

# Organizational Design of an IT-based Knowledge System: The NetAcademy Concept

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## Abstract

*The emergence of new media channels such as the World Wide Web has induced a profound growth in the publication of books, papers, pictures and hypertext documents. In addition to forming a large knowledge base, the NetAcademy (NA) is meant to provide a meeting place for the joint discussion of trends, the exchange of personal opinions and research results within a specific scientific field of research or interest.*

*Building up a compound knowledge system does not only require an adequate design and good technological implementation it involves also permanent engagement from a core of people responsible for news update, reviewing and feedback response. A smooth integration and automation of processes is therefore a key prerequisite for the successful maintenance and continuous attractiveness of the system.*

*The paper describes the realization of the NetAcademy platform dealing with its template-based design and the combination of different software tools such as e.g. Lotus Notes, InterNotes Web Publisher, Domino and Oracle/SQL. It illustrates the connections between the internal organization and the interaction with the knowledge medium, explaining how both can be optimized to mutually support each other.*

## 1. Introduction

Fostered by Information Technology and improved electronic storage devices, the production of knowledge has increased dramatically over the last decades. Computers provide the possibility to easily edit, extend, and replicate large amounts of information [10]. The emergence and great success of the World Wide Web [2] additionally stimulates the growth in global publication of books, papers, pictures and electronic hypertext documents, thus further increasing the speed of knowledge production and

dissemination. These developments pose serious challenges for the management and organization of knowledge bases and exacerbate the problem of finding the right information at the right time. While Internet services become popular to many users of „The Net“, difficulties with searching will get worse as the amount of information stored increases. This is mainly due to the problem of information overload, and vocabulary differences [5]. Moreover, it becomes increasingly difficult to judge whether and to what extent a given piece of information is accurate, up-to-date, reflects accepted opinions and/or has been reviewed by the scientific community.

### 1.1. Motivation and Target Audience

The idea for the project of creating a global „NetAcademy“ [9] originated in the academic sector. Researchers were and are still confronted with finding specific and accurate information on a daily basis. Information sourcing has become ever more challenging (more information but harder to find and select) due to the aforementioned developments. The collection, access, and use of electronic information in a variety of formats requires powerful supporting tools which we intended to implement in the Net Academy platform (<http://www.netacademy.org>).

The background of the Net Academy is the academic sector and hence the primary target audience are researchers and students but also practitioners all over the world. The initiating institution is the Institute for Information Management at the University of St. Gallen referred to as "the organization" in this paper. In addition to forming a large knowledge base, the Net Academy is meant to provide a meeting place for the joint discussion of trends, the exchange of personal opinions and research results within a specific scientific field of interest. In this sense, the NetAcademy complies with the same requirements as hypermedia management systems (HMS) discussed in Ashman

et al. [0] allowing for the dissemination, retrieval and review of information.

The architectural framework has already been described in a preceding paper [6]. The current paper focuses on the organizational design and the associated tasks of the team that operates the NetAcademy.

## 1.2. Explanation of Notions

### Knowledge Medium

According to Schmid [9] the NetAcademy (seen as an Electronic Knowledge Medium) is in its nature a new, interactive, and globally accessible information storage device based on a telematic infrastructure. It should cover the following scope of functionality:

- information storage device (comparable to books or papers in an organized form as today offered by libraries)
- process support for the generation of information (such as discussions in the scientific community, research publications, etc.)
- automation of processes (as they are today found in database management systems and organizational information systems)

### Digital Documents in the NetAcademy

Digital documents are the actual contents of knowledge media. According to Palmer [8] „Digital documents and digital libraries provide new opportunities for defining and delivering information to students and researchers“. Due to Palmer’s definition, the NetAcademy serves as a digital library but the uniqueness of the system does not only lie in the efficient representation of knowledge but in its interactive components which foster the cooperative processes within the system. The NetAcademy does not only store information but - due to its embedded interfaces and processes - serves also as a tool for the interactive generation of knowledge between different globally distributed participants. This means that the NetAcademy platform makes full use of the special characteristics of electronic documents thereby going beyond traditional concepts of digital libraries. The NetAcademy is a new form of knowledge medium which makes it possible to overcome the deficiencies of electronic documents as discussed in recent literature [8], especially the absence of contextual cues and markers to the origins of social meaning. Besides this, there are defined processes for the maintenance of a quality standard for the contents generated within the NA platform.

## 2. The NetAcademy Project

The term “academy” stems from the school for advanced education founded by Plato. Today the concept of an academy is often referred to as

*“a body of established opinion widely accepted as authoritative in a particular field” [7]*

Following up on the spirit of the ancient Greek concept of *Academia*, the term “NetAcademy” is meant to combine the ancient meaning with the ubiquitous electronic information sphere.

In the first phase of the NetAcademy project, the Institute for Information Management aimed at establishing three different academies related to its main research areas. These are:

### Business Media

Since 1989, the Electronic Business Media Group has been carrying out research on electronic markets and commerce, analyzing the impact of new media on commerce, reference models, logistics issues, and pilot projects.

### Knowledge Media

The representation of information, its semantics and inference mechanisms are the research interests this academy deals with.

### Media

This NetAcademy publishes research papers and discussions about how to analyze, define and manage the effect of the new media on society - on politics, economics, law and culture.

Today, there are a lot of powerful WWW publication and discussion tools available which enable virtually everyone connected to the Internet to participate in the information generation process on the World Wide Web. Search engines supply means of full-text search and indices but cannot guarantee *information quality*. Due to the increasing overload of information, retrieving only the updated and valid information has become the major challenge. The NetAcademy project aims at overcoming two major deficiencies of the Internet so that users will be certain about:

- the approved quality of information
- the maintenance of up-to-date information

Unlike traditional (paper-based) information, electronic information is expected to be up-to-date at any moment. Companies which provide information on Web Sites are often not aware that different rules apply to electronic media and run the risk of disappointing customers if they continue to up-date WWW-based information only with

the same frequency as they used to do for paper-based information.

With the above-mentioned deficiencies and risks in mind, a special concept was developed for the NetAcademy platform to guarantee a smooth integration of internal work processes. The following chapters deal with the basic organizational changes that were essential in order to establish the system. For further information on the content and technical structure of the NetAcademy platform refer to [6].

## 2.1. Research Issue

The main research issue which forms the basis of this paper is the following:

*How is it possible to design the internal processes of an organization so that it is optimized to support the generation and review of information to be stored in a common electronic knowledge medium?*

For the implementation of the NetAcademy platform, we decided to choose a combination of groupware technology (a self-developed Lotus Notes application) and supporting Web technology to establish the powerful knowledge database. The main idea was to foster the generation of small pieces of information thus enabling collaborative authoring (even on a global scale) with implemented background reviewing procedures.

## 2.2. Theoretical Background

Yates and Orlikowski [11] proposed using genres as a classification of organizational communication. Crowston and Williams [4] prepared a study on the use and frequency of the identified types of genres in the World Wide Web. In this context, the NetAcademy aims at the integration of all kinds of information regardless of the genres in order to present knowledge transparently to the user. The focus lies in taking advantage of the hypertext structure and the interactivity of multimedia documents as suggested by Crowston and Williams. „Second, multiple genres may be linked or embedded to form a more complex pattern of communication“. The final aim is to prevent the information suppliant from having to deal with different forms of genres offering a uniform interface which grants access to a range of different digital documents such as discussions, papers, and simple information pages. This should provide a certain familiarity with the NetAcademy and help to build up a new community around the knowledge medium as discussed by Yates and Orlikowski [11]. „Genres are useful because they make communications more easily recognizable and understandable by recipients“. The same applies for the NetAcademy, not only for the WWW-users but also for the management team because they have to deal with only one tool, i.e. Lotus Notes.

## 2.3. Genres, Technology and Implementation

Comparable to the three distinct genre systems „meeting documentation“, „collaborative repository“, and „collaborative authoring“ identified by Yates et al. [12] within a single company, the NetAcademy platform has four main information genres at its disposal (Table 1).

**Table 1: Genres and technology used**

Genre	Contents and examples	Technology used
<b>General information</b>	<ul style="list-style-type: none"> <li>Information on a research area (e.g. knowledge media)</li> <li>Theories, history, list of current discussions, activities, projects, news, etc. <i>www.knowledgemedia.net</i></li> </ul>	Lotus <i>Notes database</i> (published in HTML by Lotus InterNotes Web Publisher)
<b>Publications</b>	<ul style="list-style-type: none"> <li>All publications (papers, articles, books, dissertations, habilitations, etc.) indexed by author, date, research area, keyword, etc. <i>www.businessmedia.org/publications.html</i></li> </ul>	Combination of <i>Oracle/SQL database</i> (bibliographic information for indexing purposes) and a <i>Lotus Notes database</i> (interface for abstract and full text published in HTML by the Web Publisher)
<b>Discussions</b>	<ul style="list-style-type: none"> <li>Discussions on specific topics within a research area</li> <li>Open and closed discussion groups <i>domino.netacademy.org/discussions/emnews-letter/emnldisc.nsf</i></li> </ul>	Lotus <i>Domino database</i> (which generates HTML code on request)
<b>Information on participants</b>	<ul style="list-style-type: none"> <li>Participants' homepages used for references to authors and members of discussion groups <i>www.netacademy.org/participants.html</i></li> </ul>	Combination of <i>Oracle/SQL database</i> (for indexing purposes), a <i>Lotus Notes database</i> (for internal staff), and a <i>Lotus Domino database</i> (access for external participants via the Web interface)

A dedicated NA designer team ([www.netacademy.org/organization/nateam.html](http://www.netacademy.org/organization/nateam.html)) was formed in order to develop and implement the software for the NetAcademy platform. Those people, belonging to different groups within the organization were responsible for the design of the graphical interface, the system programming, as well as for the definition of the internal organizational processes (as described in the following chapter).

The following screenshot shows the homepage of the Business Media section. For the purpose of this paper, there are two important dimensions: the *horizontal navigation bar* which represents the current *organizational structure* of the institute (research fields), and the *vertical navigation bar* which guides the user through the *contents* of the selected research area. The small squares indicate the current position within the NetAcademy universe (in this example: selected research area: Business Media, selected content: Homepage).

- **Participants / Contributors**, homepages of the members of discussion groups and authors contributing to the Net Academy,
- **Contents**, divided in the following sub-sections:
  - *Theory*, definition of notions, reviewed and generally agreed upon knowledge,
  - *Publications*, papers, articles, abstracts, etc. from external and internal participants,
  - *Activities*, conferences, projects, meetings, etc.,
  - *Discussions*, on topics related to the selected knowledge area,
- **Search**, different kinds of search (full-text, keywords, etc.),
- **Feedback**, the possibility to get in touch with the people operating that particular Net Academy.

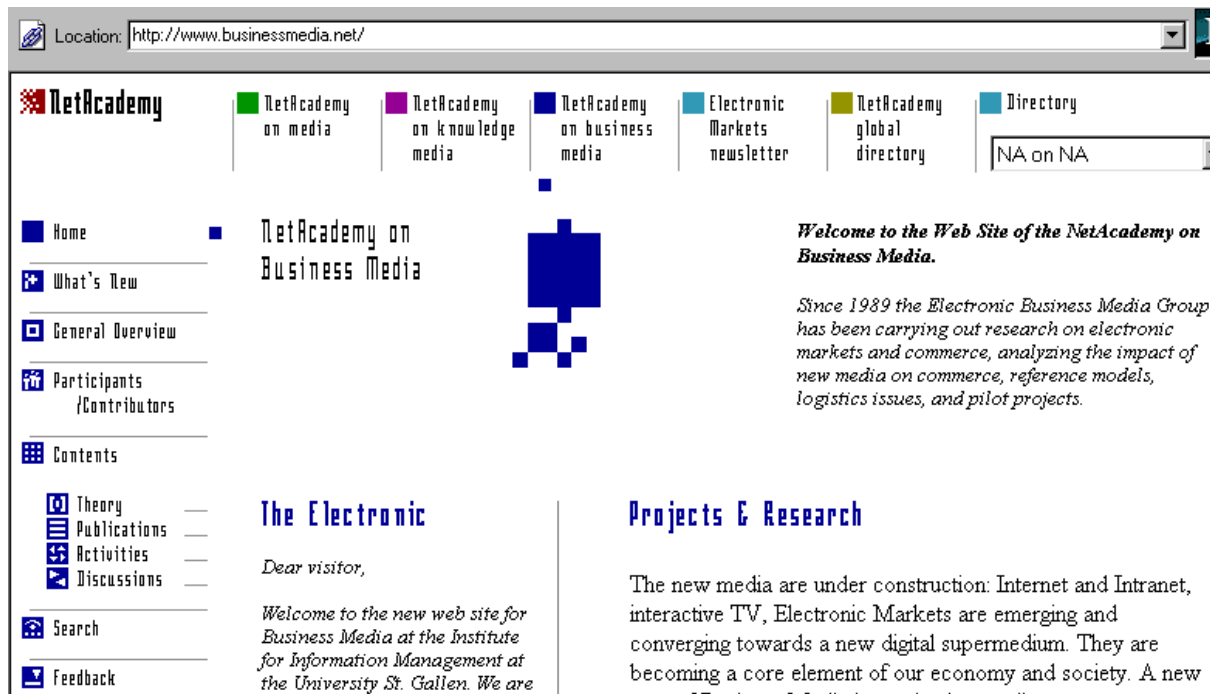


Figure 1. Homepage of the research field Business Media

The vertical bar guides the user through the NetAcademy contents. It offers the possibility to choose between:

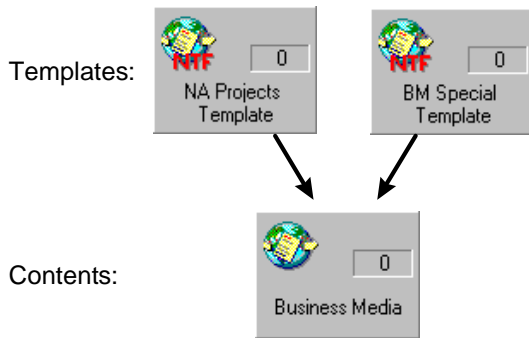
- **Home**, Homepage of selected research area,
- **What's new**, activities, news, calls for participation, etc.,
- **General Overview**, interesting facts about the selected NetAcademy,

## 2.4. Software Modules

In order to understand the organizational structure of the NetAcademy, we have to firstly take a look at the software modules. The NetAcademy platform is completely built upon templates, mostly in the form of Lotus Notes database templates which relate, again, to the above-mentioned genres:

### 1. General information

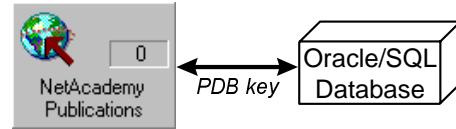
The database for the general information on a research area inherits its design from two different templates. There is a main NetAcademy template which contains forms and views for all the other Sub-NetAcademies (e.g. the NA on Business Media). Besides this, there is a special design template for each Academy which allows for additional special features within one knowledge area (e.g. a section for Call for Papers, [www.businessmedia.org/call-pap.html](http://www.businessmedia.org/call-pap.html)). To reduce the complexity of the system, these „unique features“ are preferably to be avoided. Nevertheless, there are some minor differences in terms of appearance between the different areas in the logo and the trailer section (link to homepage and respective editors) which are contained in the BM Special Template.



**Figure 2. The Contents DB inherits the characteristics from the two Notes templates**

### 2. Publications

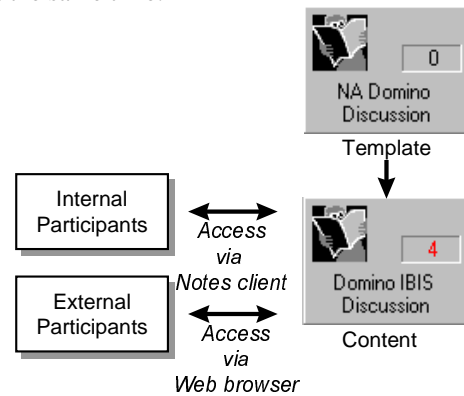
In order to supply a user-friendly interface for the input of publications on the one hand and a powerful search functionality on the other hand, we had to split up the publication database into an Oracle/SQL database (which contains the keywords and meta-information of the publication) and a Lotus Notes database (containing abstracts and full-text). One drawback of this solution is that the user is confronted with two different interfaces. In the first step, a Web information form must be completed in order to provide the user with a key for the Publication database. This key must be indicated when entering the abstract and full-text into the Lotus Notes database. There is an automatic background agent which handles new documents in the Lotus Notes database assigning the additional information from the Oracle/SQL to each document. The complete information is then published onto the Web server.



**Figure 3. Publication database**

### 3. Discussions

Each discussion is composed of a single Lotus Notes database. There is one master discussion template from which all discussion databases are derived. The discussion database serves as an interface towards Lotus Notes (internal participants) and Domino (external participants via Web) at the same time.



**Figure 4. Discussion database serves Notes client and Web browser simultaneously**

### 4. Participants

As mentioned earlier, participants of the NetAcademy have the opportunity to maintain personal homepages on the NetAcademy server. These pages have a multiple functionality. They serve as information on NA authors and are thus linked to the respective publications. Besides this, they inform discussion participants about their „virtual“ counterparts. The structure of the Participants database is similar to that of the Publications. There is an Oracle/SQL database containing meta-information. The actual information is stored in a Lotus Notes database. To be able to present an appropriate interface to internal as well as external users, it proved necessary to develop two different databases, one Lotus Notes based and the other Domino based (operable through a Web browser). To avoid data inconsistency, both Notes databases are regularly replicated with each other. A unique ID number (identifying the participant) links the Notes participants database to the Oracle/SQL database.

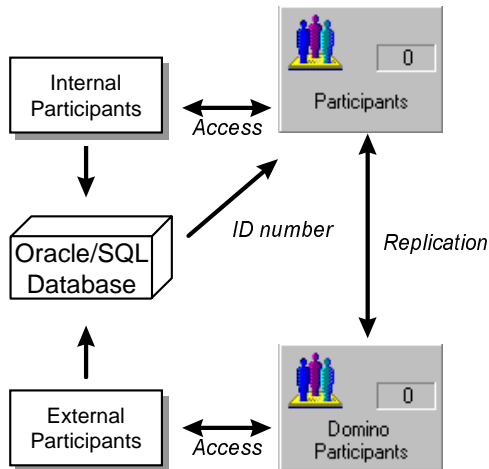


Figure 5. Participants database

selves to the upcoming project. One prerequisite to the organizational change was the prevailing acceptance of the electronic medium. The NetAcademy designer team generally agreed that information technology could help to support and stimulate the newly designed processes but that it would not lead to an organizational change due to its mere existence. So it became essential to involve as many members of the staff in the ongoing design process as possible to reach a high degree of identification with the product. Another challenge was the promotion of a „WE CAN DO IT“ atmosphere where everybody was willing to share knowledge with colleagues and to aim at good *joint* results in contrast to a system of internal competition (as frequently the case in the academic sector).

### 3.1. Organizational Structure

The current organization is divided into four different knowledge groups, each being supervised by a team leader. Each group is responsible for its respective re-

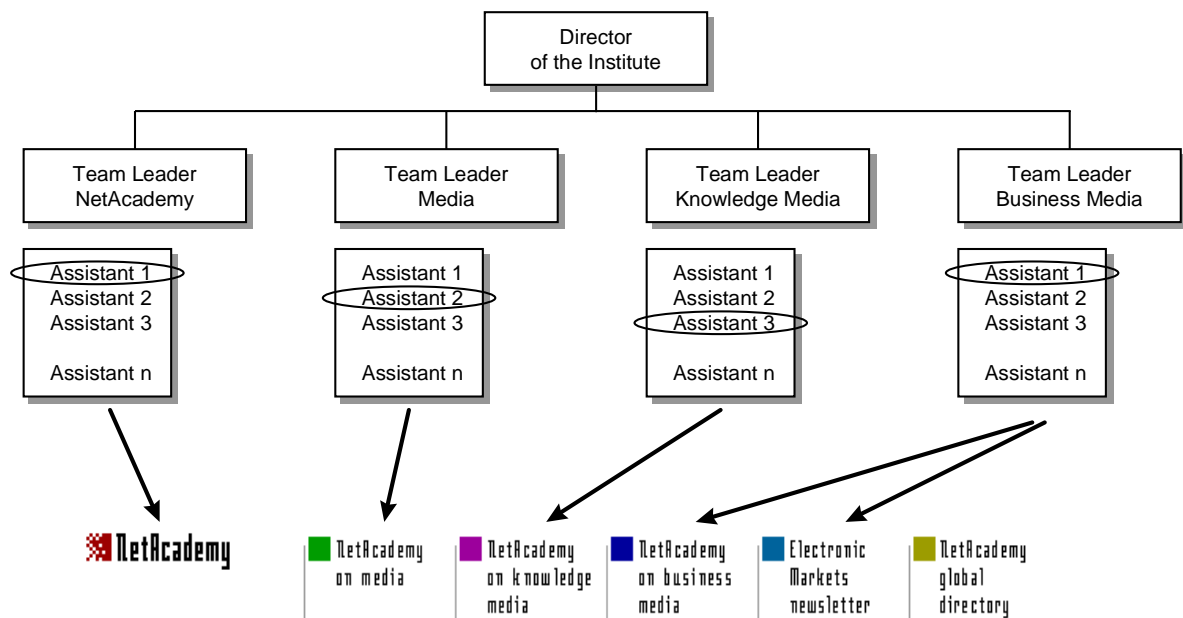


Figure 6. Organizational structure of the institute and horizontal navigation bar of the NetAcademy

### 3. Organizational Design

The NetAcademy project was initiated by the Director of the Institute for Information Management. Right from the beginning, it was clearly communicated that the implementation of a software platform for collaborative authoring would require a substantial change in the organizational processes and structures. Therefore, several meetings were held where everybody was asked for his or her opinion in order to encourage staff to commit them-

search field (horizontal bar, see Figure 1).

**3.1.1. Roles.** One research assistant from each knowledge area is responsible for the support of the respective NetAcademy. Together, they form the NetAcademy editorial team (NA Editors). The members of the NA Editors define the content structure and the long-term strategy of their respective knowledge areas. They are supposed to plan and control the continuous contributions made from

**Table 2. Participants' roles**

Role	Duties
NetAcademy Webmaster	<ul style="list-style-type: none"> <li>maintain system</li> <li>grant access</li> <li>supply technical support</li> </ul>
NetAcademy Designer Team	<ul style="list-style-type: none"> <li>design graphical interface</li> <li>develop and implement software</li> <li>definition of internal processes</li> <li>expand NetAcademy platform on users' demand (e.g. set-up of additional databases for new knowledge areas)</li> <li>continuous technical improvement of NA</li> </ul>
Sub-NetAcademy Editors	<ul style="list-style-type: none"> <li>define content structure of their area</li> <li>pre-review contributions (articles, papers, etc.)</li> <li>decide about long-term strategy</li> <li>plan and control continuous contributions of team members</li> <li>encourage external participants to contribute</li> </ul>
Team Leaders	<ul style="list-style-type: none"> <li>take care of the application of the defined control and incentive mechanisms</li> <li>make contributions to their knowledge area</li> <li>contribute to fields of joint interest</li> </ul>
Team Members	<ul style="list-style-type: none"> <li>make continuous contributions to their knowledge area</li> <li>contribute to fields of joint interest</li> <li>write feedback</li> <li>take part in discussions</li> </ul>
External participants	<p>There are 3 different types of external participants:</p> <ul style="list-style-type: none"> <li>read-only participants</li> <li>active members of discussion groups</li> <li>authors</li> </ul>

the rest of the team members to their joint research field and to areas of common interest (e.g. the global directory which gives a general guidance through the NetAcademy universe). They are also responsible for the encouragement of external participants to contribute to the system.

Table 2 contains a list of duties for the owners of the different roles within the NetAcademy.

**3.1.2. Types of contributions.** There are mainly two different types of contributions.

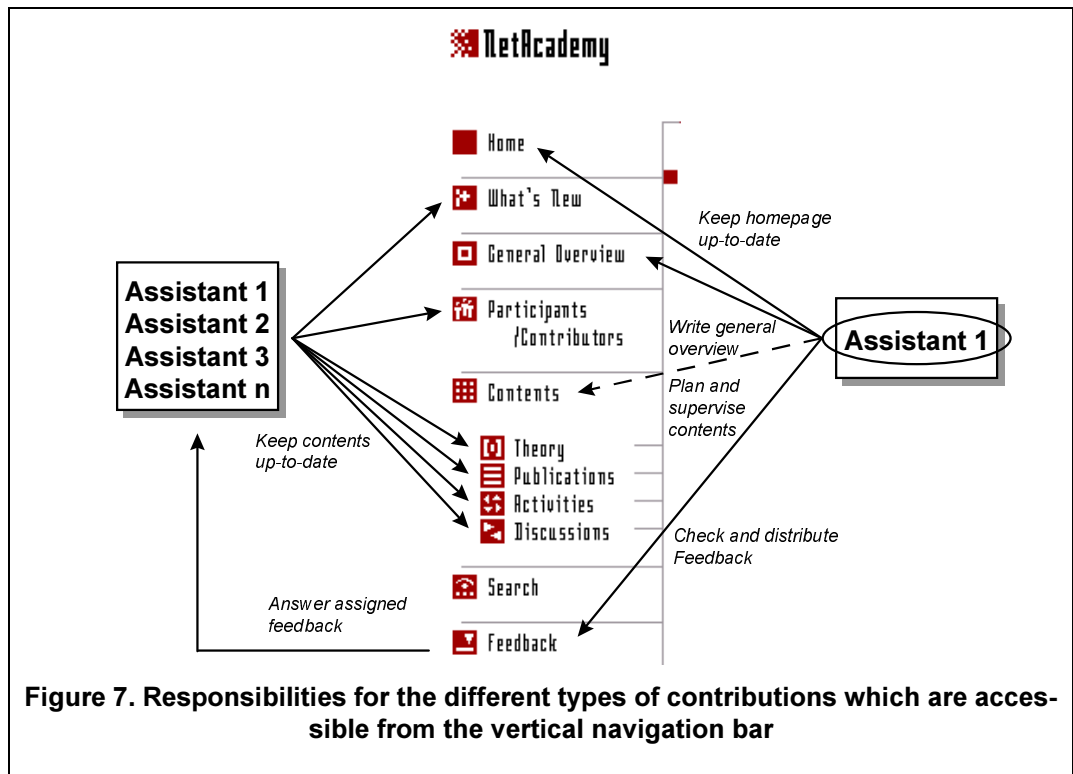
- predominately static information

- dynamic information

Static information requires an initial effort in writing but will not frequently be updated. Examples for this type of contribution are descriptions of research fields, project descriptions, disclaimer, etc. Dynamic information, on the other hand, represents the living core of the system. It helps to build a virtual community, especially when it achieves to motivate people to come back and even make their own contributions on a topic. That kind of information is best placed in *What's new* sections or discussion groups.

Figure 7 shows the vertical navigation bar (for a general overview see Figure 1) which guides the user through the NetAcademy universe. The topics serve as entry points which may contain links to further content pages that are not directly accessible from the homepage.

**3.1.3. Incentive structure.** In order to further stimulate interaction with the NetAcademy medium, a score-based incentive structure was developed. The overall acceptance of the new medium is taken for granted: the motivation scheme was meant to provide a concrete return-on-effort



**Figure 7. Responsibilities for the different types of contributions which are accessible from the vertical navigation bar**

for every internal contributor to the system. It should be the case that, people will be intrinsically motivated to use the medium because they get direct feedback and opinions to their special fields of interest. If a discussion within a certain research area becomes very intense, the success can usually be credited to the moderator of the discussion. Nevertheless, one problem we encountered was the generation of contributions in areas of shared responsibility e.g. in the field of joint project management. A typical example is the writing of feedback responses. It is rather difficult to attribute any specific credit to answering general questions on a project. Nevertheless, it is one of the most important aspects for the promotion of the system and for the development of a NetAcademy community. Therefore, a concept for the fair distribution of feedback responsibility to all members of the project team had to be implemented. Besides this, the incentive structure was meant to provide rewards to the people who actually write the responses. Within the NetAcademy, all feedback entries are automatically sent to the respective SubNetAcademy editor, who then decides which one of his team members is best suited to answer the question or, in the case of general questions, tries to evenly distribute them to all team members.

The following incentive scheme was proposed to be used during the first phase of the NetAcademy project. It will be reconsidered after being in practical operation for a certain period of time.

**Table 3. Score-based incentive scheme**

Collected points	Points	Spent points	Points
Answer feedback	2	Participation in conference	60
Discussion contribution	1	Research day at home	15
Publication	first page: 5 page 2-6: 2 max: 15		
New content page	2		
Substantial modification of content page	1		

Due to the fact that all contributions to the system are entered into Lotus Notes databases, it is possible to implement a Lotus Notes agent which regularly scans for new entries or modifications crediting them to the account of the respective editor. This is a practicable solution for the collection of bonus points, though, spending points still requires manual input.

### 3.2. Process Organization

A problem we encountered during the first phase of the Net Academy project was the integration of the knowledge generation process with the internal process organization. There were two big obstacles which we had to tackle. First, we had to develop the incentive scheme to improve the motivation of the internal staff. We decided that the mere fact that doctoral students will find it easier to write their thesis after contributing actively to the system - combining their knowledge with the contributions of other authors - would induce an increase in the number of entries. The second important factor was the implementation of technology familiar to the users. This was one decisive reason why we agreed on using Lotus Notes (internally and externally) in combination with the World Wide Web (externally) since Notes had already been the selected groupware product for the last five years.

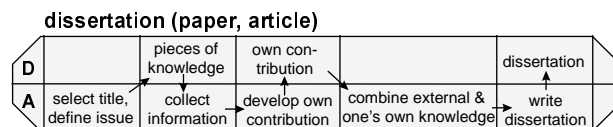
As mentioned earlier, the internal process organization had to be redesigned. It had long been discussed to focus research rather on the expected outcome which we decided to call our „products“. The following sections illustrate the newly-designed internal processes which were established to best support the four major products.

#### 3.2.1. Processes/ Products

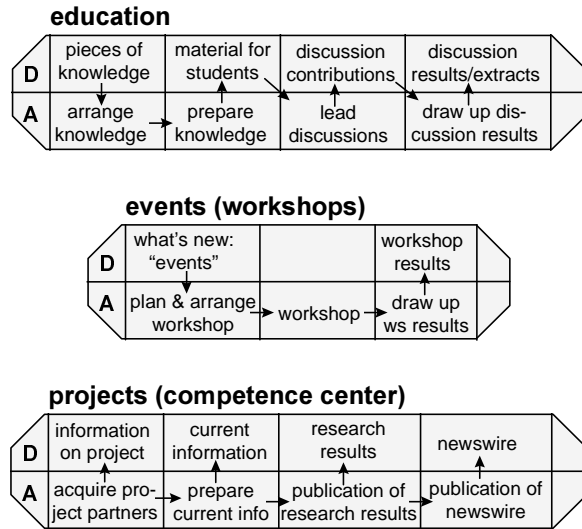
The figures depict the interaction of the NetAcademy platform (D) and the underlying research activities (A). The four main products and their accompanying processes are the following:

- Writing of dissertations, papers, or articles
- Education (classes and interaction with students)
- Workshops, events (with project partners or other potential clients)
- Support of work in the competence centers or other projects

The upper half of the illustration shows the data (D) which is generated or used during the process. The lower half describes the production process (A = Activity) for the respective product. The arrows indicate the sequence of data access and activities (showing the high degree of interaction with the knowledge medium).







The illustrations show how intensely the NetAcademy platform can be used for all kinds of academic activity and how it helps to better store and access valuable information collaboratively generated by a group of researchers.

### 3.2.2. Collaborative Authoring and Review Process

In general, the discussion sections are open to any user willing to participate. There is a general check on compliance with the Netiquette (appropriate language and topics, no personal attacks, no discrimination, etc.) but there is no censorship and the correctness of information is not checked. Once a discussion evolves in such a way that it develops new ideas or even research results, an extract is drawn from it, summarizing the main findings. However,

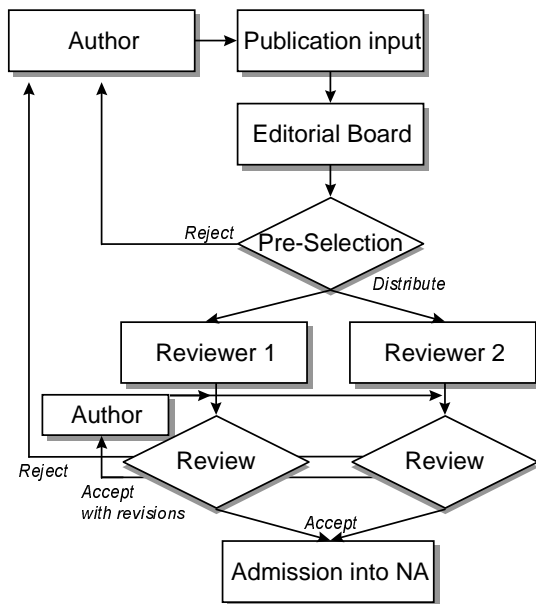


Figure 8. The NetAcademy review process

in order to maintain a good level of quality, the theory and publication section is subject to a strict reviewing process known to be the case for most articles in magazines or academic conference papers (see Figure 8).

One of the NetAcademy targets is to enable collaborative authoring for the generation of knowledge. New information pages are entered by one person and are constantly updated by whoever may be in charge. The functionality needed was achieved by combining Web technology with underlying groupware software. Online discussions and defined processes for the submission of publications extend the collaborative authoring to a global community of participants. The idea is that users may contribute a number of small pieces of information which will, in total, amount to qualitatively improved knowledge if assembled in a stream of arguments. The process will finally emerge into a massive collaboratively-acquired knowledge base.

Figure 8 describes the reviewing process. Publications or contributions to the theory part are sent to the Editorial Board where they are pre-selected with respect to language, style, appropriate knowledge area, etc. The Editorial Board is formed by the group of SubNetAcademy editors. The two reviewers are qualified people, one being a member of the internal staff and one being an external NetAcademy participant.

## 4. First Experiences and Conclusions

The NetAcademy was opened in April 1997, one month before this paper was written, and half a year after the first discussions about design and implementation had started. Looking back, there are already a number of important experiences which we could gain from the project. The three main aspects are the advantages of a modular software structure, the knowledge of how to guarantee user acceptance, and the art of forming a successful, enduring development team (the last being a prerequisite for every successful IT-project).

The *modular, template-based design* of the NetAcademy platform allows for easy expansion and global change of corporate design elements. Within a couple of hours, a new knowledge area can be established. All you need is to choose a new color, apply it to the standard graphics, copy them into a newly dedicated directory on the server, compile the needed number of Lotus Notes databases for general information and discussions and add some minor changes in terms of links to responsible editors (in the trailer section of the template). Especially in the starting phase of a project, when most requests for changes occur, a template-based design proves to be a great help. Changes at one place are automatically incorporated to all corresponding design templates.

The following list gives some clues why we reached a high degree of *user acceptance*:

- There is no need to remember HTML-file names
- The user does not have to deal with complicated directory structures
- It is easy to remember where a certain piece of knowledge belongs to because the information is stored in databases for dedicated research areas and not in single files
- There are no problems usually arising from different versions of the same document
- There is no need for HTML programming knowledge
- Access controls are built into the groupware system
- Full text retrieval is provided by the groupware software
- Collaborative authoring features are already implemented in the groupware technology, the replication mechanism allows for ubiquitous access to Notes databases for internal participants
- Motivation to contribute to the system is evident since the original author contributing an item of knowledge can clearly be identified and all participants may profit from each other
- The clear definition of responsibilities for areas within the NetAcademy helps to establish an even distribution of work, at the same time leading to a higher degree of identification with the „product“.

In our opinion, the another big advantage which became apparent during the development of the NetAcademy software was, that the same people who designed the NA were also determined to become the main future users of the platform. During the design of the NA system architecture and the processes for information supply on which it is based, the *development team* achieved a profound understanding of the nature of collaborative authoring. In order to be able to share responsibility for the support of different areas of information within the NetAcademy, the designer team had a keen interest in supplying every participant with an appropriate interface to secure that the NA infrastructure would really be used by every participant inside the organization as well as all over the world.

The NetAcademy is still in the development phase and it will, once more, take some time before the system will be in full operation. However, most of the components described in this paper are already operational. Future steps include the implementation of the semantic search engine (as described in [6]), the addition of a theory and a publications section for the current knowledge areas and the development of the described automatic agent to be used for the incentive scheme.

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