

# Supporting the Initiation of Research Collaborations

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## Bio

I have studied Wirtschaftsinformatik at Technische Universität Dresden. After gaining my diploma in March 2006, I continued here with my doctoral studies. I have been working as a research assistant at the Chair of Information Management since 2006. My doctoral research focuses on eCollaboration in scientific research, with particular interest in open research and Web 2.0.

## Abstract

*This paper describes the background, objectives and methods of my doctoral research concerned with the support of the initiation of research collaboration with the help of information and communication technologies. The research is based on the assumption that providing more information about potential partners would lead to better-grounded decisions about collaboration. The purpose of this research is also to support and utilize Open Research. To address these aims, I suggest the design and creation of an ePortfolio that will aggregate information from the Internet, particularly Web 2.0 applications.*

**Key words:** *research, collaboration, ePortfolio, Open Research, Web 2.0, game theory*

## 1 Motivation and Context

Competition is ever present in research: in the employment of researchers, in the decisions about research funding, in the award of research prizes (compare [20] [23]). Yet, many researchers choose to collaborate with others rather than to compete (e.g. [3] [4] [5] [9] [11] [14] [22]). A number of reasons can motivate researchers to collaborate, including access to useful resources, increased time and cost efficiency or higher research quality (compare [1] [18] [20]). National and international organizations promote collaboration by funding collaborative research projects [20]. The questions triggering my doctoral research are: Why do researcher collaborations occur at all in such a competitive environment? How can the initiation of research collaborations be supported with information and communication technologies (ICT)?

To analyze the reasons for collaboration in a competitive environment, I use the game theory [15]. A researcher considering the possibility to collaborate with another in a research project is faced with a decision situation that can be simplified as a repeated “public goods game”. In the public goods game, the players have to decide, if and how much they want to invest into a particular public good. The investments are then summed up and multiplied with a constant value  $r$  (where  $r$  is greater than 1, but smaller than the sum of all players) and divided among all players. In a game with only two players, the public goods game has the structure of the “prisoner’s dilemma” [17]. By depicting the collaboration decision in this form, it is possible to analyze principle forces in the decision situation.

		Researcher 2	
		No collaboration	Collaboration
Researcher 1	No collaboration	(10; 10)	(13,75; 8,75)
	Collaboration	(8,75; 13,75)	(12,5; 12,5)

**Figure 1: Public goods game for research collaboration**

The matrix in fig. 1 shows a situation in which two researchers have the choice to collaborate or not to collaborate with one another. Each matrix field represents a situation arising from the combination of strategies chosen by the two researchers. In each situation, the researchers realize utility, resulting from the chosen strategies (shown in the matrix in the form  $(u_1, u_2)$ ). The utility  $u_i$  gives the value that researcher  $i$  realizes in a given situation. The utility covers a number of things, which have value for the researchers, e.g. finance, resources, jobs, reputation. In this simple example, I assume, that in the beginning of the game, each researcher has capital of 10 (just like utility, this capital describes not only financial means, but also resources, connections, reputation, staff etc). The researchers are faced with the decision to make an investment of 5 into collaboration, e.g. a research project. The sum of the investment will be multiplied with 1,5 and divided among the researchers, irrespective of their investment behaviour.

If both researchers choose to collaborate, they will both invest 5 and together lead the project to a successful end. They then both a profit of 7,5, leaving them with the final utility of  $u_1 = 12,5$  and  $u_2 = 12,5$  ( $u_i = 10 - 5 + 7,5$ ). If both researchers do not collaborate, they will gain no benefit, but also make no investment. They are left with the utility of  $u_1 = 10$  and  $u_2 = 10$  ( $u_i = 10 - 0 + 0$ ). If the researchers agree to collaborate, but only researcher 1 invests 5 from his or her resources, the project profit is 3,75 for each player. Researcher 1 then receives  $u_1 = 8,75$  ( $u_1 = 10 - 5 + 3,75$ ), while researcher 2 gets  $u_2 = 13,75$  ( $u_2 = 10 - 0 + 3,75$ ). The same situation vice versa occurs, if researcher 2 invests into the collaboration, but researcher 1 does not.

The game in fig. 1 thus shows that it is profitable for both researchers to collaborate with each other. The utility falls if they choose not to collaborate. However, the decision to collaborate is connected to a considerable risk: if only one of the researchers decides to collaborate, then this researcher will suffer losses, while the non-collaborative researcher will profit highly. In a single game, therefore, two rational players would both decide not to collaborate. If the game is repeated infinitely with the same partners, the researchers could strike an agreement: they could agree to

collaborate, as long as none of them tries to “cheat” the other one by making no investment. Once one of the researchers strays from the agreement and makes no investment, the other researcher would cease to invest into further collaborations. This principle, also known as “tit-for-tat” is based on direct reciprocity [21]. The players base their decisions on the past actions of their co-players, punishing disadvantageous behaviour and rewarding advantageous behaviour.

In a global scientific community, however, the collaborations are not always realized with the same partner. Very often, researchers are faced with unknown potential partners. However, it is possible, that other researchers have had experience with this unknown partner already. It would then be highly advantageous to be aware of past actions of the unknown partner in the previous collaborations. The researcher could then found the collaboration decision on the behaviour of the unknown partner toward other researchers (indirect reciprocity [16]). In some cases, the researchers may be able to gather the information about the unknown partner from their social network, if the unknown partner is in some way connected to it. But to rely solely on personal experience or even on the existing social network limits the potential that could be drawn from a global scientific community.

### **2 Problem and Purpose**

The conclusion, which can be drawn from the analysis of the game scenario, is that researchers need information about the potential partners in order to make a collaboration decision. This information should make it possible to make a prognosis about the future behaviour of the unknown partner in this particular collaboration. If the researcher has personal experience with the partner, he or she can base the prognosis on this experience. Otherwise, the experience of other researchers can be used. In the absence of one’s own experience or the experience of others, the researcher facing the collaboration decision can use information given by the partner himself or herself.

The scientific community has a tradition of structured means of communication through scientific publications [2] [8]. The publications can be a source of suitable information. The Internet can also be a source of further data that can allow researchers to form an opinion about their partners. Particularly suitable for the collection of data about a researcher can be Web 2.0 applications. Web 2.0 applications allow and encourage the self-presentation of individuals. With the help of the Internet and particularly Web 2.0, some researchers are already fully or partially engaged in Open Research (also Open Science, Science 2.0), sharing openly not only their research result, but also all information connected to the research process (raw data, research methods, results of experiments) as well as personal information. There are many examples of such profiling; in the following I will name just a few. Researchers can use social networking services like SciLink<sup>1</sup> or Academia<sup>2</sup> to publish basic information about themselves and their work and find interesting contacts. For example some researchers use Wikis like OpenWetWare<sup>3</sup> for the presentation of their research work. It is further possible to display ones research interests by sharing bookmarks

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<sup>1</sup> <http://www.scilink.com>

<sup>2</sup> <http://www.academia.edu>

<sup>3</sup> <http://openwetware.org/>

via social tagging services like Delicious<sup>4</sup> or CiteULike<sup>5</sup>. Many researchers have personal or researcher related blogs or post information about themselves in microblogging services like Twitter<sup>6</sup>. Discussions take place in services like FriendFeed<sup>7</sup>. Such amount of information is valuable to researchers facing the collaboration decision.

However, this information is dispersed on different Internet sites and thus difficult to find and analyze. Similarly, researchers who wish to publish information about themselves and their research are faced with additional effort of structuring and editing often-redundant data in different applications. The aim of my research is to design and evaluate an ePortfolio for researchers, which will address the above-described problem. An ePortfolio is understood here as a Web-based collection of data, related to a particular researcher and his or her research (compare [12]). However, it is not an objective to design a new service, leading to further effort for the researchers. On the contrary, the ePortfolio will function as an aggregator for existing information in the Internet. There are two possibilities to create such an ePortfolio: automatic collection of data and purposeful self-presentation. Automatic data collection and aggregation gives no extra effort to the researcher in question: it will simply allow and automatic aggregation of public data about a researcher. The researcher in question can influence the ePortfolio indirectly, by profiling the services that are used for the aggregation. Another possibility is to allow the researcher to actively create the ePortfolio, by registering and setting relevant services. This way, the researcher can influence his or her profile, but the invested effort will not greatly exceed a one-off time investment. The ePortfolio favours particularly researchers engaged in Open Research, because they already offer a number of information about themselves in the Internet: it gives them the opportunity aggregate this information at one point.

### 3 Methods

The research described in this extended abstract is based on the constructivist understanding of reality. It is therefore assumed, that individuals create subjective reality in a creative process of construction [7]. The influence over the subjective reality of other individuals (in this case over the opinion of potential collaboration partners) is limited and can take place only through communication [19]. The implication of this assumption for this research is that researchers looking for information about potential partners will create their own subjective opinion from the information they receive. It cannot therefore be the aim of this research to provide any objective judgment about a researcher.

The approach used is that of design science [10] [13]. This includes following steps:

- Identification and description of the problem,
- Demonstration that no adequate solution exists,
- Development and presentation of an ePortfolio, which addresses the described problem,
- Evaluation of the ePortfolio,
- Publication of the results of this research and

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<sup>4</sup> <http://delicious.com/>

<sup>5</sup> <http://www.citeulike.org/>

<sup>6</sup> <http://twitter.com>

<sup>7</sup> <http://friendfeed.com/>

- Explanation of the implications for the scientific community.

The aim is thus the solution of a particular problem through the design of an artefact: an ePortfolio for researchers. The ePortfolio is designed firstly on a conceptual level and then as a prototype. The evaluation takes place on both levels, thus following a cyclic design approach.

#### **4 Implications and Original Value**

As a project of design science, this research seeks to address a practical problem. In this case, the resulting ePortfolio reduces the transaction costs (particularly costs of information search) of a decision about the engagement in research collaboration with a particular partner. The theoretical exploration of the problem area results in a better understanding of the initiation of research collaborations and the role of Information and Communication Technologies (ICT), particularly Web 2.0, in this process.

The main value of this research lies in the construction of an ePortfolio, as a solution to the described problem: the search for and retrieval of information related to a particular researcher. To reach this aim, this research explores the role of information in the initiation of research collaborations, using the game theory. This approach differs from existing literature that focuses mainly on the collaboration results (measured through co-authorship) or on the collaboration process itself. This research can thus be counted among works exploring the possibilities of supporting research through ICT, viewing the ideal example of Open Research. However, Open Research is seen here not only as means of sharing scientific knowledge and thus benefiting the scientific community; Open Research is interpreted here as a communicative measure which also reveals information about the individual researcher. This information is used to construct a subjective opinion about the researcher in question following the principles of constructivism for the purpose of making a collaboration decision.

#### **5 State of My Research and Further Steps**

In my doctoral research, as described in this paper, I am currently still concerned with the problem description and demonstration that no adequate solution exists. I have introduced the problem exploration based on the game theory. This is however only one possibility. At the moment, I am reviewing literature concerned with collaboration in teams in general. To further establish my assumption, that providing information benefits collaboration, I am planning a field experiment to be carried out in October 2009 with students participating in an international virtual project. The next step to be taken after the exploration of the problem will be the design and the development of the ePortfolio.

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