

A Comparative Analysis of E-Collaboration Research Funding in the European Union and the United States

Ned Kock

Division of International Business and Technology Studies
Texas A&M International University
5201 University Boulevard
Laredo, TX, 78041, USA
Tel.: +1-956-326-2521
Fax: +1-956-326-2494
E-mail: nedkock@tamiu.edu
Web page: www.tamiu.edu/~nedkock

Pedro Antunes

Department of Informatics - Faculty of Sciences
University of Lisboa
Bloco C6 - Piso 3
Campo Grande, Lisboa, 1749-016, Portugal
Tel.: +351 21 750 06 05
Fax: +351 21 750 00 84
E-mail: paa@di.fc.ul.pt
Web page: <http://www.di.fc.ul.pt/~paa>

Abstract

Much of the funding for research and development initiatives in the area of e-collaboration comes from government agencies in various countries. Government funding of e-collaboration research in the European Union (EU) and the United States (US), in particular, seems to be experiencing steady growth in recent years. In the EU, a key initiative to promote governmental investment in e-collaboration research is the Collaboration@Work initiative. This initiative is one of the EU's Information Society Technologies Directorate General's main priorities. In the US, government investment in e-collaboration research is channeled through several government branches and organizations, notably the National Science Foundation. There are key differences in the approaches used for government funding of e-collaboration research in the EU and US. Among other differences, the EU model appears to foster research that is aligned with the action research tradition, whereas the US model places emphasis on research that is better aligned with the experimental research tradition.

Keywords: European Union, United States, Research Funding, New Working Environments, E-Collaboration

Investment in ICT research in the US and EU

Information and communication technologies (ICT) have been among the main drivers of both the European Union (EU) and United States (US) economies. In the last 30 years, they have been the source of a significant growth in labor productivity in the manufacturing sectors of both the EU and US. In the service sector, ICT have not had the same impact in terms of labor productivity improvement. Yet, they have revolutionized delivery models, and allowed for a tremendous growth in revenues generated by service organizations. This is reflected in the size of the service sector of the economy, which now account for most of the jobs and wealth generated in both the US and EU.

Given the above, one would expect investment in research on ICT to be significant, which seems to be the case in both the EU and the US. There have been many estimates of investment in ICT research in the EU, in both the public and private sectors (EC, 2005). Some of those estimates point at \$28 billion as a recent figure for total annual private sector investment in ICT research. The same estimates put the EU's public sector investment in ICT research at around \$10 billion. By comparison, the private sector in the US invests over 3 times more; and the public sector about 2.5 times more.

The above differences become even more significant when we take into account differences in population size. While in the EU the total investment in ICT research per person annually is estimated at about \$100, including both the private and public sectors. In the US, that investment is likely to be over \$400.

Not surprisingly, there is a general perception among research funding agencies in the EU that it is lagging behind the US in terms of its ICT development and use capabilities. This is a major source of concern in the EU, because ICT are perceived as a major driver of labor productivity improvement (EC, 2005b), accounting for as much as 40 percent of the variation in labor productivity in recent years. (In the US, ICT are perceived as accounting for an even higher percentage of variation in labor productivity, namely 60 percent).

E-collaboration versus ICT research

E-collaboration can be defined as collaboration among individuals engaged in a common task using electronic technologies. As such, e-collaboration can be seen as an “umbrella” term that can be used to refer to a range of fields of research, such as those of computer-mediated communication, computer-supported cooperative work, and group support systems (Kock, 2005; 2008).

Some examples of e-collaboration technologies are e-mail, group decision support systems, instant messaging, web-based bulletin boards, teleconferencing suites, and supply-chain management systems. E-mail, arguably one of the most widely used computer applications today, is an e-collaboration technology aimed at supporting fast and relatively simple forms of communication. Certain e-collaboration technologies are more geared at supporting complex communication and decision making, such as group decision support systems. Other e-

collaboration technologies, such as supply-chain management systems, are aimed at supporting the flow of information among various departments engaged in the production and delivery of goods and services.

There are many areas of ICT that are not seen as directly related to e-collaboration. Some examples are database and telecommunications technologies. There is a great deal of research being conducted aimed at the development of new database technologies. The same is true for telecommunications technologies. Incidentally, both database and telecommunications technologies are necessary for the implementation of e-collaboration technologies.

Nevertheless, research on e-collaboration has been steadily increasing in importance recently. Evidence of this, as recently as 2005, comes from two key publication initiatives. One is the establishment of a new journal dedicated to e-collaboration research, the *International Journal of e-Collaboration* (Kock, 2005). The other initiative is the publication the Special Issue on Expanding the Boundaries of E-Collaboration of the prestigious journal *IEEE Transactions on Professional Communication* (Kock & Nosek, 2005).

Much of the past and recent research on e-collaboration falls into one of two broad categories: (a) applied research, which often attempts to provide solutions to technological problems; and (b) behavioral research, whose main goal is to understand how e-collaboration technologies affect group behavior. The former type, i.e., applied research, is often favored by industry; while the latter type incorporates elements (see e.g., Rosenthal & Rosnow, 1991) that make it more prevalent in academic journals such as the ones mentioned above.

The European Research Framework Program

The European Commission is the executive branch of the EU, which comprises 25 European countries – Austria, Belgium, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Poland, Portugal, Slovakia, Slovenia, Spain, Sweden, and the United Kingdom.

The European Commission finances ICT research mostly through the Information Society Technologies Directorate General, currently concluding the 6th Framework Program, which covered the period from 2002 to 2006. This Directorate General adopts two fundamental objectives: strengthen the scientific and technological bases of the EU industry, and encourage the EU international competitiveness. However, these objectives are combined with other policies, the fundamental one being the subsidiary principle: projects must have a trans-national nature and be inclusive in terms of members' participation, which includes the EU, candidate and affiliated countries. The international successes of the Global System for Mobile Communications (usually referred to by the acronym GSM) and Airbus technologies have been considered exemplary of the European research approach.

The Information Society Technologies Directorate General integrates several research and development instruments and thematic priorities, assembling a very complex framework. The available instruments include Integrated Projects (large-scale, focusing on technology integration and public-private partnerships), Networks of Excellence (large-scale, basically supporting

researchers' mobility) and Specific Targeted Research Projects (smaller and focused). The thematic priorities are further organized in vertical issues, such as e-Health, e-Inclusion, cognitive systems, nano-technologies; and horizontal issues, including specific research for small and medium enterprises (also referred to as SMEs), research helping the formulation of European Commission policies and support to international cooperation activities. The thematic priorities are approved after consultation with advisory groups invited by the European Commission and web-based public consultations. The gap between the production of consultation reports and project submission deadlines is about one year.

The European Commission's interest in financing e-collaboration research emerged as a confluence of various concerns defined at a political level. One notable example is the so-called "Lisbon Agenda", a political statement about how to improve European competitiveness, developed in the year 2000 in Lisbon. The primary concern is the development of pan-European ICT infrastructures and services, including interoperability and multi-lingual support. Another important concern reflects a user-centered view of work, focusing on the "quality of experience" and seamless integration of co-workers through technology.

The Collaboration@Work initiative

The Collaboration@Work initiative is one of the Information Society Technologies Directorate General's main priorities. Its focus is on research proposals that address the development of an "upper-layer" collaboration platform, residing on top of middleware platforms currently offering basic collaboration services such as person-to-person communication, web services, remote object invocation, persistency, reliability, and security (Laso-Ballesteros & Salmelin, 2005). This upper-layer would allow co-workers to orchestrate their work while moving between different work contexts, places and connected/disconnected modes. The underlying services would be used in a flexible way and customized to the users' communities.

The proposed vision is that a large "suite" of collaborative activities will seamlessly utilize the upper-layer collaboration platform. These are expected to include e-business, e-commerce, e-manufacturing, e-government, e-health and e-learning initiatives. The standardization of collaborative activities and services is considered necessary and regarded as strategic for obtaining critical mass and giving leadership to Europe in the e-collaboration field.

The Collaboration@Work initiative specifically indicates several technical challenges regarded as necessary to accomplish the above vision and expected to be present in the proposals. These include the development of reference architectures for collaboration at work; high-level orchestration and composition of collaborative services; support mobility and ubiquity; and ontologies for semantic interoperability.

The research proposals must also combine three additional key attributes. They are expected to be ambitious in terms of their expected technological impact on the society and on SMEs, which are operationally defined as organizations with less than 250 employees and "turnover" (equivalent to "revenues" in the US) of approximately \$60 million. In fact, research projects that do not only involve but are led by SMEs are quite welcome. Also, proposals are expected to involve a broad practical implementation component, carried out cooperatively by a variety of

organizations from different countries. And, proposals are expected to include a “demonstration” component, where the impact of the research on individuals, organizations, and society is clearly demonstrated.

Funding priorities and criteria in the EU

Proposing highly innovative ideas, with high potential industry impact, is not, in and of itself, a sufficient condition for obtaining funding from the Information Society Technologies Directorate General. It is mandatory that the identified research objectives be fully aligned with the thematic priorities. An interesting consequence of this supplementary criterion is that most times highly innovative ideas appear “behind” other fairly common research goals, many times shared by several proposals. The situation is even more complex if we consider that “horizontal” goals must also be explicitly addressed by the research, where the expected technological impact on SMEs assumes a critical importance. Our general observation is that under these conditions the projects’ research objectives tend to be both broad and somewhat homogeneous.

The publication of project results in journals and conferences is not seen as very important. On the contrary, project proposals should identify a list of technical reports, usually associated to the project’s milestones, which tend to be carefully scrutinized both during the evaluation and review. The funding criteria also emphasize the evaluation of project outcomes through what are called “large-scale demonstrators” (i.e., applied sub-projects), instead of controlled or semi-controlled empirical experiments. For instance, the Collaboration@Work initiative requires that Integrated Projects adopt a new evaluation method designated “living labs.” Living labs consist of community-wide environments (such as rural areas) where systemic innovation may be experimented and evaluated in a fairly open and interdisciplinary way. Although this idea is quite interesting, the evaluation context often tends to be highly exploratory.

The proposal submission and evaluation process also has interesting and defining characteristics. First of all, it should be mentioned that the overhead associated with documenting the project proposal is generally very high. There is no page limit specified for the proposals, which quite often go beyond 100 pages; and the list of requested items goes beyond scientific issues, often comprising organizational, management and administrative issues. Secondly, successful research projects must represent a balanced consortium, consisting of industry, SMEs, developers, research organizations and demonstrators. Experience with previous EU projects is also positively evaluated. Furthermore, the consortium should also reflect a good diversity of countries, either members of or affiliated with the EU. Consequently, each consortium tends to be quite large, often with more than 10 organizations.

Concerning the evaluation process, the adopted criteria require that at least three (five, in the case of Integrated Projects) evaluators analyze each project and reach consensus in one or more face-to-face meetings. Each meeting is usually preceded by a careful on-site reading of the proposal. Printed versions of the proposals are distributed to evaluators for review only in the building where the face-to-face consensus meetings take place, and cannot be taken outside that building. Moreover, evaluators are asked not to discuss the proposal they are reading with anyone prior or after the face-to-face consensus meetings. The only time in which proposals are

discussed by a larger group of evaluators, which can be more than 40, is when a shortlist of proposals is ranked. This is done in one large face-to-face meeting, which can last several hours.

In the cases where consensus cannot be obtained, additional evaluators are invited to analyze and discuss the proposals. This approach is fair, but is also time consuming and quite expensive, considering that the reviewers must travel from all over Europe, and stay in Brussels for a relatively long period of time (e.g., a week). European Commission officials carefully and systematically instruct the reviewers to stay in line with the thematic initiatives, vertical and horizontal objectives, and technical challenges specified by the Information Society Technologies Directorate General program for which they are serving as evaluators. The aim is to evaluate all projects consistently, but the approach necessarily reduces the reviewers' latitude of decision. It could be argued that wider decision latitude would be important in situations where the project proposals deviate from the norm.

A comparison with the US model

Table 1 summarizes the discussion above regarding characteristics of the funding model adopted by the EU. It also contrasts key elements of that funding model with that employed by the main equivalent funding agency in the US, namely the National Science Foundation. The term "principal investigator" is used to refer to the researcher who is the main coordinator of a research project.

Table 1: Priorities and criteria for funding in the EU and the US

EU (European Commission)	US (National Science Foundation)
Funding is provided to a consortium involving several organizations from different EU countries. Often more than 10 organizations and countries are represented.	Funding is provided to a principal investigator and co-investigator, which usually are based in universities and/or research centers. Often less than 3 organizations from the US are represented.
Emphasis is placed on integration with other research projects and broader EU initiatives.	Self-contained projects of high scientific impact are quite welcome.
Explicit emphasis is placed on desirable peripheral impacts of the project, such as impact on SMEs, gender diversity, and rural development.	Explicit emphasis is placed on the research component of the project, with some interest in minority inclusion and diversity, and the project's relationship with education activities.
Publication of results is not seen as very important. Development of tools-methods and their practical use is. The expectation is that practical use will be part of the project.	Publication of results is seen as fairly important. Less emphasis is placed on practical use of tools-methods as part of the project. The idea here is that the tools-methods will be disseminated through publications, and later used by non-project participants.
Less emphasis is placed on a controlled or semi-controlled empirical evaluation of impacts of the research project. Controlled laboratory experiments are not very welcome.	More emphasis is placed on a controlled or semi-controlled empirical evaluation of impacts of the research project. Controlled laboratory experiments are welcome.
No strict limit on number of pages in proposal.	Usually limited to 15 pages, with additional material provided in appendices.
More guidance is provided to expert reviewers, and stricter interpretation of rules is expected.	Less guidance and more leeway on what to look for as "good" elements are left at the discretion of the expert reviewers.
Evaluation is by consensus meetings where all expert reviewers have to unanimously agree on a score in connection with an aspect of a proposal (e.g., quality of consortium, impact etc.). Unanimous consensus is required for a funding decision to be made.	Evaluation is conducted by expert reviewers independently at first, based on an online version of the proposal. A group discussion is conducted at the end. Unanimous consensus is not needed for a funding decision to be made.
Evaluation process is very expensive and time consuming. Expert reviewers are brought in from several countries (including countries outside the EU), and work together for several days or more (often several weeks).	Evaluation process is relatively inexpensive and not very time consuming for reviewers. Expert reviewers work together for a day, after they produce their independent reviews.

As it can be seen from Table 1, there are key differences in the funding models employed by the EU and the US. It is beyond the scope of this chapter to provide a detailed discussion of the merits of each funding model, or a detailed analysis of the likely consequences of each model in terms of research impacts on ICT development in the EU and the US. While such discussion would undoubtedly add value to the chapter, the complexities associated with such a broad comparison would probably be better addressed through a book-length publication. Also, much

more consultation is needed with researchers in the EU and US to produce such a detailed discussion. Hopefully this chapter will provide the motivation for this and other related initiatives.

Interestingly, one could argue that the EU model fosters research that is better aligned with the “action research” tradition (see, e.g., Kock, 2003; 2006), in which inquiry is seen as aimed at having a positive impact on the participating organizations and society at the same time as the investigation is being conducted. The US model arguably fosters research that is better aligned with the “experimental research” model, whereby inquiry is guided by the goal of testing theory and related hypotheses either in laboratories or the field.

It is important to note that comparing the European Commission with the National Science Foundation presents several challenges, which means that the discussion presented in this chapter should be examined with some caution. One of the problems is that there are other research funding bodies in the EU other than the European Commission. The situation is the same in the US, with several other research funding organization other than the National Science Foundation; e.g., DARPA, Office of Naval Research, Army Research Institute, Air Force Research Laboratory. Nevertheless, it seems that the National Science Foundation, due to its breadth of research coverage, is the organization the fits best the notion of a US counterpart of the European Commission in the EU.

It is also important to note that comparing the EU with the US leads to some unavoidable limitations in the conclusions drawn from that comparison. While the EU and the US present some macro-level similarities, such as economic size and overall level of development, they also are different in many aspects. While the EU is a multination body with diverse constituents, the US is one single country. (Although some would argue that there is a lot of diversity among the States that make up the US – e.g., a visit to the southern part of Texas may conceivably look like an overseas trip to a New York State resident). Also, many different languages are spoken in the EU, whereas in the US English is spoken by the vast majority of the population. (Spanish is also spoken, but far behind English, and is often spoken among bilinguals).

Conclusion

Investment in ICT research seems to have been growing both in the US and EU, which is likely a direct consequence of the fact that the ICT sector of the economy has also been one of the main wealth and job creators in both the US and EU. There is a general perception that the EU is trailing behind the US in ICT research investment. This is true both in absolute amounts invested, as well as in per-capita terms. The lag in terms of per-capita ICT research investment is more accentuated, since the EU population is about 50% larger than that of the US.

The area of research and industry development known as e-collaboration generally comprises electronic technologies and related methods that enable collaboration among groups of individuals engaged in common tasks. While not all ICT research involves e-collaboration study, investment in both ICT and e-collaboration research seem to go hand-in-hand. In the EU, a key initiative to promote governmental investment in e-collaboration research is the Collaboration@Work initiative. This initiative is one of the EU’s Information Society

Technologies Directorate General's main priorities. In the US, government investment in e-collaboration research is channeled through several government branches and organizations, notably the National Science Foundation.

When we look at e-collaboration funding priorities in the EU and US, some marked differences emerge. EU funding seems to be more geared at promoting large applied projects, modeled on the action research tradition, with broad organizational participation. In the US, funding seems to be geared at promoting focused projects modeled on the natural sciences approach to inquiry, often involving only one or a few research organizations. The process of selection of research proposals for funding in the EU is significantly more expensive and consensus-oriented than that adopted by the US. That process also relies on published guidelines a lot more strongly in the EU than in the US.

Which is the "best" e-collaboration research funding approach, the one employed by the EU, or that employed by the US? The answer to this question is a lot more difficult to provide than could be inferred at first glance. If we look at the societal and organizational impact of research projects, while the projects are being conducted, one could argue that the EU approach is better, given its action research orientation. Besides, its focus on multi-organizational collaboration in large research projects is well-aligned with what many see as the ultimate goal of e-collaboration research – to allow for seamless collaboration among individuals who are geographically distributed and yet have to accomplish joint tasks.

However, one could argue that under the EU model research goals are more strongly defined and enforced by European Commission officials than in the US, thus decreasing the research funding system's flexibility while increasing latency. Furthermore, the more focused US approach arguably creates and strengthens focused centers of excellence contained in single organizations. Past experience suggests that work in these focused centers ends up leading to the development of breakthrough technologies. One example that could be mentioned here is the largely government-funded National Center for Supercomputing Applications at the University of Illinois in Urbana, whose research led to the development of the first graphical browser for the World Wide Web. That Web browser, dubbed Mosaic, opened up the doors for the Internet technological revolution, whose developments underlie many of the ideas behind government funding of e-collaboration research in both the US and EU.

Two reasonable conclusions that one could reach trying to answer the question as to which government e-collaboration funding approach is better are that: both, the EU and US funding models, are likely to lead to highly desirable results; and each approach has its pros and cons. Given that, perhaps they could be made a little more like each other. For example, the research proposal selection approach employed by the EU could be made less expensive by employing a combination of online and face-to-face consensus meetings. The approach employed by the US could be made more applied, by the funding agencies placing more emphasis on problem-solving aspects of projects in their selection of proposals to be funded.

We hope that this discussion brings to light the differences in funding approaches in the US and the EU, and promotes more discussion about the merits and consequences of each of the key defining characteristics of each approach. More than anything, we hope to see in the future more

funding of e-collaboration research in both the US and EU, without which neither will make progress in the development of e-collaboration technologies and methods or the understanding of the impact of those technologies on individuals, groups and society.

Acknowledgements

A previous version of this chapter has been published in the *International Journal of e-Collaboration*. The authors thank Isidro Laso-Ballesteros and Bror Salmelin, both officers with the EU's Information Society Technologies Directorate General, for several discussions that formed the basis for this chapter. Those discussions gravitated around ways in which the project proposal selection processes employed in the EU and US differ, and how each can be made more efficient. Thanks are also due to Arden L. Bement, Jr., Director of the National Science Foundation, for his comments on a previous version of this chapter and for information about the National Science Foundation's funding of e-collaboration research. The opinions expressed in this chapter are not meant to be presented as being shared by the EU or the US governments, their branches, or any of their officers. Any errors and omissions are the sole responsibility of the authors.

References

- EC (2005). *i2010 – A European Information Society for Growth and Employment*. Brussels, Belgium: Commission of European Communities.
- EC (2005b). *i2010 – A European Information Society for Growth and Employment: Extended Impact Assessment*. Brussels, Belgium: Commission of European Communities.
- Kock, N. (2003). Action research: Lessons learned from a multi-iteration study of computer-mediated communication in groups. *IEEE Transactions on Professional Communication*, 46(2), 105-128.
- Kock, N. (2005). What is E-Collaboration? *International Journal of e-Collaboration*, 1(1), i-vii.
- Kock, N. (Ed) (2006). *Information systems action research: An applied view of emerging concepts and methods*. New York, NY: Springer.
- Kock, N. (Ed) (2008). *Encyclopedia of e-collaboration*. Hershey, PA: Information Science Reference.
- Kock, N., & Nosek, J. (2005). Expanding the Boundaries of E-Collaboration. *IEEE Transactions on Professional Communication*, 48(1), 1-9.
- Laso-Ballesteros, I., & Salmelin, B. (2005). AMI-endowed collaboration@work. In G. Riva, F. Vatalaro, F. Davide, & M. Alcaniz (Eds.), *Ambient Intelligence: The evolution of technology, communication and cognition towards the future of human-computer interaction* (pp. 237-265). Amsterdam, The Netherlands: IOS Press.

Rosenthal, R., & Rosnow, R.L. (1991). *Essentials of Behavioral Research: Methods and Data Analysis*. Boston, MA: McGraw Hill.