European Journal of Taxonomy: assessment of an open, collaborative project

Natacha Beau[1,2,*] & Laurence Bénichou[3]

[1]Botanic Garden Meise, Nieuwelaan 38, 1860 Meise, Belgium
[2]Fédération Wallonie-Bruxelles, rue Antoine Lavallée 1, 1080 Bruxelles, Belgium
[3]Publications scientifiques du Muséum, CP41 - Direv, 57 rue Cuvier, 75231 PARIS cedex 05, France
*Corresponding author: natacha.beau@br.fgov.be

Abstract
Natural History Institutions (NHI) have played for centuries a major role in dissemination of scientific information, including publication of names and taxonomic descriptions of organisms that are new to science. However, these institutions are facing numerous strategic and technical challenges as the field of scholarly publishing evolves rapidly towards new models. *European Journal of Taxonomy* (*EJT*) was launched in 2011 by a consortium of NHI to tackle these challenges and offer enhanced visibility and usability of taxonomic contributions as well as a coordinated strategy to retain control over editorial policies, publishing tools and standards. The project was built upon an innovative business model, with the use of Creative Commons License for the published content, open source software OJS as publication platform and "diamond" Open Access model, where neither authors nor readers pay fees. In this framework, main objectives of the *EJT* consortium were (1) to establish an innovative, transdisciplinary journal; (2) to integrate openness initiatives and new technologies in the content production; and (3) to set up a solid team able to reclaim expertise and tools in scholarly publishing. This paper aims to provide a first assessment of the project, to show the issues that the *EJT* team had to face, how they were addressed, how the project evolved throughout the years, and finally consider the journal's future. Doing so, we will examine the underlying assumptions we had at the beginning of the project about the challenge of a multilingual team, standardisation, IT expertise, open access and citability, and transdisciplinarity.

Keywords
Open Access; Scholarly Publishing; Collaborative Project.

INTRODUCTION

Natural History Institutions (NHI) have a core mission to facilitate the understanding of our natural world through biological collection inventories and conservation of our biodiversity heritage, to carry out scientific research on the natural history collections and to disseminate results within the scientific community and to the general public.

The discovery of organisms new to science is a key aspect of the scientific research in NHI. Taxonomy (naming of new organisms) and systematics (their classification) are fundamental and essential to further research. How can one discuss the role of an insect in an ecosystem if one does not know which insect is the subject of the study? To avoid having multiple names for the same organism, the scientific community adopted a standard classification and a set of protocols to name and describe them since the 18th century. These standards were improved over the years, where common rules were legitimated in codes of practices, including the *International Code of Zoological Nomenclature* (ICZN 2000 and amendments) and

the *International Code of Nomenclature for algae, fungi and plants* (ICN, also called the Melbourne Code, see McNeill *et al.* 2012).

Dissemination of scientific findings is one of the main objectives for NHI. Most NHI have a long tradition of publishing, often producing institutional series and journal. As scholarly publishing evolved to integrate new technologies, NHI had to face complex issues related to access and visibility of their titles, sustainability of their business models and the integration of new technologies within workflows and content management. Keeping up with rapid technological developments and renewed requirements by scientific users has been a major challenge for NHI. An appropriate solution to these rapid changes relies, in our opinion, on a common vision and an aggregation of resources to develop and maintain a coordinated strategy for the publication of taxonomic results.

In 2008, the European Distributed Institute of Taxonomy (EDIT) research network appointed a group of 6 publishing experts from several NHI to address these complex issues. The group has worked, since June 2009, to propose a joint journal that provides open access to taxonomic publications where key developments have been embraced (Bénichou & Duin 2009, 2010). In 2011, 6 NHI formed a consortium and launched the *European Journal of Taxonomy* (*EJT*) to break the professional isolation of staff involved in publishing within their institutions. The project received much support from the taxonomic community, particularly through its integration into the Consortium of European Taxonomic Facilities (CETAF; see http://www.cetaf.org/taxonomy/publications).

Since then (as of July 15th 2015), *EJT* has published 128 taxonomic papers, comprising 4093 pages; 510 taxa new to science were named, described and published, accounting for approximately 127 new taxa per year. *EJT* receives around 50 new manuscripts each year, and the average acceptance rate is 80%. Average delay between submission of manuscript and publication is 5 months.

In the light of publishing criteria, *EJT* proves to be successful: not only does the journal publish papers in all disciplines from its scope, but the editorial office received in January 2015 a letter from Thomson Reuters which selected *EJT* for coverage in its products and databases. Moreover, in June 2015 the journal was awarded its first Impact Factor (Thomson Reuters 2015) with a score of 1.312, which is significantly higher than many well-known taxonomic journals in the same category (zoology).
In this paper we will examine the journal's achievements with respect to the objectives put forward at the beginning of the project, which were to: (1) establish an innovative, transdisciplinary journal; (2) integrate openness initiatives and new technologies in the content production; and, (3) set up a solid team able to reclaim expertise and tools in scholarly publishing.

CHALLENGE OF A JOURNAL WITH A BROAD SCOPE

1°) Multiplicity of small journals *versus* pooling resources

Traditionally, the publishing model followed by many European NHI was institution-centred, where each institution produced its own "small" journal whose scope was limited to the main taxonomic focus of the institution. Some institutions covering all natural history fields split their journal into different series representing different domains: botany, zoology, entomology and palaeontology.

All these journals have a strong tradition of providing their library with free copies to sustain their exchange programs. As a result of these programs, libraries could acquire, through exchange, taxonomic publications published in their field and fulfil its mission to provide their researchers with needed

literature.

Most of the journals are published in print format; when an online version exists, its dissemination to a large audience is often correlated to the technical capacities or budget of the institution itself (e.g. outsourcing dissemination via an external publishing platform) (Bénichou & Duin 2009).

Instead of having each NHI publishing its own journal, the *EJT* project attempts to share publishing resources. NHI have major in-house capacities and skills owing to their long tradition in scientific publishing, which could be used to achieve greater development and contribute to increase availability and use of biodiversity data. Furthermore, the pooling of financial resources reduces publication costs (Crow 2006). The savings may then be reallocated to the development of state-of-the-art interactive tools, allowing a wider dissemination of the content.

At first, the idea of a transdisciplinary journal was mainly motivated by technical assumptions:
1) Aggregating technical and financial resources allows economies of scale;
2) Combining editorial resources and author production from several NHI prevents repetition, and with the appropriate technical resources, ensures wider distribution and higher visibility of the content. Recent publishing models in taxonomy (zoology, botany…) integrate the same key principles: that biodiversity data should be readily available, machine-readable and distributed globally;
3) Beyond the technical aspect, the *EJT* Consortium wanted to send a strong political message and prove that a cross-institutional strategy at the European level was sustainable in the long term while benefiting the participating NHI. The new journal would therefore need to cover many taxonomic groups.

The scope of *EJT* covers descriptive taxonomy of all eukaryotic organisms, including zoology, entomology, botany and palaeontology, on a single platform. The *EJT* team aims to promote an in-depth discussion concerning technical, conceptual and methodological boundaries (or absence of boundaries) amongst these 4 taxonomic domains. But, is *EJT* truly a transdisciplinary journal?

2°) Transdisciplinarity applied to research and academic publishing

The concept of “transdisciplinarity” is often debated, with several attempts to be defined in the light of closely related themes, such as multidisciplinarity and interdisciplinarity. Rosenfield (1992) distinguished (1) “multidisciplinary research” as a weaker form, where each discipline works independently on a common problem before uniting the results; (2) “interdisciplinary research” as a medium form where researchers collaborate together on a common problem, but still within the boundaries of their specific discipline; and (3) “transdisciplinary research” as the strongest form, where researchers work jointly on a common problem, using a shared conceptual framework. These various degrees of cross-disciplinary collaboration are particularly used to tackle complex problems, especially when challenges from different disciplines are interconnected, such as socio-ecological challenges. According to Després *et al.* (2004), the difference between transdisciplinarity and interdisciplinarity comes from the Latin prefix “trans” (meaning “other side of”) as going beyond the boundaries of each discipline. Jahn *et al.* (2012) argue that a universally accepted definition of transdisciplinarity is not available, and examine scientific publications to offer an alternative definition: transdisciplinarity is a “reflexive research approach that addresses societal problems by means of interdisciplinary collaboration as well as the collaboration between researchers and extra-scientific actors”.

While the term “transdisciplinarity” is promoted in science policy rhetoric, Jahn *et al.* (2012) notice that in practice it is not effectively established in the academic world, notably because a universal definition and appropriate quality standards to support this approach are lacking. Kueffer *et al.* (2007) remark that although an array of publications embrace the “transdisciplinary” label, these publications do not reflect

all relevant research activities and that transdisciplinary scholars have difficulties to identify appropriate journals to publish their work. They propose a distinction between problem-oriented journals and practice-oriented journals (for a definition of these concepts, see Kueffer *et al.* 2007).

EJT is not a transdisciplinary journal in the strict sense, because each paper is still published in its own section (for plants: botany, for insects: entomology…), by a single or several researchers who specialize in a single discipline. The core principle behind the scope of the journal is that botany, zoology, entomology and palaeontology are four disciplines which share the same need for taxonomy and which traditionally are studied in NHI. These NHI tend to collaborate by affinities: natural history museums study mostly zoological/entomological/paleontological collections, whereas botanical gardens work on plants/fungal/algal collections. Nevertheless, there is some multidisciplinary collaboration in taxonomic research, for example joint expeditions to collect animals, insects and plants, as well as linguistic, ethnical or geographical data which result in a joint publication several years after the expedition (e.g. Santo Expedition: Bouchet *et al.* 2011).

3°) Limits of transdisciplinarity: indexing and archiving scientific publications

Although *EJT* does not promote strict transdisciplinarity, the journal does face challenges resulting from its broad scope. Indexing services and databases specialized in life sciences classify journals according to some categories (e.g. biochemistry, ecology…) but do not identify taxonomy as a specific category. As outlined by Stichweh (2001), scientific disciplines had an archival function before the 19th century, e.g. in encyclopaedic compilations of knowledge "in which disciplines function as unit divisions of knowledge". After 1780, the emergence of specialised journals with their own community of authors (Stichweh 2001) shaped disciplines at a communicational level. In modern society, new disciplines arise constantly, thus making the modern system of scientific disciplines a very dynamic one, with changing discipline boundaries. However, modern archival and retrieval systems of academic publishing (abstracting & indexing services, databases) are often based on quite ancient and stable controlled vocabularies and set of subjects, matching library classifications. For example, the Directory of Open Access Journals (DOAJ) is based on the Library of Congress classification (https://doaj.org/subjects), which distinguishes "botany" and "zoology" as subclasses, and palaeontology as a topic within the subclass "geology" (Library of Congress 2014).

Some databases accept a unique journal to be classified in several categories (e.g. zoology and botany), but this is not always the case. Classification under a single category has a direct influence on the searchability of articles, as it is the case for *EJT*: on Thomson Reuter's Web of Science, the papers are available only in the category "zoology".

When looking back at the three technical presuppositions on transdisciplinarity, *EJT* has met the first objective (economies of scale due to aggregation) and the last one (sending a strong political message to promote cross-institutional strategies), as we will outline further in this paper. However, our second assumption (preventing repetition and providing higher visibility of the content) proved entirely wrong.

EJT founders expected that gathering all taxonomic results on the same platform would benefit all disciplines and would ensure a better visibility. After four years, we realize that most *EJT* papers are published in two sections of the journal: zoology (65 contributions, 50% of the content) and entomology (43 contributions, nearly 34%). This predominance may be partially explained by the fact that 3 zoological journals and 1 entomological journal previously published by NHI were merged into the new title; however, one journal on palaeontology was also merged, but there are only 8 contributions within this

section. No botanical journal was merged, and the number of botanical papers is low (9 papers). Manuscript submissions follow the same pattern.

These results show that the journal has somehow failed to attract authors working on plants or on fossils. When questioned, few authors expressed their reluctance to submit manuscripts to a journal when they did not identify quickly papers of their own category.

The *EJT* team acknowledges this pitfall and will have to seek a solution for a better representation of botany and palaeontology papers, perhaps through some "quick access" elements on the main page of the website. However, this approach will not solve the classification problems encountered on external abstracting and indexing services or databases. Future negotiations with representatives of these services should include this dimension.

OPENNESS INITIATIVES AND NEW TECHNOLOGIES

1°) Open Access and copyright

During the last decade, a growing interest for open access of scholarly publications has emerged, motivated by the benefits it could bring to researchers as readers and authors, and to non-researchers "by accelerating research and its influence on all the goods that depend on research, such as new medicines, useful technologies" (Suber 2012). A definition of open access emerged from three major public statements: the Budapest Open Access Initiative (2002), the Bethesda Statement on Open Access Publishing (2003) and the Berlin Declaration on Open Access to Knowledge in the Sciences and Humanities (2003). What was then seen as a true opportunity to support academic freedom and to promote the dissemination of knowledge has triggered a radical change, if not a revolution in the world of scholarly publishing.

By removing most financial, legal and technical barriers, open access publications optimize the access to knowledge and greatly benefit the public and the society as a whole. Open access also benefits researchers (as authors), providing higher visibility of their contributions and a larger impact on the community.

According to some studies, open access papers are more cited than non-open access papers (e.g. Gargouri *et al.* 2010), and the Open Citation Project (2013) provided an extensive bibliography of studies measuring citation impact of open access papers *versus* non-open access papers (now maintained and updated by SPARC Europe, see http://sparceurope.org/oaca/). Methodologies used in such studies are still subject to debate (e.g. Moed 2012). However, if the open access movement initially received a reserved reaction, it now arouses increased interest from academics, and beyond, from policy makers and stakeholders. The most blatant outcome of this interest is the progressive shift towards open access in research policies worldwide, for example:

- The new Research Councils UK policy on open access (Research Councils UK 2013);
- The US National Institutes of Health (NIH) Public Access Policy (National Institutes of Health 2008 and subsequent amendments);
- The European Commission's recommendation on access to and preservation of scientific information (European Commission 2012), and the creation of the OpenAIRE portal (OpenAIRE 2015).

All these policies are based upon a growing consensus that results and data of publicly funded research should be made available for all. Clobridge (2014) remarks that debate on open access has evolved, and

that it is no longer focused on the legitimacy of the movement, but on best practices, sustainability and impact.

The research policies mentioned above insist on the goal (open access of data), but leave the scholars (and the publishers) a relative freedom on how to achieve it. For example, the Research Councils UK leave two choices: publish in an open access journal with no embargo period and a Creative Commons CC-BY license ("gold" open access); or publish in an open access title applying an embargo of less than 6 months and allowing self-archiving ("green" open access), with author retaining copyright on the publication. This latitude is meant to accommodate to two most used open access models.

The question of copyright status is treated differently by each one of the 3 policies: while the Research Councils UK policy is strict (author must retain copyright), the European Commission simply encourages authors to retain copyright without making it a strict condition; and the NIH public access policy warns that the author should evaluate carefully the consequences of any copyright transfer to the publisher, as it may impair the requested public availability on PubMed Central 12 months after publication.

For publishers, following the open access route means finding a sustainable business model, as no revenues can be expected from subscriptions to the journal or from single article purchases. When launching OA journals or providing OA options in subscription-based journals (hybrid journals), publishers may switch to an "author pays" business model, with so-called "Article Processing Charges" (APC). These APC are meant to cover the costs of publication (including copy-editing, layout, Web hosting charges…). According to Solomon & Björk (2012; 1,370 journals studied), the average APC was 906 US dollars, but varied between 8 USD and 3,900 USD, with substantially higher APC for commercial publishers.

In the UK and NIH open access policies, the principle of institutional funding to cover APC is integrated (Research Councils UK 2013, National Institutes of Health 2015), but the "author pays" model has been recently criticized. OA journals funded through APC are becoming an important segment of the publishing market and authors often have to combine sources of funding (grants, institutional funds, even personal contribution) to cover these costs (Björk & Solomon 2014). A specific problematic is also seen with journals based on a hybrid model, which can cause the phenomenon of "double dipping", when the journal receives money from readers' subscriptions during the embargo period (the paper is published, but not in open access yet) as well as APC to cover open access after the embargo period (Björk & Solomon 2014). Organizations funding research such as the Wellcome Trust are aware of these problematics, thus promote initiatives to measure impact of APC on global cost of journal access (Björk & Solomon 2014).

As more and more life forms are threatened worldwide, accelerating the discovery of new organisms, as well as encouraging research on existing data, ensures a better understanding of our planet's biodiversity, which can then be endorsed by national and regional policies for a more efficient conservation. Like Suber (2012), the institutions behind *EJT* are convinced that open access should not be seen as a problem, but as a true opportunity; they see the benefits of aggregating and making publicly accessible the massive knowledge hidden behind the walls of museums, herbaria and libraries. Therefore, these institutions multiply the number of openness initiatives by liberating access to collections data (e.g. participation in Global Plants Initiative and Europeana portal, see http://www.europeana.eu/portal/) and to taxonomic publications, for example through their participation in global projects such as Biodiversity Heritage Library (http://www.biodiversitylibrary.org/) aiming to digitize the legacy biodiversity literature worldwide. Aside from access to original collections and legacy literature, the time has now come for NHI to engage in immediate open access to data as soon as they are published, e.g. by supporting initiatives such as *EJT*.

The *EJT* Consortium resolutely shares the vision of the founders of the open access movement, and chose

an audacious business model, as well as a copyright model ensuring both protection of the authors' rights and freedom of authors and readers to distribute, share and reuse the content of the journal. All *EJT* papers are published following the "diamond" open access model: authors do not pay article processing charges, and readers do not pay to access the content. All publications and distribution costs are borne by NHI members of the *EJT* Consortium, which fund the copy-editing, editorial and referee processes and the publications costs. The core mission of the institutions involved with *EJT* is to disseminate research results in natural history sciences and make the information accessible and discoverable for everyone who needs it. This means that no technical, legal, financial barriers should slow down publishing, access, or reuse of taxonomic data, while respecting the norms of credit and peer-review. Thus, the NHI supporting *EJT* fulfil their mission by providing a non-profit, high quality peer-reviewed journal compliant with all taxonomic rules, including the guarantee of long-term access and preservation (thanks to the LOCKSS network, see point 4°) further in this section).

Moreover, papers are published under a Creative Commons CC-BY license, and authors are encouraged to distribute their paper and archive the final version on institutional or personal websites once the paper is published (pre-publication of taxon names is not authorized by nomenclatural codes, see ICZN 2000 and McNeill *et al.* 2012). Readers are encouraged to distribute the content, to share it and to re-use data. The sole restrictions are to acknowledge the paper's authorship and initial publication in *EJT*.

The rationale behind the creation of *EJT* was that the result of scientific research should be disseminated to the largest audience possible, particularly in the case of publicly-funded research. In order to suppress any barriers that would prevent the dissemination of information, *EJT* founder followed recommendations on copyright (Bénichou & Duin 2009) and legally registered the journal in France. Indeed, French law on copyright explicitly allows reproduction of copyrighted works, provided that the source and author are cited, for scientific or educational purposes. According to Egloff *et al.* (2014), the differences between national copyright legislation in Europe with their specific limitations could hamper the emergence of an integrated system for the management of biodiversity knowledge. Until harmonization of copyright laws within Europe, the legislative frame for *EJT* (French law) remains one of the least restrictive as regards reproduction and dissemination for scientific and educational purposes.

Prainsack *et al.* (2013) defines the "diamond route" for OA publishing as a model where the "journal is freely accessible and the author pays no APC". This route is suited for non-commercial journals that mostly do not have a profit imperative. Fuchs & Sandoval (2013) add restrictions to this definition, saying that the model does not allow commercial and for-profit re-use. This would mean using a more restrictive copyright license, for example CC-BY-NC (Attribution-NonCommercial). The issue with using such license is that it would add a legal barrier to "protect" the content against commercial use; this license is criticized by scientists (see Open Letter from Tennant *et al.* 2014) because it is not compliant with standards of the Budapest Open Access Initiative. Claire Redhead from The Open Access Scholarly Publishers Association (OASPA) advocates the choice of a CC-BY license (see http://oaspa.org/why-cc-by/), especially given the difficulties to define what falls under commercial use or not. We agree with the views of OASPA on such issue, as we want to see taxonomic content used by everyone who has interest in it.

As a result of this open access and copyright model, publishing a paper in *EJT* complies with the most recent research policies in the UK and the US, as well as with the recommendations from the European Commission. Not only *EJT* is totally and freely an open access journal but it also does not enforce any embargo period and the authors retain their copyright.

2°) Use of open source software

The use of open source software to publish the journal follows the principles chosen by the *EJT* Consortium, i.e. the idea of openness, of sustainability (no costly licenses) and the political choice to regain control on editorial policies. Several open source software are available and cover most aspects of editorial and publishing work, for example:

- Open Office or Libre Office for written documents (manuscripts going through review process);
- Scribus (alternative to Adobe Indesign) and GIMP (alternative to Adobe Photoshop) for layout purposes;
- Open Journals System (OJS) for the online tracking of submissions, and as publication platform.

The Public Knowledge Project (PKP), founded by John Willinsky in 1998, is dedicated to improving the scholarly and public quality of research. Open Journals System (OJS) was originally developed as a part of the research program of PKP, in an attempt to improve access to research through open access publishing (Willinsky 2005). Willinsky's main objective was to find options to lower drastically the costs of online publishing. After a survey, it became evident that a viable option could be to create an open source software specifically designed to manage and publish journals online (Willinsky 2005). In order to ensure its adoption by scholars and its efficiency, the software had to be as user-friendly and easily run as possible, even by people with little experience in journal publishing. It also aimed to provide flexible management tools and options close to the ones of commercial software (Willinsky 2005).

After 18 months of software development, the first version of OJS was released. Currently, it is supported by PKP, with the contribution of the Simon Fraser University Library as the administrative and operational base. OJS proves to be an efficient software for peer-review management and journal publication, particularly adopted by small, non-profit publishers and in developing countries (see examples of OJS use in Hedlund & Rabow 2007, Murray 2008, Minj *et al.* 2008, Damasio 2011, Walker 2009, see also studies within Edgar & Willinsky 2010 and Owen & Stranack 2012). OJS is also used for archival purposes or as a repository by universitites or libraries (e.g. Panagiotis 2011). OJS users can choose to host and customize themselves the software (e.g. using a local server), or to be hosted by PKP Services and receive assistance in development and customization for reasonable fees. The success of OJS relies not only on the dynamic team developing the software, but also on its flexible architecture allowing users to develop their own tools for specific uses. Numerous plugins, patches and display themes have been developed and integrated in the software, or are available for installation via GitHub repository (https://github.com/pkp/ojs). A large OJS community used to interact on the old forum (previously at http://pkp.sfu.ca/support/forum/index.php, archived in early 2015 but comprising nearly 35,000 posts about OJS). The new forum (http://forum.pkp.sfu.ca/) will continue to offer this exchange online space where users contribute by posting their resources, requests and solutions. When a journal needs a specific tool or feature, the journal team can develop it in-house, and ideally share it on GitHub or on the forum; if the journal team does not have time or expertise, the PKP team can create it for a fee.

Sutton (2011) summarizes the "win-win" situation that stimulates the growth of OJS: "By offering a product that can substitute for commercial services to electronically manage peer-review and production processes, SFU [i.e. the Simon Fraser University] has simultaneously given something away yet created a need for their unique expertise to make it work even better for individual users."

OJS offers an online peer-review management system, as well as a state-of-the-art publication facility, all on a single platform. The publication tools are well developed on OJS and various interoperability features facilitate the visibility of a journal (e.g. indexing on Google, on OAI-PMH-compliant services…). The PKP team has also multiplied collaborative work with external services such as CrossRef, PubMed, DOAJ to provide import/export solutions to OJS users (Owen & Stranack 2012). The numerous features and advantages of OJS drove the *EJT* team to use it for the journal.

OJS is used for the online publication of *EJT* papers, as it provides efficient export features and publication tools. The *EJT* team uses "commercial" software for the submission and peer-review process (Editorial Manager) and for layout (Indesign, Photoshop).

Indeed, used for the peer-review process during the first year, OJS received rather negative feedback from users, particularly from editors and reviewers. Main remarks were that:
- In OJS workflow, all editors roles had access to the final decision on publication (accept/reject); this configuration did not match the journal's workflow, as the *EJT* manuscript is first handled by a subject editor who does not take the final decision on publication but rather send a recommendation to the editor in chief;
- Reviewers reported difficulties to structure their reports, and editors were concerned that documents provided by reviewers were not anonymized automatically in the system.

EJT subscribed to Editorial Manager (Aries, see http://www.editorialmanager.com) on the second year as it allowed high customization of the editorial workflow and better control on anonymity of documents. Its main disadvantages are the expensive fees, and the lack of interoperability with OJS. In the future, a return to OJS for the peer-review process is planned, as it would lower the costs. However, an appropriate customization to meet the journal's needs in terms of editorial workflow would be essential; this prerequisite could be achieved either by external intervention (e.g. request to PKP services for a fee) or through hiring a new member of staff with extensive expertise on the system (see further in the text).

Concerning the layout tasks, a commercial software was chosen "per default", as *EJT* desk editors were already using said software in the frame of their job in NHI.

3°) XML

Since its launch, in addition to integrating openness initiatives, *EJT* aims at developing new technologies in the content production so as to enhance the visibility and the dissemination of its content.

The use of XML format in scholarly publishing, particularly for e-journals has been widely promoted since the early 2000s, and its advantages have been abundantly discussed by publishers, scholars and librarians. XML is seen as a reliable archival format (Wusteman 2003), and has the potential to revolutionize the way information is presented, disseminated and classified, as it is machine-readable and enables data interchange (Apps & McIntyre 2000). XML provides a flexible format that captures the information content separately from styling and display (Apps & McIntyre 2000). Shotton (2009) notes that, although journals are available online, the fundamental structure of the research article has remained relatively unaltered, and identifies the introduction of semantic web technologies and intelligent use of interactivity as the future for academic publications.

Many academic disciplines can benefit from introduction of XML-based workflows in publishing, and providing XML versions of research articles is already a prerequisite for inclusion in PubMed Central (National Library of Medicine and its Journal Article Tag Suite, see http://jats.nlm.nih.gov/about.html).

In taxonomy, producing efficient XML output is quite challenging, mainly because taxonomic articles contain a great diversity of information. Therefore, the markup (XML tagging) requires high granularity to render this diversity. A breaking-through experiment was introduced by Plazi (www.plazi.org), which created a suitable extension of the National Library of Medicine's DTD called TaxPub (see Catapano 2010). TaxPub allows extensive tagging of biodiversity information, including names of taxa, but also collection data. Citation of material used to conduct the research (specimens) was a particularly challenging part of

the article's content, as specimen citation contains many pieces of information (Catapano 2010). TaxPub was primarily used to digitize information coming from the legacy literature. The markup was operated through the GoldenGATE XML Markup Editor (http://plazi.org/wiki/GoldenGATE_Editor).

Following this route, the most interesting developments of XML-based workflow and production were implemented by a key publisher in taxonomy, Pensoft Publishers (http://www.pensoft.net/). Pensoft used TaxPub to tag articles and tested it on material submitted in different formats (Penev *et al.* 2010). With development of its own software to edit and tag documents (Pensoft Markup Tool), Pensoft was able to provide an array of dissemination operations, such as exports to databases and repositories (PubMed Central, Encyclopedia of Life, Plazi repository for species descriptions), and semantically enhanced HTML versions of the papers (see http://www.pensoft.net/page.php?P=14 for an exhaustive account). Miller *et al.* (2012) relate that semantic tagging would allow taxonomists to access all data elements from a publication; however, based on experience with Plazi and Pensoft, Miller *et al.* (2012) notice that XML markup "multiplies production costs by 5 and takes 0.5 to 2 minutes per page".

Pensoft further developed a new tool, Pensoft Writing Tool, which is an online platform using pre-defined template for articles, in which the author directly writes his manuscript, with an underlying XML structure (Smith *et al.* 2013). This approach minimizes the amount of work needed from the publisher, as the author is the one who actually adds most of the semantic tagging in the template.

XML production was included in the road map of the *EJT* project, and different possibilities of workflow were assessed (XML up-front, XML from pdf or from Indesign files) as well as potential collaboration with Plazi. However, the *EJT* Consortium was soon confronted with the lack of staff specialised in XML production, as desk editors only have a limited knowledge on what XML is, and are unable to implement technological solutions to ensure high quality markup. Basic IT support (OJS configuration, maintenance and backups) provided by the Natural History Museum of London is only on a part-time basis, and does not include support for XML production. An outsourced production of XML from pdf has been considered, but the additional costs were high and this option still required extra work from desk editors to control the quality and correct errors after production.

While XML has many advantages, it remains complex and many publishers seem to throw in the towel after some attempts (McIlroy 2012). The success story of Pensoft shows that XML-based workflow and production is possible in taxonomy. However, we are convinced, as expressed by Maxwell *et al.* (2010), that it requires a considerable amount of organizational effort and labour, including intensive programmer support to fit the journal's needs. When the *EJT* project began, the level of expertise and labour needed for XML production was clearly underestimated.

The upcoming challenge for the *EJT* Consortium will be to allocate a substantial budget and hire IT staff specialised in XML production, to further develop in-house technical capacity.

4°) Exports to databases and repositories, sustainable archiving

Dissemination of biodiversity data is one of the core objectives of the *EJT* project. An XML-based workflow should facilitate export of the journal's data to main databases and repositories in the field of taxonomy, including Global Biodiversity Information Facility (GBIF: http://www.gbif.org/), Encyclopedia of Life (EoL: http://eol.org/), and Biodiversity Heritage Library (BHL: http://www.biodiversitylibrary.org/). Names registration repositories such as ZooBank (http://zoobank.org/) and the International Plant Names Index (IPNI: http://ipni.org/) were also targeted, as registration of zoological names became a requirement for publication in the latest version of the *International Zoological Code of Nomenclature* (Zhang 2012) and

that the *International Code of Nomenclature for algae, fungi and plants* (McNeill *et al.* 2012) could readjust its current requirements in the future.

The fact that *EJT* published only pdfs and does not yet provide XML format has forced the team to adjust this objective for the time being. We chose to target less exports, those we considered as the most important, and focused on what was technically feasible by the *EJT* team.

Currently, the journal exports its article metadata to CrossRef and Directory of Open Access Journals (DOAJ) using the plugins available in OJS. The desk editors register manually all data of zoological papers in ZooBank, through the user interface. The collaboration with IPNI to register plant names was made possible by applying a basic workflow using Excel spreadsheets. Although the last two "DIY" initiatives are far from an automated XML-based process, they currently cover *EJT*'s needs in terms of taxa name registration.

The decision to halt XML production until relevant investments are found brought paradoxically some fresh air to the *EJT* team, as it was able to allocate more time and effort in the overall visibility of the journal, and prospect possible inclusions in journal databases.

In 2014, *EJT* made two major applications for content inclusion: Scopus (Elsevier's database: http://www.scopus.com/) and Thomson Reuters' products, including Web of Science (Thomson Reuters: http://wokinfo.com/). In June 2015, *EJT* received its first impact factor in the Thomson Reuters Journal Citation Reports, with a score of 1.312, which is a high score for a taxonomic journal. The impact factor is criticized by scholars and some publishers and its validity as a metrics disputed (e.g. Agnarsson & Kuntner 2007), but it remains a key criteria used by institutions like laboratories and universities. This official recognition of the title brings bright perspectives for the future.

The *EJT* team has worked closely with the Library of the Natural History Museum of London to have the journal's content archived in the LOCKSS network (http://www.lockss.org/). In 2013, integration of *EJT* in LOCKSS became effective, and the whole content is archived, including papers published between 2011 and 2013. This coverage guarantees long-term preservation of the digital content, which is critical for taxonomic disciplines (e.g. for botany see the recommendations of the Melbourne Code in McNeill *et al.* 2012).

EXPERTISE AND TEAM

1°) Federate our expertise

Natural history institutions share a long tradition in academic publishing, but are facing radical changes to keep their journals alive. Some institutions react by reducing the number of titles maintained, and concentrate their budget and efforts on a single journal, providing more margins to invest in workflows, staff and technologies. Other institutions turn to larger commercial publishers for production and distribution (outsource completely editorial workflow and/or content production).

The decision to outsource the publications brings serious concerns about copyright ownership of the content, as most commercial publishers require copyright transfer. Another main inconvenience is that the institution loses largely its control over workflow, layout presentation, distribution network and even editorial policies. For example, publishers of journals with a traditional scope covering descriptive taxonomy can be tempted to shift this scope towards phylogenetic and molecular research to get more

citations, thus a higher Impact Factor (Agnarsson & Kuntner 2007). While the numbers of scholarly peer-reviewed journals continue to grow, the proportion of non-profit journals has declined (Crow 2006).

When an institution decides to reduce the number of titles, or "sell" the journal's name and reputation to an external publisher, the direct consequence is a loss of valuable in-house expertise and knowledge on publishing. Crow (2006) stresses the fact that "this lack of in-house resources becomes especially critical as the transition to electronic dissemination accelerates and the efficacy of subscription models declines for many small publishers".

Federated publishing cooperatives offer an alternative operating model for society publishers (Crow 2006); moreover, cooperatives with relatively homogenous memberships are more likely to succeed, especially if they gather publishers from related disciplines, sharing the same niche publishing environment (Crow 2006). Conscious of the value of such cooperatives, NHI participating in *EJT* wanted to regain control on their editorial policies and preserve their publishing expertise.

The *EJT* Consortium is a joint decisional structure appointed to conduct the project under monitoring of NHI representatives. Each NHI brings financial support to the project, and/or in-kind support by:
- Allocating financial means to the project, which are used to purchase software, IT services, register to essential services/databases like CrossRef…;
- Appointing scientific staff (editors, publication manager) to help with the editorial process of manuscripts (e.g. to supervise peer-review process) or with management of the technical team;
- Hiring technical staff (desk editors, IT technician) to ensure high quality production (layout, proofing, online access…).

Some Consortium members merged their existing journals into the new title and allocated the released resources to *EJT*, while others have chosen to add the title to their existing portfolio.

2°) Challenge of a multilingual, diverse team

Members of the *EJT* Consortium primarily assumed that pooling their human resources in a joint publishing project would raise some major obstacles, including the need for a highly qualified technical team (desk editors) for content editing and layout. Very few NHI have a complete publishing team, and most journals are run by isolated members of staff (Bénichou *et al.* 2012). In some institutions, scientific members of staff were in charge of the editorial process, but also of other steps of production that could be covered (more efficiently and at a lower cost) by technical staff (copy-editing, layout, proofreading, distribution). These scientific members are hired on a higher salary scale than technical workers, making the journal production more expensive. Therefore, the *EJT* Consortium identified as key organisational principle the hiring of desk editors ("technicians") trained in taxonomic research (Bénichou *et al.* 2012), allowing scientific staff to dedicate all their time to research.

One of the biggest challenges of the *EJT* collaborative project was to bring together the core editorial and technical team (Bénichou *et al.* 2012), with members scattered through several European countries and speaking different languages (Dutch, French, German, Danish and English and potentially others as the Consortium would enlarge).

Such widely dispersed team, known in management as a "virtual team", can be seen as a phenomenon of globalization (Zakaria *et al.* 2004). Lipnack & Stamps (1997) suggest the following definition: "A virtual team works across space, time, and organizational boundaries with links strengthened by webs of communication technologies". Like any work structure, it has both advantages and inconveniences. In NHI, research activities and journal publishing structures rely heavily on virtual communications. Even before

the Internet era actors of the publishing chain (authors, editors…) were using post (letters) and faxes to communicate and break down physical barriers. However, as journals were traditionally kept in-house, this "virtual" communication concerned mostly temporary actors of the chain, such as authors and reviewers. Long-term actors, such as editors were in general affiliated to the same institution, therefore sharing a corporate culture, and had means to regularly meet face to face.

The Web 1.0 and 2.0 accelerated those virtual exchanges, but we agree with Zakaria *et al.* (2004) that using electronic communication does not necessarily make a team a virtual one, because "virtual teams have no options as to whether or not to use it [electronic communication], since they depend on virtuality". We could think that in scholarly publishing virtual teams are becoming quite common, for example if looking at the composition of editorial boards. However, most journals still have an "editorial office" with a core team of few individuals from the same institution.

3°) *EJT* team

EJT's core editorial team (to manage peer-review process) was initially composed of an editor in chief, chosen from the task group which has created *EJT*: Koen Martens, and of 3 editors with general expertise in the 4 taxonomic areas covered by the journal. From 2011 to 2014, one editor left the project (lack of time for the editorial tasks), whereas new section editors reinforced the group.

The international advisory editorial board was first limited, but counts nowadays 24 members worldwide.

The technical team (online access, new technologies) was limited to one member from the Natural History Museum of London, mainly solicited during the technical setup stage (OJS setup), for general maintenance tasks (backups, server environment) and then sporadically (e.g. bug fixing).

The production team is composed of a publication manager, Laurence Bénichou, and of 4 desk editors. This team is quite diverse:
- The publication manager has strong experience both in EU project management and scientific publishing;
- One desk editor was hired on basis of her educational background (Master in publishing);
- Another one was recruited thanks to his professional experience in scientific publishing and his knowledge on taxonomy and zoology;
- A third one was already working for a journal specialised in botany within her institution, and works now part-time for *EJT*;
- The last desk editor was managing editor for a zoological journal that was merged into *EJT*.

Representatives of NHI meet twice a year for the Steering Committee of the *EJT* Consortium, to assess the journal's status, approve the budget and promote an active discussion between participating members. Editors promote *EJT* through institutional communications and publications, including during scientific events.

The Management Committee (production team and editors) physically meets at least once a year, to evaluate the current situation and provide targeted objectives. This Committee includes both scientists and technicians involved in running the journal. This combination of publishing and scientific expertise resulted in an efficient team in which all members are strongly involved.

Members of the production team communicate regularly for the day-to-day management and upcoming issues, using emails, phone and VoIP. The working language is English. They participate in conferences, workshops and events related to scholarly publishing, new information technologies, open access and taxonomy; by doing so, they learn new elements and techniques to improve their work for *EJT*.

The need for skilful and multi-task staff has urged the production team to discover and master additional knowledge and know-how, for example by learning nomenclatural rules specific to other disciplines or new trends and protocols in publishing practices. The desk editors and the publication manager participated in a proactive discussion to set up the standard format applied to all disciplines for most of the text, as well as specific formats for each taxonomic specialty (e.g. taxonomic treatments for plants, insects, animals…). Mastering these specific formats is critical for quality, as the production team must ensure that layout let no ambiguity for interpretation by the reader, and that the work complies with the specific nomenclatural rules (i.e. the *International Code of Zoological Nomenclature*, ICZN 2000 and the *International Code of Nomenclature for algae, fungi and plants*, McNeill *et al.* 2012).

Desk editors learned on the job how to deal with different taxonomic practices, and gained additional knowledge by helping each other, one bringing the advice that the other needs.

The team has been really stable over the past four years, with only one editor leaving the journal. This stability was an advantage, because we were able to multiply contacts between members to conduct a long-term strategy.

EJT receives in average 40 to 50 submissions per year, and human resources available proved to be sufficient for content production. From 2012 to 2014, the team published around 30 to 37 papers yearly, and the same level of output is expected in 2015. While most papers are quite standard (around 10-20 pages), 14 monographs (more than 50 pages) were published since 2012, including 4 monographs of more than 150 pages each.

To summarize, running a widely dispersed team proved much easier than expected, and the Consortium has positively acknowledged dedication and efficiency of the team members. One of the core objectives of the *EJT* project was to bring together people scattered throughout several institution and to break their isolation. From this point of view, *EJT* is a great success; the team is not only able to participate in the international scholarly publishing debate but it has demonstrated the ability of technical and scientific staff to interact and enrich each other. The institutions participating in the project have gained substantial expertise in scholarly publishing.

Recently, the publication by Thomson Reuters of *EJT*'s impact factor on June 18th 2015 resulted in a surge in the number of submissions (14 manuscripts received since that date). The recent endorsement of *EJT* by the Consortium of European Taxonomic Facilities (CETAF 2015) may facilitate the inclusion of new partners (botanical gardens, museums) to reinforce the team by financial or in-kind means. But a question remains: will this reinforcement come soon enough? At this rate, *EJT* could become a victim of its success, with longer delays between submission and publication. Currently, *EJT* team can handle the production of 2300 pages published per year and publish annually 1300. Another alternative would be to raise the rejection rate and increase the selection during the peer-review process. However, the difficulties to find reviewer remains a real burden nowadays and should be kept in mind.

CONCLUSION

After four years of existence, *European Journal of Taxonomy* contributes to the dissemination of knowledge on our planet's biodiversity. Its innovative Open Access model ensures that no economic barriers can prevent an author from publishing his results or a reader from accessing the journal's content. The team behind *EJT* is multi-national, and its solid scientific and technical background ensures high

standards of publication. Objectives were met in terms of open access, archiving, business model and publishing expertise empowerment. The journal's visibility is growing and has been rewarded with a high first impact factor. However, lack of staff specialised in XML and data exports halted the journal's technical progress: papers are still published in pdf, and the journal does not provide full linkage to all major biodiversity repositories and databases. We identify three main challenges for the future of our journal: firstly, the visibility of each section (botany, zoology, entomology, palaeontology) has to be reviewed and improved, including in external databases and abstracting/indexing services; secondly, the *EJT* Consortium has to grow and welcome new partners in order to enlarge the existing team (more editors and desk editors) so that the number of published pages can increase without altering the quality; and finally, a specific and substantial budget should be allocated to IT developments, including XML workflow and tools in order to meet all expectations of the project.

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