

Abstract, to be included in the Annex 3 document

Sub-Thematic Priority most relevant to your topic[1]:

1.1.7.i Knowledge based societies (Varieties of paths towards a knowledge society)

Other relevant Sub-Thematic Priorities[2]:

1.1.2.iv Knowledge and Interface Technologies

1.1.2.i Applied IST (Cultural Heritage)

The European Mathematical Society seeks the support of the European Union in contributing to the Digital Mathematics Library, in the framework of an international endeavour endorsed by national mathematical societies in Europe and by the International Mathematical Union. This will be Europe's contribution to a world-wide project to digitise all the mathematical literature, with further support from non European funding agencies like the National Science Foundation in the United States. This project will have a strong impact on the way mathematics is done and used in the 21st century. The outcome will be a digital collection representing a significant amount of Europe's Cultural Heritage, an enhancement of existing Knowledge and Interface Technologies, and an important path towards a Knowledge Society.

A Digital Mathematics Library

Expression of Interest to the European Union
submitted by the European Mathematical Society

Mathematics is unique among the sciences in its dependence on the past scholarly literature. Therefore, the world-wide mathematical community pursues to digitise the existing scientific mathematical literature in order to create a Digital Mathematics Library available on the Internet to all mathematicians in the world.

For this reason, the European Mathematical Society seeks the support of the European Union in contributing to the Digital Mathematics Library, in the framework of an international endeavour supported by national mathematical societies in Europe and by the International Mathematical Union.

The Digital Mathematics Library (DML) will be a comprehensive collection comprising both retro-digitised and natively digital documents. It is meant to serve the scientific communities, the students and, more generally, the citizens worldwide, by providing easy and efficient access to a large corpus, and in particular to the important European heritage of printed materials. The total volume of the mathematical literature world-wide is estimated at 50 million pages. This is a large volume, but it is manageable by a world-wide effort.

The raw data in the DML should be freely available to all on the Internet, as far as copyright rules allow. It is expected that mathematics institutions, learned societies, or publishers, will enhance the collections by providing added value such as organization, cross-linking and derivatives of scientific interest.

**Mathematics, its dependence on the past literature,
and the expected impact of the Digital Mathematics Library:**

As other sciences, the discipline of mathematics is rapidly growing and relies intensively on computation. However, it is unique among the sciences in its

longevity of results and methods. Ideas and techniques for solving contemporary problems in mathematics and other sciences often come from mathematical works published in the distant past.

The mathematical literature is at present not generally available. Due to the wars of the last centuries, serious gaps exist in the collections of many libraries. Moreover, available literature is often only locally accessible and not always referenced in electronic form. The Digital Mathematics Library will provide easy and efficient access to the whole mathematics heritage, in particular for developing countries.

Since the 17th century, mathematics has played an important role in the physical sciences and in technology by providing tools to organize, analyse, compute and predict. More recently, mathematics has assumed a similar role in the quantitative aspects of the life sciences. The role of mathematics in technological development is increasing every day.

We expect the Digital Mathematics Literature to have a significant impact on the way mathematics is done and used in the 21st century, an impact which could be similar to that of the emergence of scholarly journals. We expect the Digital Mathematics Library to have a strong impact on the advancement of other sciences as well.

Towards a unified global programme:

Some digitisation programmes are already at work in Europe:

- DIEPER (Digitised European PERiodicals, several European university and national libraries, lead by SUB Göttingen)
<http://gdz.sub.uni-goettingen.de/dieper/>
- ERAM (Electronic Research Archive for Mathematics)
<http://www.emis.de/MATH/JFM/JFM.html> in Germany
- Gallica (Bibliothèque nationale de France)
<http://gallica.bnf.fr/>
- Göttinger Digitalisierungszentrum
<http://gdz.sub.uni-goettingen.de/>
- Mathematical Institute of SANU (Belgrade)
- NUMDAM (NUMerisation de Documents Anciens Mathématiques)
<http://www-mathdoc.ujf-grenoble.fr/NUMDAM/> in France
- Österreichische Zentralbibliothek fuer Physik

or in the United States of America:

- JSTOR <http://www.jstor.org/>

- Collections of digitised mathematics books are available at Cornell University and Michigan University
<http://www.math.cornell.edu/> and <http://www.lib.umich.edu/>

A project with transatlantic co-operation is the "Distributed Digital Library of Mathematical Monographs" (<http://www.library.cornell.edu/mathbooks/>), funded by NSF and DFG. But in general, although contacts do exist between the institutions involved, these digitisation projects are mostly unrelated and are not based on common standards. Furthermore, the number of available documents in digital form is very small compared to the wealth of the mathematics literature.

In view of the necessity of past mathematics literature for current research, it is essential to design a clearly identified and coordinated international digitisation programme overarching national or regional initiatives with standards and general principles.

For that purpose, in this summer an international group including European representatives will start detailed planning for such coordinated efforts (meeting funded by US National Science Foundation).

In view of the importance of its mathematical heritage and its size (both in terms of published serial titles and books and in terms of library holdings) Europe cannot afford to be left out of this enterprise and should in fact play a leading role.

A European digitisation organisation for mathematics:

Members:

- European Mathematical Society
- Libraries: Mathematical Institute of SANU (Belgrade), Österreichische Zentralbibliothek fuer Physik, Réseau National des Bibliothèques de Mathématiques (France), SUB Göttingen, Swiss consortia of libraries,
- Learned societies: Deutsche Mathematische Vereinigung, London Mathematical Society, Société Mathématique de France, Société de Mathématiques Appliquées et Industrielles
- Publishers: Cambridge University Press, Springer Verlag

New members will enter at a later stage, e.g.,

- Associated countries
- Industrial partners (companies specialised in digitising)
- IST research teams

Consortium agreement:

Members agree to participate in digitising a substantial part of the mathematics literature, directly or through subcontractors, in the framework of the international endeavour (under conditions to be detailed).

Organisation *(to be fixed in consortium agreement):*

- Governing council: members will have voting rights: (a) one vote for each member
(b) size of votes according to their input to the project
For acceptance, majority in both (a) and (b) separately are necessary.
- Project manager (full time scientist)
- Administrative assistant (full time)

The project will have European representatives in the committees that will be set up in the framework of the world-wide endeavour.

Planning:

- Design (two years: identify contents, decide priorities, address copyright issues, define standards)
- Implementation (three years: set up the data base, digitise raw material, build specialised search interface, build distributed systems)
- Sustained operations (archiving and format migration)

Financial contribution from the EU:

Financial contributions to the project will come from the members and from the EU, on a basis to be defined in the consortium agreement. These financial contributions will cover manpower (design, implementation), overhead and actual treatment (scans, optical character recognition, search interfaces and specialised software) for a large bulk of the literature.

The total budget for the project is 16 million Euros.

Expected output of the project:

- i) It is expected that up to 8 million pages will be digitised within the project, depending on the treatments that will actually be applied to the printed material.
- ii) Tools (programs, standards) will be developed that will make it easy for the mathematical community world-wide to continue the digitisation programme in the future and to take care of the sustained operations.

- iii) Apart from the DML itself, as a set of digital collections representing a significant amount of Europe's Cultural Heritage, which will dramatically improve the working conditions of the scientific community, we expect that this project will have a strong impact on the way mathematics is done and used in the 21st century.

In particular, considerable scientific benefit for research in the Knowledge and Interface Technologies can be expected. Indeed interesting applications will arise from the digitisation programmes like optical recognition of formulas or structures, seamless interaction between library data and computer algebra systems, intelligent search machines, new formats, and others.

- iv) The total digitisation of the literature of a whole scientific discipline could well serve as a reference model for other sciences and areas. Developed methods and tools could be adapted and used in order to enhance the scientific infrastructure and will build up an important path towards a Knowledge Society.