompasses two aspects:

- offering reliable ways to find the ISSN of a resource ;
- providing, for each ISSN, essential metadata elements that allow its precise and reliable identification. The list of these “essential” metadata elements is still to be defined by the ISSN International Centre.

The metadata should be delivered to human or machines thanks to a simple request based on the URI corresponding to the ISSN number of the resource, on ISSN International Centre namespace.

The linked data policy of the ISSN, on the other hand, acknowledges the importance of drawing links between records of continuing resources: within the Register itself and between Register records and external data. It covers also the exploitation of these links to enrich information provided by the ISSN International Centre. Its ultimate objective is to dramatically enhance the possibilities of reusing this information by publishing it in linked data formats.

- It should be, once again, stated that ISSN information is already highly interlinked. In fact, most of the value of the ISSN Register already comes from the precise recording of relationships between continuing resources: links between former and successor titles; between sources and results of splits and mergers; between main edition, special editions, geographical or language editions, etc.

  Since 1975, the recording of relationships has been mainly performed individually, by cataloguers. In order to publish the ISSN Register information as linked data, however, some automated quality improvements processes could be achieved: for example, automatically check, and potentially correct, the consistency of relationships between resources (e.g. a former/successor title relationship should be bidirectional).

- Additional links may be ingested in the Register. For example, ISSN International Centre is a member of ISNI: as such, it is able to submit to the ISNI database the names of the issuing bodies that bear an intellectual responsibility on any continuing resources. The

ISNIs of these issuing bodies should be assigned by the ISNI database and retrieved by the ISSN International Centre to enrich the Register. The ISSN Register already contains ISNI numbers, coming from some national centres. The ISSN International Centre should now work on ISNI assignment for the resources under its own responsibility.

- The ISSN International Centre could also use the links available in the Register to retrieve external information in order to enhance its knowledge on continuing resources. A more complete knowledge would allow for better services. This is the way ROAD is currently working: the records of Open Access resources available in the Register are exported to a dedicated database, where they are enriched with data coming from partners (DOAJ, Keepers, etc.): the ISSN number is used as the matching key. ROAD can thus provide enriched information to its end-users.
  This model could be extended to the whole Register: additional classifications, coming for example from national libraries, could be added to enhance individual records; geospatial coordinates could be associated to places of publication… As for ROAD, it would probably be preferable to perform this matching and enrichment in an external database.

- Finally, original or enriched information should be made accessible to users – free users or customers – on linked data formats. To that end, it will be necessary to define several data models. The ISSN International Centre considers working on three different models:
  - A "light" model would correspond to essential information provided as linked open data. As this information would be encoded within the webpage (using RDFa or Microdata), schema.org would probably be used as the basis ontology.
  - A "full" model would provide all information fields from the Register – plus potentially external information. This model would be intended to facilitate re-utilisation of ISSN data. Therefore, it should be easy to understand and should be based on simple and popular ontologies (e.g. schema.org, dcterms, FOAF). To express the specificities of periodicals, additional classes and properties may be reused from more specialized ontologies: $PRESS_{OO}$, obviously, but also ontologies originating from the library world (for example Bibframe, UNIMARC elements in linked data…). However, this model may be lossy on some aspects. It may notably be difficult to express the context of the record production – knowing when a record has been created, and by whom, is important to understand which cataloguing rules have been used. Knowing this context may be a requirement for libraries reusing ISSN data.
  - An "expert" model would therefore be defined, based on CIDOC-CRM, $FRBR_{OO}$ and $PRESS_{OO}$, from the experience of the ROAD project. This model would be able to render the full semantic meaning of ISSN records; however, it would require from the end-users a good understanding of the bibliographic data model.

  The ISSN International Centre also intends to publish, as SKOS ontologies, the list of codes specific to ISSN records, for example the codes identifying national centres responsible for the production of a record.

The linked data policies of the ISSN are still under discussion. They have to be defined through a dialogue between the ISSN International Centre, its governing bodies, and the

network of national centres. They have notably been debated at the 40th Meeting of Directors of national centres (Belgrade, October 2015) and the 21st General Assembly of the ISSN (Paris, April 2016) – and future events of the ISSN Network will represent occasions to further determine them.

4 IMPLEMENTATION PROJECTS

These linked data policies will be implemented through the development of tools and services that are part of a general rebuild of the technical architecture of the ISSN International Centre. The current ISSN architecture is rather monolithic, in the sense that a single software – Virtua – is responsible for most functions, from cataloguing to access. ROAD, the most recent development of the ISSN International Centre, is on the other hand a fully different software application.

The ISSN International Centre intends to enhance or redevelop the different parts of its processing workflow. Its objective is to set up a modular architecture, where the main components of the system would be independent and loosely-coupled. Transparent exchanges of data would be performed between components by using APIs (notably REST interfaces). For the sake of modularity, but also technical independence, open source tools should be favoured.

On the access side, the goal of the ISSN International Centre is to release a web portal that would act as a single point of access to all ISSN records. The design and ergonomics of this portal could be inspired by ROAD. According to the consultation context (free or paid-for access, type of requested information), it will propose different services and display different types of data.

- Search and discovery should represent a fundamental component of the portal. A search facility from the Portal should be provided. Individual users consulting the freely accessible part should therefore be offered a “look-up service” with limited search fields. Customers of the portal should have extended possibilities to access all search fields, and the full Register information.
  Besides, the webpages of the free Portal should be indexed by web search engines.
- Besides, several data download services should be proposed. For the freely accessible part, machines should be able to automatically retrieve “essential information” either through the Portal API, or by extracting information from HTML webpages.
  Portal customers would have the possibility to extract either individual records, the sets of records corresponding to specific search criteria, or records corresponding to a list of ISSN. As for today, the possibility of bulk downloads of the database could be offered.
  Data could be available in linked data formats, following the different models presented above, but also as UNIMARC, MARC21 or MARCXML.

On the production side, the ISSN International Centre should experiment the possibility to set up a data computing platform that would ultimately provide information to the ISSN portal. This platform would contain all Register metadata and would enrich it with information coming from external sources, for example:

- national libraries or international consortia (for subject classification, authority records);
- publishers;

- other information providers in the linked open data (wikidata, geonames, etc.).

Ultimately, information supplied by ROAD partners (e.g. ranking of resources in DOAJ, SCOPUS, etc.) should also be ingested in that database. As a matter of fact, when the Portal will be mature enough, ROAD should cease to be an independent service and software application and should be integrated in the ISSN portal – maybe keeping its specific graphical layout. Complete ROAD information should continue to be freely accessible to anyone: it would demonstrate, to users of the free portal, the wealth of ISSN Register records.

The ISSN Portal is therefore less a project in itself, than a series of projects which needs to be progressively developed according to a common data production and publishing strategy. Development priorities should be established not only between the different components of the Portal, but also between the different modules of the general IT system. Flexibility in the project(s) management is therefore a requirement; this is the reason why it will be carried out following agile methodologies. Agility is also critical to be able to adapt to the evolution of technologies or user requirements. To identify them, the ISSN International Centre will strive to set up, for its linked data tools and services, an expert user group. Its role will be to provide advice and recommendations on expected functionalities and on underlying technologies that should be used.

5 CONCLUSION: ENSURING A SUSTAINABLE TRANSITION

When developing and releasing a new offer of data and services, the ISSN International Centre will need to accommodate many requirements that may somehow appear contradictory: provide accurate and sufficient information to make the ISSN a reference identifier for continuing resources in the linked open data; set up the technical infrastructure to allow for automated, machine-to-machine, metadata retrieval; while ensuring the sustainability of its own business model. There are also contradictions from the data modelling point of view: on the one hand, information should be distributed through models easy to understand, in order to facilitate usage by a wide community of stakeholders, especially out of the library domain. On the other hand, the ontologies adopted should be rich and detailed enough to express the full semantic meaning of the ISSN Register. The ISSN International Centre needs therefore to define policies which build on the conviction that linked data principles and technologies are decisive to unleash the wealth of the ISSN Register; but which consider with great concern sustainability issues. These challenges should be faced in order to let the ISSN International Centre remain, in the long run, a trusted provider of complete, accurate, reliable and authoritative data.