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2nd version

C3.1.4 Identification of barriers and benefits in the operations of the physical and digital infrastructure components

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Summary

This report intends to explore some barriers to be expected in the creation of a European taxonomic infrastructure as well as possible solutions. It also highlights some potential benefits at institutional level that may raise institutional commitment and support. It further touches on some critical issues that merit discussion in EDIT's final year, such as the interaction with CETAF.

The report is structured along various components of the sustainable EDIT infrastructure: physical (collections, archives, labs), digital, research and administrative. It builds on the presumption that a light infrastructure office is a key component to be sustained through institutional funding. Many other components are expected to be self-sustaining, i.e. working on a neutral budget in which benefits & cost savings in certain domains are invested in domains needing strategic support.

Major decisions by the EDIT directors stemming from the report and the underlying documents are:

- will EDIT start a process of in-kind service exchange among institutions and do they agree on designing MoUs to underpin and formalise this process?
- do you agree on the principle of estimating cost savings in some domains and reinvesting the gains in domains needing strategic support?
- will you (de)sign an MoU on giving credit/merit to staff members who spend time on contributions to international databases, species registers, initiating and running international coordination efforts, etc.?

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Abbreviations

ATBI+M	All Taxa Biodiversity Inventory + Monitoring
BoD	EDIT Board of Directors
CBS	Fungal Biodiversity Centre, Utrecht
CETAF	Consortium of European Taxonomic Facilities
DEST	Distributed European School of Taxonomy
DNA-B	DNA-barcoding
DoC	Directors of Collections
E(BOLD)	(European) Barcoding Of Life Database
E(CBOL)	(European) Consortium for the Barcoding Of Life
FSG	Future Scoping Group
ISTC	Information Science and Technology Committee
LIMS	Laboratory Information Management System
NCB	Netherlands Centre of Biodiversity Naturalis, Leiden
NELL	Network of European Leading Labs
NSC	EDIT Network Steering Committee
OECD/GSF	Organisation for Economic Cooperation and Development
PESI	Pan-European Species-directories Infrastructure
PI	Performance Indicators
SciColl	Scientific Collections International (organisation fostered by OECD/GSF, to be launched in 2011)
SPG	Science Policy Group
SPNHC	Society for the Preservation of Natural History Museums (US-based)
SYNTHESYS	project on (mainly) collections management, funded by EU, 1 st period under Framework Programme VI, 2 nd period under Framework Programme VII
TDWG	Taxonomic Databases Working Group
WOS	Web of Science

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Background documents

- Executive_summary_BoD_working_group200709_v2.doc
- summary of plenary Directors' workshops (Portugal 2008, Leiden 2009)
- Galey & Kriegsman, 2008. First Workshop of EDIT Directors of Collections. EDIT newsletter 10, Aug. 2008.
- Quaiser, C. & Kriegsman, L.M., 2008a. First design report of integrated physical infrastructures. Report to the European Commission on behalf of the EDIT Network of Excellence, component C3.1.1, 35 pp.
- table from NSC listing activities to be pursued after the end of the EDIT contract, with indicative costs (2009)
- Kriegsman, L.M. & Rijkers, T. 2007. Questionnaire on the design of a realistic working model for a European Distributed Institute of Taxonomy (EDIT WP3.1 & 3.5). Report to the European Commission on behalf of the EDIT Network of Excellence, component C3.1.2, 7 pp.
- Rijkers, T. & Kriegsman, L.M. 2007. The concept of Biological Resource Centres: towards Taxonomic Collection Repositories. Report to the European Commission on behalf of the EDIT Network of Excellence, component C3.1.2, 41 pp.
- Lane et al., 2008. Taxonomy in Europe in the 21st century. Report by the Future Scoping Group (FSG) to the EDIT BoD, 4th BoD Meeting – Annex 1, Jan. 2008, 7 pp.
- Quaiser & Kriegsman, 2008b. First Design of Integrated Physical Infrastructures. EDIT newsletter 12, Dec. 2008.
- results from the SYNTHESYS project (www.synthesys.org)

Introduction and scope of this report

The first three years of EDIT have seen the development of several infrastructure activities (e.g., scratchpads, ATBI+M, cybertaxonomy platform, DEST) and committees (e.g., BoD, DoC, ISTC) that have proved successful and would merit to be continued after the project phase. Discussions on the sustainable EDIT infrastructure after 1 March 2011 have therefore focussed on identifying mechanisms for such components to be continued.

In an earlier report (Quaisser & Kriegsman, 2008a) we extracted expectations, requirements and strategic decisions for each component (collections, labs, etc.) from vision documents (e.g., Lane et al., 2008). On the investment side, one expectation stated by all groups was technological up-scaling of DNA barcoding to industrial level that requires large-scaled lab facilities like DNA barcoding factories and interoperable Laboratory Information Management Systems (LIMS), enabling a high turnover and massive sampling. The development of such large-scaled facilities faces financial limitations, which need a strong involvement of research institutions and organisations outside EDIT (e.g., industry) through co-financing, cooperation and sharing of resources. This clearly involves barriers and challenges.

On the benefit side, it has been proposed by the NSC to set up shared services for those institutions which are too small to develop internal services for particular tasks. This is an important avenue to explore, because it underscores the strengths of certain institutions, often but not invariably the largest ones, and gives benefits to other institutions. As a corollary, obvious strong points per partner institution need to be mapped. Some examples are:

- loans management: the DoC could identify mechanisms to allow / facilitate one or a few institutions to provide this service to others, e.g. by providing appropriate storage facilities
- coordinating DNA-barcoding (JEMU Brussels, ECBOL / EBOLD / NELL: NCB Leiden & CBS Utrecht)
- developing standards and procedures for collection digitisation; general expertise in bioinformatics (BGBM Berlin)
- capacity building in biodiversity-rich countries (e.g., Africa: RMCA Tervuren)

In this process, it will be important to ensure an efficient network office serving all institutions, and a minimum bureaucracy. Ideally, some form of business plan is to be written for each sustainable component of EDIT, an activity envisaged for EDIT's fifth year.

This report intends to explore some barriers to be expected in the creation of a European taxonomic infrastructure as well as possible solutions. Each item starts with a statement on needs, followed by potential risks & barriers, challenges, solutions, potential benefits and/or opportunities. The report also highlights some potential benefits at institutional level that may raise directors' involvement and support.

A. Physical infrastructure (collections, labs, libraries & archives)

1. There is a strong need to expand the user base of European natural history collections, to increase their visibility and to increase ring-fenced money to safeguard their proper management
 - barriers: insufficient digital information on natural history collections at object and metadata level; insufficient linkage to other datasets (ecological, Earth observation)
 - risk: low to moderate use of collections despite large investments, potentially leading to reduced ring-fenced money in future
 - solutions: increase digitisation efforts (see 17); strongly endorse GBIF initiative to increase production of and access to digital specimen and collection information; give full support to Scientific Collections International (SciColl¹) and LifeWatch, two main initiatives that will expand the use and user base of collections; increase the use of collections, notably type specimens, for DNA-barcoding
 - benefits: better (more reliable) scientific basis for long-term management of biodiversity, increased visibility, broader user base, more connections to other scientific collections to facilitate addressing some of this era's major research questions; DNA-barcoding with its high applied potential may bring in funds for specimen-level digitisation

2. Business continuity must be ensured in the case of local disasters; collections are becoming a non-renewable resource (not considered until recently), and when they are renewable the cost may be higher than preserving the existing ones.
 - risk: loss of or damage to collections may be aggravated in the absence of a back-up plan or disaster plan
 - barriers: low sense of urgency; national or local view on this issue
 - solution: SYNTHESYS has developed a general disaster plan that can be implemented in EDIT after proper discussion in the DoC; create a Collections Rescue Task Force, possibly linked to the SYNTHESYS Expert Panel; task can be coordinated by DoC secretariat
 - benefits: mitigation plans can reduce the time that reference material is unavailable to the scientific community in case of a disaster and could significantly reduce insurance costs of operations

3. Closure, serious neglect or illegal (e.g., sensu CBD) deaccessioning of small to medium sized collections is a regular event in Europe and elsewhere, leading to orphaned collections
 - potential risks: losing collections, capabilities and expertise in support activities that are critical for proper collections management and research
 - barriers: focus on own institutional holdings; already understaffed collections; lack of European level thinking on academic heritage; insufficient description of many collections and their unique value
 - solution: create single entry point for orphaned collections; trust fund to purchase orphaned collections => EDIT/CETAF will own it => mechanism for long-term deposit at suitable institution (permanent loan); needed: survey of laws & regulations & mechanisms that protect natural history collections (national, EU); this has the current attention of the DoC who also wish to establish a European orphaned collections rescue task force

¹ SciColl is an international initiative, advanced by the OECD/GSF, devoted to increasing the benefits that object-based scientific collections and their associated information produce for scientific research and some of the major challenges facing society. It was largely initiated from within WP3.1 (1st meeting in Leiden, 2007). SciColl's program of work is intended to help scientific collections and their host institutions increase the return on investments made in the long-term management of these collections and the professional workforce responsible for them

- potential benefit: continued access to collections for the science community; can attract a lot of attention and goodwill from policy makers and the general public
4. Rational development of an international research infrastructure requires the coordination of collections acquisition
 - risk: some governments wish to see a limit to the size of natural history collections, thus putting a limit to acquisition, posing a risk to the preservation of voucher specimens of current and future research at national level
 - barrier: institutions work in very different legal context and collections can have vastly different formal status; national heritage rules may hamper the rational development of an international research infrastructure
 - solution: DoC and science directors (SPG?) should look into various aspects of collections acquisition (targeted acquisition, donations, taking over orphaned collections, collections profiles, institutional strengths & gaps) & deaccessioning; a collections survey held in SYNTHESYS 1 could serve as a basis; investigate complementarity, redundancy, exchange; some duplication required to mitigate the effects of disasters (see 2); jointly operated central storage facilities (like Millennium seed bank) could also be considered for some collection types
 - potential benefits: international division of labour in collections acquisition may increase the number of voucher specimens preserved for science; more focus on institutional strengths, more rational use of space; improvement of service to users.
 5. Natural history collections need a self-evaluation system including performance indicators (PIs), to be able to monitor progress in many fields (e.g., quality of collections management, digitisation)
 - Risk: lack of standards and protocols may give investors (subsidiaries) the impression of a lack of professionalism; this is a handicap for users, who are unable to evaluate the quality of collections unless they actually see them, also meaning additional cost for user access.
 - Barrier: reluctance of curators and institutions, for whom PIs may be both a burden and a danger (e.g., reluctance to be compared objectively, anxiety to appear not so good); institutional policies and regulations may also constitute a barrier; the great heterogeneity in regulations and evaluation (institutional, departmental and staff level) hampers European standardisation
 - solution: adopt a common self-evaluation and audit system for the quality of collections management developed by SYNTHESYS 1 and 2; ask the BoD to sign an MoU on contributing to and using the system (EDIT WP3.1, JPA5); can be linked to collections PIs to be developed by SYNTHESYS 2 & SciColl
 - challenge: design PIs without undesired (“perverse”) side effects, designing a fair system shared at all levels
 - benefits: because SYNTHESYS is developing a self-evaluation system, no staff fte’s need to be spent on developing it at national level; the system can be incorporated into specific national demands for self-evaluation; at global level, it leads to standardisation.
 6. There is a need for a European network of DNA & tissue banks to develop standards and coordinate activities, avoiding the long history of isolated solutions that characterise classical collections
 - risk: suboptimal solutions chosen for local economic reasons
 - potential barrier: insufficient willingness to develop European-wide protocols
 - solution: an ESF proposal has been submitted to start a working group & meetings on this topic (WP3.1, JPA4)

- opportunities: A European network could be key player in Scientific Collections International (see 1); contributing to the Planetary Genome Project (preserving a synoptic sample of genomes representing life on Earth) could increase the impact and visibility
 - benefits: overall better sample treatment protocols and storage conditions, increased European standardisation; better use of resources
7. Collaborate in the testing and purchase of collections preservation and storage materials
- risks: some institutions dependent on local providers who see little benefit in providing specialised materials to a small user community; suboptimal solutions chosen for lack of expertise or for lack of availability at national level
 - barrier: insufficient effort in this quick win field; needs leadership
 - solution: install a working group of collections managers to find optimal solutions
 - Benefits: cost savings; smaller dependence on unique national providers; higher quality through European material standards; unified quality control providing quality guarantees for users (of collections & of sequences).
8. There is a need for a common European competency framework for curators
- potential risks: different institutions/countries working according to vastly different standards
 - barriers: the high variability of organizational structures leads to different notions on curatorial tasks and skills; language
 - solution: DoC may, after the end of the EDIT grant, look into harmonised career development and expected competencies; establish common standards & provide standardised training (starting point may be competency grids established by NHML, MNHN and Tervuren); couple to personal performance indicators
 - potential benefit: easier exchange of staff; more efficient meetings; reduced cost of advanced training (e.g., database curation); higher motivation of staff members; clear career perspectives
9. It is becoming increasingly difficult for small to medium-sized institutions to maintain staff levels in collection preparation and conservation; examples: thinsectioning, taxidermists
- potential risks: losing capabilities and expertise in support activities that are critical for proper collections management and research and core business
 - barriers: insufficient ring-fenced money for collections management
 - solution: establish a mechanism to send material or to send (for limited periods) dedicated staff to places where support is needed; distributed & shared services (equipment, human resources)
 - potential benefit: significant cost reduction possible in some domains; more material prepared and preserved properly
10. There is a great need for training in collections management, as revealed by both a survey among EDIT institutions and the high number of applicants for SYNTHESYS
- risks: loss of skills in techniques developed in the past (e.g., preservation; preparation); insufficient skills in modern in data curation
 - challenge: training in new techniques (e.g., databasing; collection digitisation), dependent on the future competency framework for curators (see 8)
 - barrier: lack of a common language may hamper effective and efficient communication and exchange of knowledge
 - potential benefits: knowledge exchange; signalling function for training needs; spreading of best practices.

- potential solution: a survey among EDIT institutions has revealed large interest in a European collection managers forum; this forum could, when successful, develop into an independent forum or society; this will lead to more vigorous exchange of ideas, best practices, transfer of new techniques, training, etc.; in the case of data curation, specialised training on standards like ABCD(EFG) may require the involvement of TDWG
 - investment: a light secretariat (0.2-0.4 fte?) is needed that may be linked to the DoC and/or to CETAF
11. Initiation and running of international projects on collections, public awareness, etc., need working time and effort by museum staff, generally scientists and collections managers as well as project managers
- Risk: staff not given sufficient merit or support from their (employer) institution for their effort on European or inter-institutional projects
 - potential barrier: insufficient willingness to dedicate institutional funds or in-kind contributions to transnational infrastructure
 - directors' solution: each institution focuses on its strengths and offers that component for use by others; example: some on-line taxonomic services (BGBM Berlin); coordinating DNA-barcoding (NCB Leiden & CBS Utrecht, JEMU Brussels); can be linked to an efficient system of in-kind service exchange
 - additional element of solution: ensure that such efforts of collective interest beyond one institution are a regular element of staff review & performance indicators
 - benefit: the directors' solution safeguards that international activities are closely related to institutional core business
12. Spreading of excellence in collections management is needed to raise the global level: some countries have tens to hundreds of major collections with unique specimens (types or other reference material) curated under suboptimal conditions => EDIT/CETAF/SYNTHESYS should take a leading role in developing the standards of collections management in those countries
- risk: increasing mismatch between curation levels in different countries within Europe
 - barrier: insufficient resources to spread excellence beyond own institution
 - solution: apply for targeted funds
 - potential benefit: improved access to collections in those countries; increased linkage of collections data between countries
13. Increase European collaboration and coordination on DNA-barcoding through ECBOL (& BOLD & NELL) in collaboration with CBOL
- potential risks: duplication of effort; poorly interoperable systems (LIMS) and outcomes
 - barriers: national interests because of applied potential; insufficient willingness and effort by individual researchers and institutions to share datasets
 - solutions: European coordination of efforts through ECBOL; collaboration through Network of European Leading Labs (NELL) working according to specific standards and lab protocols; establish a European database (EBOLD), working with the global BOLD system; relate to European network of DNA & tissue banks; set common targets for DNA-barcoding and divide the labour
 - potential benefit: considerable cost savings is possible by developing a common Lab Information Management System (LIMS), or components thereof, and a common database (EBOLD); some cost saving by avoiding duplication of barcoding efforts;

higher benefit to users; coordinated services to society and funding applications can provide additional income

14. Investment in new, sophisticated lab facilities (DNA, microCT scanning, isotope analyses) can be more rational when coordinated at national or European level
 - potential risks: user base too small to warrant setting up sophisticated labs in specific places (“white elephant”); insufficient funds for operators and technical staff
 - barriers: not easy to combine national funds from different countries; longer distance between researchers and their specimens and analytical equipment; more travel time
 - solution: establish a working group to coordinate the purchase, co-financing and use of preparatory and analytical labs; exchange mechanism with each participating institution focussing on specific strengths; efficient system to send around material for preparation and analyses; investigate the possibility of remote control of equipment (e.g., microscopy, SEM, TEM, microprobe) through internet
 - potential benefit: significant cost reduction possible in some domains by shared use of existing equipment; reducing cost of investment in major equipment by co-financing; remote access to equipment increases the usage time of equipment; access can be given by a special password during a specific period of the day, even during closing hours as long as staff have placed specimens under the microscope (or in the vacuum chamber, etc.); payment can be done on an in-kind service basis; may also lower the number of transnational loans and reduce the risks of travel to key specimens

15. Libraries are increasingly deaccessioning a significant part of their books and journals; coordination is needed to ensure that key literature is not lost and that duplicates exist in case of disasters
 - potential risk: losing access to knowledge
 - barrier: preference for short-term, rentable solutions
 - solution: establish a working group on deaccessioning library holdings (already proposed in JPA5); do this together with on-line access through BHL, leaving 3-5 copies of the original in selected places
 - potential benefits: reduce number of journals in institutional libraries by coordinated deaccessioning of & access to library journals; maintain access to original sources of scientific knowledge

16. Not only can European natural history museums benefit from internal cooperation, it also has much to gain by cooperation with other organisations across continents
 - potential risks/barriers: Europe should not develop things already existing elsewhere; Europe should not focus only on its own biodiversity
 - solution: transcontinental collaboration (e.g., ABRS in Australia, SANBI in South Africa); global stewardship of collections, natural resources, etc.; external MoUs and working programmes with other international infrastructures, organisations, networks (a.o., LifeWatch). WP3.5 is taking care of this until 1 March 2011
 - potential benefits: more efficient use of revenues, more rational investments; money can be saved by avoiding duplication of digitisation efforts (BHL) and by division of labour (EoL); increased use of European collections from non-European countries

B. Interface between physical & digital infrastructure

17. Increased collection digitisation at object and/or metadata level is a key to increasing visibility, access and use
- risk: many institutions are starting uncoordinated efforts in collection digitisation, leading to duplication of effort; variable technical levels; poor interoperability of systems and/or resulting data
 - barrier: limited staff resources to be dedicated to this task, allowing only significant progress when additional staff can be hired on external grants; little direct impact or political benefit for funding sources of collections holders.
 - solution: the establishment of a working group on collection digitisation that deals with prioritisation and coordination; strategic partnerships & alliances can help solve some problems (e.g., GBIF, SPNHC, ABRS, SciColl)
 - potential benefit: cost savings by avoiding redundancies in digitisation; possibilities to link to registration systems and also make these interoperable; increased access for the science community at large; increased use of collections in academically and societally relevant research
18. ICT is a key area to invest in for all institutions to meet the demands of modernising taxonomy and increasing access to collections; early-stage coordination and partial harmonisation are needed in many digital operations
- risks: significant resources wasted on suboptimal solutions in a fragmented infrastructure; reinventing solutions already discovered elsewhere; outdated data structures
 - barriers: high investments done already at local level may hamper the drive towards European solutions; local languages and national laws & regulations on data access are other barriers
 - solution: ensure functioning of the Information Science and Technology Committee (ISTC) after the EDIT contract; or set up a sustainable / permanent informatics task force within a partner institution or by subcontracting the task to a specialised organisation; involve BioCASE helpdesk in SYNTHESYS 2; add GeoCASE helpdesk; develop a widely accepted thesaurus and metadata for collections description; ensure system interoperability by using at least two languages, one of them English; follow TDWG standards like ABCD(EFG).
 - potential benefit: save money & personnel time by sharing ICT expertise; increase interoperability of systems; easier data transfer to GBIF; avoiding duplication of effort in collection digitisation; similar with developing thesauruses for collection description
19. European natural history museums should actively promote data repatriation to and capacity building in collections management in biodiversity-rich countries
- risk: without a pro-active approach to data repatriation, some biodiversity-rich countries may step up the CBD regulations to levels seriously hampering research
 - barriers: insufficient awareness; limited resources to do do tasks outside core business
 - challenge: assume a proactive attitude towards CBD-ABS issues; link to accelerating species discovery by stimulating biodiversity-rich countries to raise their own taxonomic effort
 - benefit: promote the holdings of EDIT institutions, most of which have a high percentage of type specimens for taxa with non-European geographical ranges; political benefit for the EU governments and the EC toward the CBD.

C. Digital infrastructure

20. The EDIT infrastructure and its user community should be a driver of modernising taxonomy for researchers and stakeholders. An important element of the EDIT mission is accelerating the identification of known species, the discovery and description of new species, and understanding their position in the Tree of Life. EDIT's digital infrastructure should serve this mission element.
- Risks: without modernising, taxonomy is unlikely to reverse or even halt the trend of decreasing numbers of professional taxonomists, resulting ultimately in degradation of the quality of the service to society.
 - barriers: some researchers may not like to change the way they do their research; institutions may be unwilling to invest in web-based taxonomy when the outputs generated are not counted in peer review visitation schemes
 - challenge: to formulate research priorities in line with the EDIT mission, before the end of the EDIT project, strongly building on web-based taxonomy; use research priorities as constraints on the infrastructure needed (critical elements of collections, cybertaxonomy platform, scratchpads, etc.); use to prioritise revisions of specific taxa and/or regions: prioritised species (e.g., discussion within PESI)
 - solution: advertise the cybertaxonomy platform and mobilise a large user base within and outside Europe; modernise field methodology, currently being done by WP7 and WP6, and link to DNA-barcoding and collections acquisition; use the mission and research priorities to prioritise collection digitisation; promote LifeWatch as a mechanism to raise sufficient funding for continued development; strategic partnerships & alliances can create more momentum (e.g., SANBI, ABRIS)
 - potential benefits: more efficient production of taxonomic knowledge, including increased contribution to GBIF; more rational investments; increased visibility, attracting new users of collections and expertise; larger datasets for own researchers to mine
21. The visibility and impact of taxonomic output needs to be increased to meet its societal relevance
- risk: taxonomy may remain a low-impact science with a hundred local taxonomic journals often lacking digital access and, in at least 50% of the cases, marginalised from the Web of Science; insufficient academic credit to employees working on databases and other non-WOS products
 - barriers: institutions may be afraid to lose visibility by stopping publication of their house journals; those who already have WOS indexed journals do not want to lose this indicator of their quality, which is part of their evaluation system for funds
 - solutions: ensure that more taxonomic journals make it into the Web of Science; an open access e-journal, a European Journal of Systematics in WOS, can be a major tool and could be linked to a European Systematics Association; a shared journal could be matched by a reduction in the number of non-WOS journals within EDIT institutions; use the Taxonomic Data Conformity Index (TDCI) developed by SYTNHESYS 1 to cull existing journals; an alternative or complementary tool is a common digital portal to access taxonomic journals; it may also be useful to develop a common scientific evaluation metric to deal with non-WOS output (currently being done by a directors' working group), collection & data curation, services to society, etc.; give credit to taxonomists who spend time on societally relevant activities
 - potential benefit: increased access to taxonomic information; increased visibility and impact through WOS; significant cost savings possible when non-WOS journals are discontinued, mainly saving staff time that can be redirected to support a new European journal

22. A taxonomic information backbone is needed for exchange of data with users and will also help efforts in digitisation of collections
- risk: local thesauri in each institution, if existent, may hamper interoperability and are a waste of resources
 - barriers: insufficient willingness to jump from local to international solutions; insufficient awareness of the long-term benefits
 - solution: adopt a taxonomic information backbone for the cybertaxonomy platform, ensuring interoperability with taxonomy based information system (GenBank and similar, national inventories, CITES etc); promote efficient use of taxon names to cross-link biological information in various operations and projects (thesauri for specimen information; web-based taxonomy; EoL & CoL / GSIS / PESI / LifeWatch)
 - benefits: this backbone is mainly being developed through external grants, saving huge efforts at local level
23. The EDIT cybertaxonomy platform must be developed into and maintained as the global golden standard (workbench) for web-based taxonomic research; usage will ultimately define its success
- risk: insufficient use of the cybertaxonomy platform; insufficient funding to update and modernise; insufficient national support for LifeWatch to serve as one of the sustainability mechanisms
 - barriers: some researchers may not like to change the way they do their research; institutions may be unwilling to invest in web-based taxonomy when the outputs generated are not counted in peer review visitation schemes; insufficient funds to update and modernise the platform regularly
 - solutions: the PESI community can be stimulated to use the cybertaxonomy platform; the platform can be promoted through scratchpads; advertise the platform at key events (taxonomy meetings); establish a task force under the umbrella of the ISTC to drive the continued development of the EDIT cybertaxonomy platform; always look for external funding, together with CETAF (good examples: ViBRANT and i4Life proposals); LifeWatch can be a mechanism to sustain EDIT e-infrastructure
 - potential benefits: the taxonomic output can be expected to rise through use of the cybertaxonomy platform; joint research with scientists in other countries is facilitated; long-term usage by own and external research community as well as citizen scientists
24. A business model is needed for the cybertaxonomy platform incl. scratchpads, ATBI monitoring sites, systems, hardware & software
- risks: too much dependence on short-lived & ad-hoc project funding; usage is likely to pick up after the end of the EDIT contract
 - barriers: insufficient willingness to devote core resources to maintaining and developing the e-infrastructure for modern taxonomy
 - solution: move support of critical items from grant funding to core support with ring-fenced money and make this a key element of institutional policy documents; exchange services with several institutions focussing on strengths (e.g., BGBM Berlin: CDM data store & portal supported for 5 years)
 - potential benefit: governments may see that e-infrastructure elements like the cybertaxonomy platform are core business for modern taxonomic institutions and may become convinced that it requires long-term infrastructural funding; a benefit for governments providing the funds is the increased taxonomic output and the improved linkage to societally relevant functions (e.g., species registers; monitoring)

25. Ensure the long term sustainability of pan-European species checklists

- risk: national species registers not working according to European standards and lacking long-term financial support
- barrier: insufficient credit given to museum staff for populating biogeographical and species databases
- solutions: PESI facilitates and gives the means and standards to national focal points to function in an optimal manner, dependent on local ambitions; support an expert network society (actually SMEBD) for the long term governance (ownership / IPR / copyright) of taxonomic e-data; MoU to be signed by directors on giving credit/merit to their staff for contributions to international databases, PESI and related activities (e.g., see the Smithsonian's decision on EoL)
- benefit: national focal points / species registers that work according to European standards are in agreement with existing and upcoming EC regulations on biodiversity related issues (pest control, environmental control, water quality, etc.) for effective implementation of European policies at national level

SUMMARY OF BENEFITS

The table below summarizes some benefits in a non-exhaustive manner, with tentative amounts of cost-saving in terms of staff fte and other expenses. The sum is a staggering 1.4 M euros that could be reinvested in joint operations. This is a high number, but it possibly represents only 0.2% of the total budget of EDIT institutions (c. 700 M euros ?). The main potential areas for cost-saving are small journals and not wasting money on developing local thesauri.

<u>description of benefit</u>	<u>estimated annual cost-saving (kEuro)</u>	<u>arguments</u>	<u>reinvestment</u>
stop small journals & organise European taxonomists	680	EDIT institutions hold >70 journals, of which possibly 20 can be discontinued; on average 0.4 fte (editorial, lay-out) & 10 kE printing costs saved annually	high-profile European taxonomic journal & online data repository; consider linking to a European Systematics Association; staff fte's dedicated to journal, association & PA activities (editorial, layout, website)
coordinate collection digitisation	50	coordination => less duplication of effort => reserve a fixed % for European coordination within neutral budget	coordination; European collection managers forum; collections expert panel after 2013 (now SYNTHESYS)
coordinate DNA-barcoding	100	coordination & joint LIMS development => less duplication of effort => reserve a fixed % for European coordination within neutral budget	coordination; interoperability of LIMS
coordinate BHL/ BHLc /EoL contributions	50	coordination => less duplication of effort => reserve a fixed % for European coordination within neutral budget	coordination; non-WOS staff metrics
common taxonomic information backbone / names architecture / thesauri	400	can be used in each institution and may save 20 kEuro per institution; link to species registers (PESI)	coordination; interoperability
co-financing large labs	100	many institutions are purchasing sophisticated labs; co-financing in combination with regional user plans would reduce costs	remote access (microscopy, SEM, TEM)
collections self-evaluation system	50	using system being developed by SYNTHESYS reduces staff efforts to develop self-evaluation system	improve staff competencies
total (kEuro)	1430		
left after coordination?	600	(re)invest !	

CRITICAL OPERATIONS NEEDING INVESTMENT

The table below summarizes some areas to invest in, with the highest expenses in the EDIT front office. Possibly, the shared service mechanism can be merged with the front office.

<u>description of investment</u>	<u>estimated annual investment (kE)</u>	<u>arguments</u>	<u>spin-off / products</u>
front office	300	<i>see BoD documents, Portugal, Dec. 2009</i>	lobby at science-policy interface; website; visibility at key meetings (e.g., EPBRS, SciColl, SPNHC)
shared service mechanism	100	coordinator	in-kind solution => no tax to be paid; staff & expertise exchange
improve staff competencies	100	English language courses focussed on collections management & data curation; many courses based on SYNTHESYS, etc.	higher skills and interoperability (e.g., English; standards); easier staff exchange
travel grant system	50	exchange programme for scientists and collection staff	higher scientific output; improved staff skills
DEST, summer school	50	coordinating teaching activities takes staff time and can hardly be covered by fees	new generation of taxonomists
remote access (microscopy, SEM, TEM)	100	increase access by allowing scientists to view, manipulate and analyse specimens through internet	less travel time, higher efficiency
total (kEuro)	700	largely covered by benefits!	

FOLLOW-UP ACTIONS

The list of items in this report is not exhaustive and is largely based on the author's personal opinion. The report is open to comments and an updated version taking all comments into account will be produced during EDIT's final year.

If the general gist of this report is accepted, a small team could also make a better analysis of the actual and potential benefits.