

**Knowledge is Power!**  
**Is Passing on Knowledge a Loss of Power?**  
**Social Success Factors of Knowledge Networks**  
**in Research and Development**

WILFRIED SIHN  
Fraunhofer-Institute for  
Manufacturing Engineering and  
Automation (IPA)  
Phone: 0049 711 970-1964, Fax:  
0049 711 970-1927

[whs@ipa.fhg.de](mailto:whs@ipa.fhg.de)

MARTIN LENZ  
Fraunhofer-Institute for  
Manufacturing Engineering and  
Automation (IPA)  
Phone: 0049 711 970-1078, Fax:  
0049 711 970-1927

[mal@ipa.fhg.de](mailto:mal@ipa.fhg.de)

ANKE MICHALSKI\*  
Fraunhofer-Institute for  
Manufacturing Engineering and  
Automation (IPA)  
Phone: 0049 711 970-1992, Fax:  
0049 711 970-1927

[akm@ipa.fhg.de](mailto:akm@ipa.fhg.de)

\* Corresponding author

**ABSTRACT**

The systematic collection and use of existing data marks the transition from information society to knowledge society. The combination of buildup, transfer, application and distribution of knowledge is the key to progress in almost all domains. The degree to which a society is able to grow and develop largely depends on the ability to build up and use knowledge. One can revert to textbooks to select tools and methods for the management of knowledge. However, this solves the problem only partly. One crucial factor is often not taken into consideration when it comes to knowledge management: the human factor. Machines are not able to produce and utilize knowledge. Only human intelligence can do that. At the center of every knowledge management system must therefore be people with all their desires and demands, but also their fears and reservations. Only if we can achieve a general acceptance of knowledge management, as well as recognize and break down possible barriers, will the technical solution be successful and the appropriate use of knowledge possible. Knowledge is an agent of power! But is there necessarily a loss of power when this knowledge is passed on? Particularly in research and development, knowledge is closely tied to people. A person's 'economic value' increases with the experience and knowledge that this person has acquired over the years. In competition-oriented economic systems it can thus not be taken for granted that knowledge is going to be passed on.

The disadvantages for a business are obvious:

- A loss of knowledge every time an employee leaves the company
- A heavier work load due to lacking sources of knowledge and experience
- A loss of quality due to a lack of expert consultation

The following article entitled Knowledge is power! Is Passing on Knowledge a Loss of Power? examines visions, ways and concepts, but also problems of constructing a knowledge network in the research and consultation environment of the Fraunhofer Institute Production Engineering and Automation (IPA) which is based in Stuttgart, Germany.

The article focuses on solutions concerning social aspects. The technical side will be briefly mentioned and references

to outside sources will be made.

Since the article does not include details specific of Fraunhofer and the methods used are typical of development-oriented work, the knowledge gained can be fully applied to any other organization, institution or business enterprise.

## 1 Initial Situation

### 1.1 The Fraunhofer Society and the Fraunhofer IPA

The Fraunhofer Society, with its 47 autonomous institutes and more than 9.000 employees, is the largest research organization in Germany. The Fraunhofer Society endeavors to transfer research results to the economy. The work of the institutes adheres to practice-oriented research and is done only in close cooperation with the industry and public research organizations.

The work of Fraunhofer is aimed primarily at the support of medium-sized businesses. By collaborating with the Fraunhofer Society, these businesses gain easier access to results of research and development. This helps to ensure a healthy medium-scale sector of the economy.

The subject of this study is the largest individual institute – the Fraunhofer Institute Production Engineering and Automation (IPA). The Fraunhofer IPA concerns itself with the producing sector of the industry, and its work ranges from automation solutions to innovative methods in enterprise management.

### 1.2 Scientific Work at the Fraunhofer IPA

The scientific work performed at the Fraunhofer IPA is characterized by the following aspects:

- Visiting customers  
Employees of the Fraunhofer IPA usually work on location with customers of the industry or research partners three to four days of the week.
- Work in project teams  
The work is usually performed in project teams of two to four people. The constellation of these project teams changes with each new task.
- High variety of subjects  
The subjects an employee concerns himself with remain within the limits of his expertise, but vary from project to project.
- Individual knowledge buildup  
It is typical of research-oriented work that knowledge is gathered by employees. Their experience and their knowledge is crucial for the quality of work and economic success.

### 1.3 The Objective Necessity for Knowledge Networks

The characteristics of scientific working methods lead to insufficient transparency of work contents and work results for the employees. The exchange of knowledge occurs only ad-hoc and incompletely. This creates the following main problems for the enterprise and for each employee:

A loss of knowledge when an employee leaves the company

A heavier work load due to lacking sources of knowledge and experience

A loss of quality due to a lack of expert consultation

Each one of these points weakens the economy, or in other words – the potential to improve the economic situation and the quality of work becomes obvious even when examining these points only roughly.

### 1.4 The Subjective Necessity for Knowledge Networks

Committed employees in enterprises and organizations always have an information deficit. The belief in the necessity for knowledge networks is generally omnipresent.

Furthermore it must be taken into consideration that knowledge directly influences the working methods of each employee and supports him considerably in his daily work.

If there is no knowledge network, each employee will generate his own system to compensate for knowledge deficits. It can thus be concluded that there is a general acceptance of knowledge management solutions.

However, it must also be recognized that central solutions are often perceived as limiting and obstructive. One's own solution, on the other hand, is never associated with these drawbacks.

These aspects must receive special attention when designing a knowledge network for research and development.

## **2 The Knowledge Network for Research and Development**

### **2.1 Guidelines for Knowledge Networks in Research and Development**

When designing a knowledge network for research and development, it is important to follow the guidelines given below. One can distinguish between method-oriented and employee-oriented guidelines.

#### Method-oriented:

All results of research and development are documented and can be retrieved on demand.

In research and development work the documented knowledge can be used in a subject-oriented manner.

In certain project situations it is possible to identify specialists and consult them when needed.

#### Employee-oriented

Each employee knows how to use knowledge components and who contributed them.

It is clearly defined which activities and processes are obligatory and how they are performed.

The benefit for each person is common knowledge.

### **2.2 Identifying and Prioritizing Knowledge**

The identification and prioritization of knowledge stands at the beginning of the knowledge network project. The following questions must be answered:

- 1 What kind of knowledge is it?
- 2 What form does this knowledge have?
- 3 Which people can provide this knowledge?
- 4 Are these people willing to share their knowledge?
- 5 What kind of knowledge does the enterprise need?
- 6 What knowledge is important and what is less important?

With this kind of "collection of materials" it is possible to distinguish different types of knowledge. However, they never stand alone. It is the relationship between them that makes them valuable.

#### Projects

A type of folder to document the process of knowledge buildup in cooperation with an industrial customer or

research partner. In particular these are project reports, methods and tools used, procedures, goals, successes and generated knowledge.

#### Addresses

Project partners and potential customers, including correspondence and history.

#### Documents

Different kinds of papers, such as project sketches, correspondence documents, offers etc.

### **2.3 Technological Components**

The technology used is the basis for an efficient knowledge network. A stable and flexible solution – usually software-oriented – is the foundation for its success and acceptance by the user. Since most studies focus on the technical aspects of software solutions, they will not concern us in this presentation. The key words below are only supposed to hint at the selection of a software system and will not be described in further detail. More detailed suggestions can be found in secondary literature.

#### Flexibility:

- Irrespective of platform
- Management of all data formats
- Open data model

#### Adjustment to business specifications:

- Interface to standard software solutions
- Simple extendibility and adjustment
- Access safety up to field level

#### Support of distributed work places

- Replication functionality
- Integration of home offices
- Access via HTML clients

#### User friendliness

- Easy operation
- Reasonable and understandable ways of categorizing and archiving
- Support of various user groups

### **2.4 Social Success Factors of Knowledge Networks**

Knowledge management influences and changes the culture of an enterprise or an organization. These cultural changes affect people, and since people do not like change, they will adapt very slowly.

When new systems are introduced, a love affair with technology often tends to take over. The selection of a

functioning, future-oriented and conclusive technology – usually software – is essential for the system. Its successful operation, however, depends even more on their acceptance by employees.

The key to success lies in the title of this paper: Knowledge is power! Is Passing on Knowledge a Loss of Power? The network will only be successful if passing on knowledge does not result in a loss of knowledge for the individual, but instead supports him in his daily tasks.

This becomes clear when looking at the basic functions of knowledge networks:

**The retrieval of knowledge**

- is obstructed through technological barriers in the operation of the system
- is supported through user friendly and well thought-out systems

= **requires the existence of knowledge**

**The entering of knowledge**

- is obstructed through social barriers
- is the prerequisite for retrieving and using knowledge

= **decides over success and failure of knowledge networks**

## **2.5 “Human“ Barriers of Knowledge Networks**

To overcome the “human“ barriers of knowledge networks is the central task when knowledge management is introduced in research and development. The following main points can be distinguished.

### **2.5.1 Knowledge as Personal Possession**

Particularly in the area of research and development enterprises, knowledge centers around human beings. An employee’s knowledge and experience are the capital of the company – but also his personal capital.

Employees raise their “economic“ value through successful projects and their so acquired knowledge. As a consequence they are not very eager to pass this knowledge on to others.

It has been shown that this barrier rises with the degree of anonymity. The open-mindedness people display in personal interviews changes when they are asked to make their experience available to anonymous readers in a software system; even if (or maybe because of it) they belong to the same company.

### **2.5.2 Knowledge Transparency as an Instrument of Control**

It is important to keep in mind that transparency can also be understood as an increase in control. Each information about work that an employee enters into a system can potentially be used to evaluate and monitor his performance. And this is usually perceived as unpleasant.

### **2.5.3 Knowledge Documentation as Additional Work**

It must be taken into account that time consuming work and strain reduces a person’s readiness to document work. Documentation is considered to be stupid work which is unpaid and unacknowledged and should therefore be avoided as much as possible.

### **2.5.4 Favoring Own Solution**

A lack of knowledge management systems forces employees to create their own group-constrained solutions. Even though these solutions do not offer a complete and current overview, they do solve the employees’ main problems.

The requirements for each employee are almost identical, but they differ in detail. And it is these details that are the strength of own developments and solutions.

A new central system is not able to take each individual person into account – instead it offers up-to-dateness and completeness.

## **2.6 Ways to Overcome the Barriers – Ways to Successful Knowledge Networks**

Successful knowledge networks are supported by a large majority of people. For the successful implementation of knowledge networks in research and development, it is crucial to overcome the barriers (as described in section 3.4.1), by taking the following measures.

### **2.6.1 Personalization of Knowledge**

The design of knowledge networks determines their general acceptance. It is important to select a structure which

allows the employee maximal control of his knowledge and at the same time supports an open exchange. A personalization of knowledge is able to break through this anonymity and increase the willingness to pass knowledge on to interested colleagues. Crucial for the design are two principles:

## 1. Principle of openness

In order to meet the demands of a knowledge network, the components must be accessible for each employee. This includes on the one hand a concept for reasonable storage of information and on the other hand the possibility for each employee to retrieve all information. Restrictions depending on a person's function are possible.

## 2. Principle of ownership

Each information has an owner. The owner is usually the one who makes the knowledge available to his colleagues. He has rights and duties regarding "his" knowledge:

He has the exclusive right to change information. In the case of a dispute he decides if the knowledge will be passed on (in normal cases this is regulated via processes). Any access to his documents is recorded and thus counteracts the anonymity of the software system.

The owner has the duty to update his information. He is solely responsible for the changes and the accuracy of the information.

### **2.6.2 Benefit-Oriented Argumentation**

The benefit for each individual employee is at the center of each argumentation – not the features of the software solution. It must be made clear that the new system supports each single employee at work and makes his job easier.

Since the entire knowledge network does usually not operate with its full range of functions from the beginning, the benefit-oriented argumentation must be supported by reliable schedules. The benefits must be clearly pointed out for each implementation step.

### **2.6.3 Integration of Employees in the Entire Process**

From the beginning one must ensure that the participating employees are able to contribute their efforts in the process of knowledge management. This can be achieved through:

- Continued information concerning the state of development
- The possibility to contribute to the design

A "black box situation" in which each person has only incomplete information about the state of design and the progress of implementing the knowledge network must be avoided. Rumors and half-truths quickly cause defensiveness, and they are later difficult to refute.

Particularly the chronological order of single components within the framework of gradual implementation must be shown.

In addition to the classic informational gatherings and conferences employees can be successfully integrated through intranet solutions, FAQ pages, discussion forums and employee magazines.

### **2.6.4 Transparency of Processes**

In addition to the planned contents, the transparency of the future knowledge management processes are of utmost importance. Only if it is clear what there is to do, who has access to information and which (positive) effects this has on everyday business, will employees be willing to pass on their knowledge.

The processes are a crucial in preventing passing on knowledge from turning into a loss of power.

### 2.6.5 Knowledge Management is a Management Function

The management must support the knowledge network and act as a role model. If it is obvious that the management itself allows more transparency, the fear of control will decrease automatically.

Passing on knowledge must be a constant component of an employee's goal system. Documentation work is acknowledged and does no longer represent annoying extra work.

### 2.6.6 Successful Outside Examples

Successful examples of knowledge networks in outside companies, if possible competitors or role models from the same business domain, are more convincing than even well thought-out presentations.

## 3 The Knowledge Network at the Fraunhofer IPA in Practice

### 3.1 Goals

It was the main goal of the implementation of knowledge networks at the Fraunhofer IPA to guarantee each employee immediate advantages for his everyday work. It is crucial that data is not being stored isolated from the processes.

The following functions helped to achieve this goal:

- Simplification of the daily business through:
  - Support of correspondence jobs (faxes, letters, e-mails)
  - Automatic re-submission of sales activities
  - Generation of project reference lists
  - Documentation of project results, methods, tools, procedures and innovation
  - Support of each individual employee's work organization (e.g. by keeping phone notes, to do lists, etc.)
  - Document sharing and exchange of information between geographically distributed teams
- Efficient acquisition of projects through
  - Target group-oriented contact of customers and interested parties
  - Up-to-dateness of address data base
- Complete customer history and documentation of project work facilitates the buildup of knowledge documentation.
- Support of mobile jobs through groupware-oriented software solutions.

According to function, three subjects were identified and assigned goals

<b>Mobile Jobs</b>	<b>Management of Documents</b>	<b>Management of Addresses</b>
Integration of mobile employees into business processes	Access to documents, such as project documents	Efficient acquisition of projects through target group-orientation

Access to all information about Internet or dial-in	Possibility to edit documents in teams	Simplified invitation to events
Reduction of phone costs through Internet access (SSL coded)	Classification and search of project reports, offers, etc.	Documentation of project experiences
Reduction of information channels through unified messaging	Documentation of project experiences	Acceptance and up-to-dateness through the support of everyday work

Three main scenarios exist in application:

Project work scenario:

The information flow and exchange of documents among project employees on location with the customer is controlled by means of groupware solution and Unified Messaging System. All employees have access to all data and news, irrespective of their actual place of work.

Knowledge scenario:

The documentation of the project work allows for a demand-oriented exchange of knowledge. By means of key words each employee is able to access existing experience at any time from any place and use it in his current job.

Sales scenario:

The employee responsible for sales presents the work of the Fraunhofer IPA to the potential customer on location. For the presentation he has documents from all research fields as well as the history of all customers with similar needs and problems in his computer. He has access to his correspondence from any place.

### 3.2 Contents

The knowledge network at the Fraunhofer IPA distinguishes three basic objects which form relationships between each other. These relationships help structuring the information. The relationships must be n:n because only they make it possible to enter the knowledge data base according to all different aspects.

#### Projects

The scientific work with the customer on location, research organizations or in-house work is recorded.

#### Addresses

Addresses of project partners, research partners, potential customers and suppliers.

#### Documents

Documents mainly consist of the presentation of results, project documentation, reports, offers and correspondence.

The projects are the core of the implementation. They can be divided into four life cycle phases. The pertinent information is added and recorded in each phase. This gives a complete profile of the activities at the Fraunhofer IPA.

The phases and their jobs in detail:

Sales process

control of sales via re-submission – prevention of double sales – knowledge of past activities with the customer – information material on location with the customer – assessment of strengths and weaknesses

#### Offer

text blocks for similar problems, IPA's tasks and their popularity with the customer, analysis of strengths and weaknesses

#### Processing

document sharing, exchange of information between geographically distributed project participants, access to experience and expert knowledge

#### Documentation

buildup and collection of knowledge; documentation of procedures, methods, tools and innovation; project references for the sales process

### **3.3 Technical Implementation**

Taking into account the social aspects of knowledge networks as described in the previous chapters, the Fraunhofer IPA implemented a combined groupware/Unified Messaging solution. It has the characteristics of an integrated, team-oriented software solution for the management of data and documents.

The software solution is based on client/server technology. Data is stored on a data base server according to relational factors. The interfaces to the data base are open and documented. Third party applications have a reading access to the data – this allows for an easy integration of other individual applications, even own solutions. The access privileges are regulated by the application server together with the data base server.

The additional Unified Messaging solution can be used in a stand-alone manner or integrated into the groupware.

## **4 The Effects of Knowledge Networks**

### **4.1 at the Fraunhofer IPA**

Compared to the initial situation, the knowledge network of the Fraunhofer IPA represents an important step toward achieving the main goals. Due to the fact that basic information was processed and made available from the start of the knowledge network, it soon became clear that the promised advantages cannot only be achieved on paper, but also in reality.

Through the gradual introduction and completion of the total system, the subjects and the new, altered work processes were made accessible to the employees in digestible portions.

By keeping in mind the needs of the employees, a powerful network for research and development has emerged at the Fraunhofer IPA. Its positive effects on the generation of knowledge is clearly noticeable after a mere six months of operation.

Bearing in mind that cultural changes take time and that passing on knowledge no longer necessarily means a loss of power, comparable activities seem highly recommendable.

It is also important to note the network's positive side effects: Due to the increasing exchange of knowledge, a culture of openness, collaboration and trust begins to emerge.

### **4.2 for Research and Development Oriented Organizations**

The scientific work at the Fraunhofer IPA is typical of research and development-oriented organizations. The described path and the corresponding design of a knowledge network can be adopted by institutions, organizations, consulting firms and research and development departments of corporations with very few specific adjustments. As discussed, the positive effects on the buildup of knowledge and the corporate culture show almost immediately, as long as the knowledge network is carefully implemented.

## **SHORT BIOGRAPHIES OF THE AUTHORS:**

**DR. WILFRIED SIHN** is the Director and Head of the Corporate Management Division at the Fraunhofer Institute for Manufacturing Engineering and Automation (IPA) in Stuttgart.

[whs@ipa.fhg.de](mailto:whs@ipa.fhg.de)

**MARTIN LENZ** is employee in the Corporate-Management-Division at the Fraunhofer Institute for Manufacturing Engineering and Automation (IPA) in Stuttgart, where he has been working in the marketing department since 1998. His work focuses on knowledge management in the marketing of a consulting and scientific institution.

[mal@ipa.fhg.de](mailto:mal@ipa.fhg.de)

**ANKE MICHALSKI** is working as a research engineer at the Fraunhofer Institute for Manufacturing Engineering and Automation (IPA) in Stuttgart.

[akm@ipa.fhg.de](mailto:akm@ipa.fhg.de)