
The knowledge network: knowledge generation during implementation of application software packages

Eric Scherer

The author

Eric Scherer is the General Manager of intelligent systems solutions ((i2s) in Zürich, Switzerland.

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Abstract

Under increasing pressure, many industrial enterprises are seeking means to improve their performance. Years of rationalizations led to the conclusion that no one-time improvement will enable continuing success. Thus companies realize that their edge lies in the transformation of knowledge to action. The field of knowledge management addresses a broad range of aspects but still is rooted in a rather technical methodology. Establishing knowledge management is a process of organizational innovation. As the implementation of application software packages is now considered the major driving force of organizational innovation, a close look at IT implementation projects as a means to establish integrated knowledge management at operational business levels seems promising. The paper will present the knowledge network concept as a means of establishing an integrated approach to knowledge management and will highlight it using observations made during system implementation in SMEs.

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The industrial innovation carousel: a brief look at practice

IT-enabled innovation

Looking at industrial practice during the past decade nothing appears to have had such a great impact on organizational innovation as the growing market of application software packages such as SAP, BAAN, Peoplesoft or J.D. Edwards. This growth is hardly imaginable but through its connection to the concept of reengineering. The aim of the application of information technology (IT) is the profound improvement of the economic efficiency and effectiveness of all business processes. Thus it seems possible to implement best practices within an organization. Even though the connection between application software and organizational innovation is a good enough reason for the strategic decision to implement an application software, plenty of potential situations are neglected during system design and implementation (see Bancroft *et al.*, 1998; Dolmetsch *et al.*, 1998).

Virtualization of organizations and lack of structure

With organizational changes becoming a predominant feature of industrial life, one can observe a tendency to the “virtualization” of organizational structures – with “virtualization” not corresponding to any theoretical concept of the “virtual organization”. Thus “virtualization” in today’s industry can also be described as a loss of structure (Scherer, 1998a). In many enterprises traditional structures have been washed out so that even managers need the help of process maps and organization charts to describe their tasks and responsibilities. Stable structures are replaced by multidimensional matrix organizations, dotted line of reporting and continuously changing alliances among different management factions.

For a long time, stable organizations relied on the generation and maintenance of information to tackle their tasks. With the growing virtualization, knowledge about the rules and behavior of an organization becomes a major resource for success.

Generating organizational knowledge: the knowledge network concept

With the implementation of application packages becoming a major driving force of

organizational change, one has to consider a project's ability as well as need to generate knowledge about an organization, its roles and behavior. Therefore a concept is required that integrates the aspects of knowledge management within the framework of any implementation project. Here the knowledge network concept provides a suitable basis from which to implement robust processes, to provide the basis of a sustainable management of organizational knowledge and trigger continuous learning.

In the following sections we will briefly examine the characteristics of systems implementation as well as the concept of organizational knowledge, in so doing introducing the basic concept of the knowledge network.

Systems implementation and organizational innovation

A growing number of enterprises consider the application of an integrated software package as a significant contribution to the solutions to their respective problems. Both the availability of pre-tailored solutions and the possibility of maintaining their own hardware at reasonable costs make software packages especially attractive to small and medium sized enterprises.

The perception of software packages thereby tends to draw mystical roots: reengineering software packages have become the *deus ex machina* of modern organizational design. It seems to be the predominant opinion that the implementation of a software package does not have any side effects. However, the impact on the organization is strong and intentional and therefore many unintended side effects may result. Only the worst cases make it to the public eye and usually are covered by the technical press.

Effects and side-effects of system implementation

Two of the most desired characteristics of software packages cause major problems: integration and process orientation. As a SAP implementation specialist note:

When SAP is installed, the actual computer system is integrated into every department, plant, business unit of a company. That means that people are going to have access to information they didn't have access to before,

and they are going to have real-time involvement with the new system. The consequences of an individual's action are going to be seen more quickly in all different areas of a company. [...] If people refuse to communicate with one another, the lack of human integration can cause a breakdown in the best configured system integration because the people won't use it appropriately (Dietz, 1999).

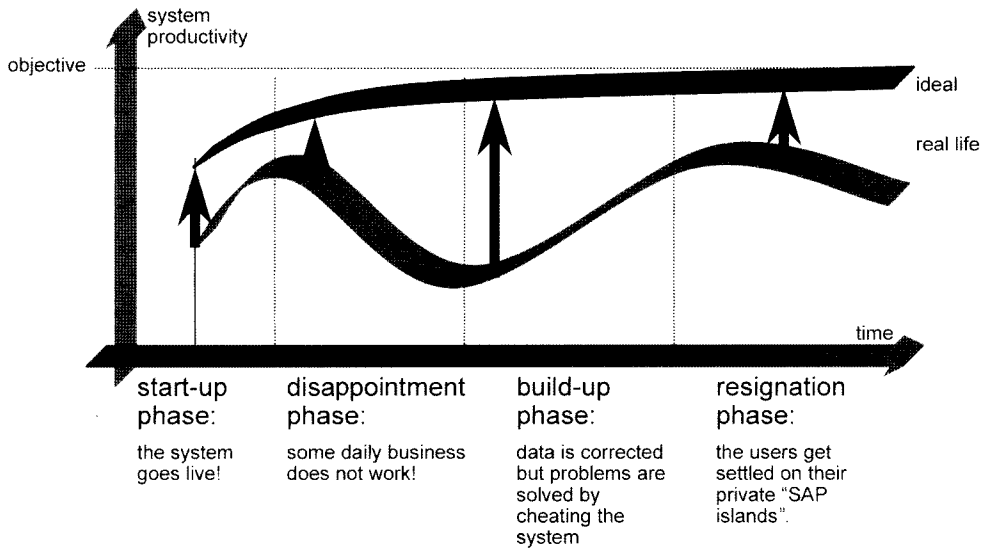
The example makes it clear: even though companies try to improve integration and process orientation through the implementation of software packages as a means of organizational innovation, they tend to neglect the challenges attached. In contrast to computer systems, humans and organizations cannot be programmed. Change in an organization is a process which takes time and requires the participation of all those who are affected.

The end-user trap

Most software implementation projects are still handled mainly as technical projects. Thus they tend to utilize a technocratic approach to systems design. Here project team members tend to design an organization in the same way as they design machines. Tasks to be performed by individual people are often only considered to be part of a larger business process. As a result the distinctive user with his everyday perception of working life and his limited technical knowledge is considered a disturbance rather than a customer and future performance factor. As a result, end-users do not gain enough attention throughout most projects and lack a sufficient lobby within the project team (Scherer, 1999). As a result the system will lack the anticipated productivity and the inability to improve over the course of time (Figure 1).

Managing organizational knowledge

After a decade of reengineering and focus on short-term effectiveness and efficiency, knowledge management is seen as a key to sustainable and long lasting success. Still within most scientific communities dealing with management and logistic systems, the term knowledge is rather vaguely defined and often misused. In knowledge management research two factions exist. Those who favor an IT dominated view focus on technology as a solution and tend to maintain the perception that knowledge can easily be

Figure 1 Lack of productivity during system start-up and use

Source: Drude, 1999

transferred from one individual to the other as long as it is structured and can be retrieved from a system. Here buzzwords like “business information warehouse” or “management information system” are frequently used. “Knowledge” therefore is reduced to a structured sum of information as provided by an IT system. Thus knowledge management mainly seems to be a technical problem with some soft factor aspects to consider in the second line.

At the other end of the spectrum, promoters maintain a view rooted in organizational development and individual behavior and insist that technology is no answer (see Dataware, 1999). Here knowledge becomes something very private, rather a possession of a single individual than a group of people or even a whole organization. Thus most of the relevant research focuses on the single work rather than a team or set of people.

Looking at today’s industrial enterprises both approaches tend to neglect the large role of both information technology – as the backbone of the structural organization[1] – and people – as individual actors within the organization. To get full use out of knowledge management both views have to be incorporated into a holistic approach. Furthermore research must not maintain a reductionist view and just promote a joint approach; the technological and social systems are designed to form a holistic system that has to focus on the design and development process itself.

Concepts of organizational knowledge

If one examines the characteristics of the knowledge that is required to act and work within an organization, one will find that besides theoretical knowledge, experience is of major importance for competent action (Fleig and Schneider, 1998). Knowledge from experience is often termed tacit knowledge. In the context of operational excellence, tacit knowledge is often referred to as “work process knowledge”. Work process knowledge is based on experience gained by an individual while performing tasks within an organization. Work-process knowledge only exists within the mind of an individual, it is related to the context of an action and can only be objectified to a limited extent. This results in the fact that work process knowledge can neither be bought or constructed but has to be generated and developed throughout engagement within a work process.

By cooperation and communication during work, work-process knowledge results in a communality of practice. Even though work-process knowledge is of an individual nature, through common experience it becomes a characteristic of an organization. Due to knowledge’s dependency on a context, establishing knowledge management within a specific corporation should not be the sole aim of a project but needs to be connected to technological innovation of both strategic and operational scope.

Generating knowledge from experience

For competent action, people have to rely on experience rather than theory. People

“function” as stabilizing “regulating elements” within an organization. However, by their intervention they may also alter the predefined goals, thus changing and renewing the whole system. This leads to the well-established opinion that any informal part of an organization has to be limited as it tends to oppose the formal system – at least in a managerial perception – and is beyond traditional practices of control. As a result, the aspects and requirements of knowledge generation throughout the project are usually neglected. Furthermore, the number of people involved in a project is rather limited to a small circle of users. Thus the majority of possible end-users do not participate in the project nor in the process of knowledge generation.

A third problem is the tight time schedule for projects. Knowledge from experience usually takes a long time to be built up. Usually experience comes from years of practice. Implementation projects, in contrast, tend to cover a period of 9 to 24 months.

Therefore it becomes necessary to increase the intensity of experience throughout a project. Several factors facilitate the generation and development of knowledge from experience:

- participation in change and decision making;
- recognition of organizational interrelations;
- reflection on one’s own work;
- communication and cooperation;
- the possibility of gaining concrete experience in everyday working life.

Generally, in an average organization, generation and development of knowledge from experience is mostly limited to experiences from everyday working life. Such knowledge generation is performed by itself without enforcement by management or corporate culture.

Accordingly it is possible to intensify the knowledge generation process through sponsoring participation, learning, reflection and communication. A software implementation project provides several chances to act accordingly and therefore may be considered an attractive platform to accelerate the generation of common knowledge within an organization.

The knowledge network concept

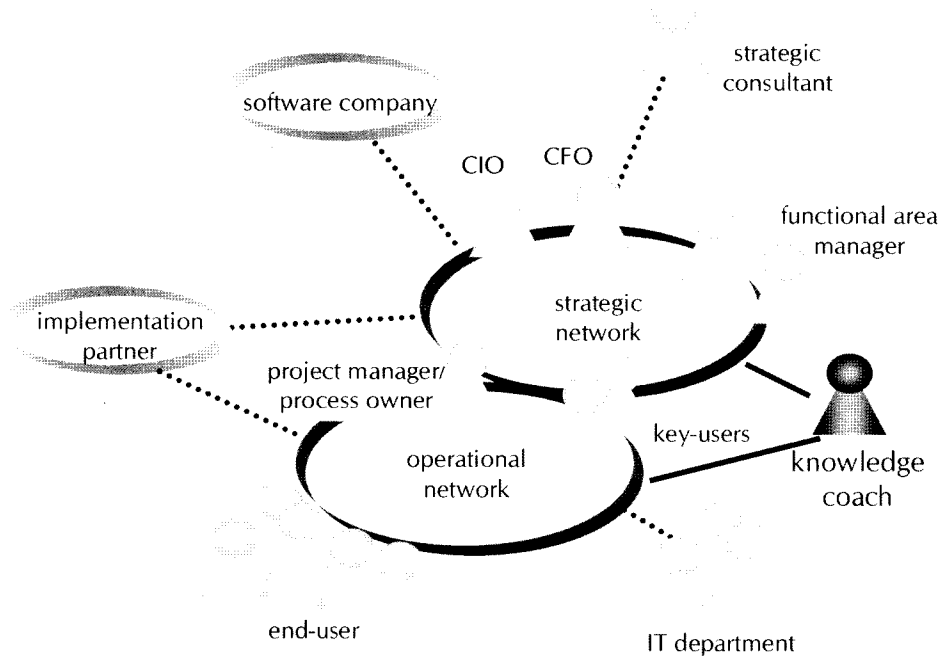
The concept of the knowledge network provides an enterprise with a framework to

facilitate the generation of organizational knowledge on a broad scale. Major objectives are to involve all end-users as well as to take into consideration the relatively short period of time given by a project schedule. It should only demand moderate efforts and costs.

Roles and structure of a knowledge network

The knowledge network has to be considered as a virtual or matrix organization which is supplementary to the far smaller implementation team. A knowledge network is continuously built up in parallel to the regular project’s progress. Key-role within the knowledge network is a knowledge coach whose major task is to facilitate and control the knowledge generation process. Besides the key-users and the implementation project manager, the knowledge coach is both member and leader of the knowledge network as well as member of the system implementation team. The knowledge coach becomes the major spokesperson of the project team to the end-user, and besides building up and maintaining the knowledge network is responsible for project marketing and communication (see Conrad and Poole, 1998). In principle, in its final stage, the knowledge network involves all roles involved in operating, maintaining and the utilization of the system. Thereby the term “system” refers to the IT system itself as well as processes, techniques, and procedures within the organization. Usually the network is divided into two platforms – one strategic, one operational (Figure 2).

In the final stage of build-up, the knowledge network succeeds the implementation team. It takes over all those tasks not primarily related to IT matters, e.g. process definition, quality management and performance improvement. The knowledge network is closely linked to the process team – which defines and maintains the various business processes and is headed by the former project manager turned process owner – and the technical board – which takes care of IT operations-related problems. The knowledge network offers certain services and products to the end-user and respective department managers and therefore should maintain its own resources and budget. These products can roughly be categorized into knowledge products and implementation products. Knowledge products such as user meetings,

Figure 2 Structure in principle of a knowledge network and the roles involved in the final state of build-up

bulletin boards, intranet services, e.g. news groups and FAQ lists, and a telephone hotline are produced to improve the daily utilization of the application. As a supplement implementation products are designed to ensure a minimum qualification for system use, e.g. user training and courses, process documentation and handbook, written rules and procedures for system use and support for seldom used functions, e.g. reporting and queries. Figure 3 gives an insight into the tasks and products of the knowledge network.

Build-up of a knowledge network

Building up a knowledge network is a process that should be run parallel to the system implementation process. The process of fully building up a knowledge network can be split into three phases:

- (1) project phase;
- (2) training phase; and
- (3) production phase.

The features of each phase can best be described by using the communication platform approach as indicated in Figure 4. Communication and thereby participation in the project's progress and results are the major means of the knowledge network. The network is built up in steps through intensifying communication about the new organization and the change taking place.

While the communication is limited in the beginning and mostly one-way from resources of the project organization towards the end-user community, eventually communication becomes more intense and bi-directional.

Figure 4 gives an example from a mid-size company. Here the first step was the communication of the mission statement by the top management followed by workshops with midlevel management. Parallel to the business blueprint phase[2] a change dialog was established where mixed groups from various functions as well as different managerial levels would discuss the new organization, the future role and the impact of new application on the organization as well as individual visions and fears. The results of the change dialog were constantly reported to a sounding board, i.e. a subgroup of the steering committee facilitating and directing the change process, and then fed back to all end-users. The central phase of build-up and final initiation is the end-user training. Training is a crucial part in any implementation project since it allows concrete interaction with a real-life system and facilitates the formation of a social network from a previously anonymous crowd of end-users. During training the communication is very intense over a reasonably short period of time. The final phase of production focuses on continuous improvement. Here all different functions and

Figure 3 Functions and products of a knowledge network

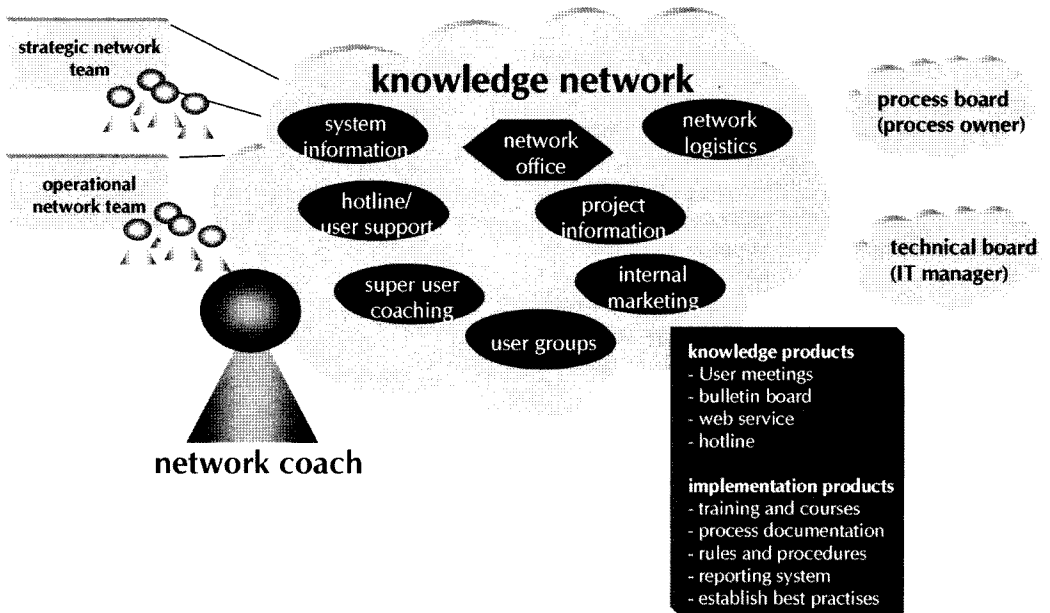
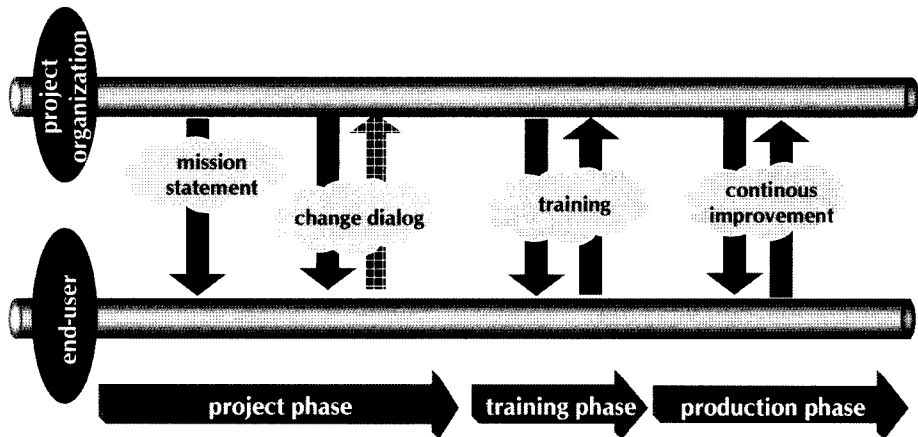


Figure 4 Communication platforms and respective phases of knowledge network build-up



means of communication as previously described are utilized.

The key role of the training phase

As described, the training phase is of most importance to establish a knowledge network. Here, all users finally get involved and are confronted with the application. Theoretical knowledge is the subject of classroom sessions and experience is gained hands-on through playground scenarios (see Fischer and Stuber, 1998). Besides focussing on techniques and experience, the training phase permits open talk about the possible drawbacks of the new system and the respective organization, ranging from fears of loss of one’s workplace to personal work overload. For the

implementation team, the training phase provides the possibility to perform large scale user/integration tests and verify the to-be processes fitness for everyday operations. In addition, the implementation team can tackle grapevine rumors and try to provide the end-user with a profound and realistic view of the system’s pros and cons.

Accordingly the objectives for the training phase are:

- Provide an insight into the situation and facilitate understanding through basic information concerning the project and the application.
 - What will happen? What are the individual consequences? What are the characteristic effects of IT

- implementation? How will daily work change? Am I alone or am I part of a community?
- Provide a process view and organizational transparency through role games, simulation and basic process training.
 - What are the objectives towards organizational innovation? What share do I have and what can I achieve? What is the individual meaning of customer focus? What is the meaning of process orientation? What are the effects of integration? What does integration and process orientation mean for future cooperation and communication?
 - Indicate the context of change and implementation and facilitate integration of knowledge in everyday working life through guided case studies and exploration of business processes using the application:
 - How will the individual workplace change? How will I work with the system? How is the new system integrated in the established working environment? How can I improve desktop performance?

How do I deal with the “routine of exception”?

- Initiate the knowledge network and continuous improvement through a positive and social environment:
 - What knowledge is necessary to use the system effectively? Who is able to provide me with help? Which knowledge resources exist? How do I solve a new problem? How do I explain a problem to a third person?

Means and procedure of training

The typical objectives for training can be achieved by focussing on a certain organizational concept or aspect. Table I gives an example which can be regarded as a general guideline.

It is important to see the training phase as the initialization of a learning process. Thus all training activities have to consider a long-term perspective and facilitate continuous learning. As a result, the training phase cannot and should not aim at a 100 per cent perfectly trained user – that’s unrealistic. Rather a stepwise procedure to achieve the status of sufficient knowledge is appropriate (Table II).

Table I Focus of knowledge generation during training phase

Focus of knowledge	Utilized concept	Possible method
Cooperation and integration	Processes orientation, work organization	Classroom teaching (process maps), case studies, guided process tours, interdisciplinary user circles
Tools and methods	Functional orientation	Classroom teaching (system functions), playground scenarios, training-on-the-job, workplace coaching, performance optimization, peer support, innerdepartmental user circles
Organizational change	Mission statement, corporate strategy, project objectives	Change workshops, sounding board, management road show, project marketing, internal communication, progress and performance visualization

Table II Stages of qualification and expertise

Stage of qualification	Description
Initial qualification	Basic qualification, allowing the end-user to navigate through the system. The end-user has knowledge about the system architecture, its modules and the knowledge resources within the organization
Minimal qualification	Broad qualification, allowing the end-user to operate most processes without help and enabling him to gain any knowledge necessary to operate further functions independently
Final qualification	Complete qualification to operate all respective processes independently and independently tackle problems and exceptions

Knowledge as key to lasting success

Knowledge is a key factor for success of any organizational innovation. With IT and standard software package implementation being a driving force of organizational innovation in today's industrial enterprise, the relation of knowledge management and system implementation gains in importance. In addition to knowledge, a well designed information system providing input, a human-oriented organization facilitating motivation and defined responsibilities allowing staff the authority to act independently are major factors for success (Figure 5, see Scherer, 1998b).

The concept of the knowledge network as described in this paper was successfully implemented in full as well as in part in two Swiss enterprises. Findings show that besides facilitating the generation of common organizational knowledge, the focus provided by the knowledge network approach also furthers the other success factors.

Even though the idea seems to be compelling, resistance is great among project managers as well as other groups involved in an implementation project, namely external consultants and top management. Their concerns are that too much end-user interaction will increase costs and prolong the implementation period. Though this cannot be neglected, the concept largely reduces post-implementation problems and costs. While plenty of enterprises suffer post-implementation trauma caused by problems not taken into account, experience from

successful knowledge network application shows that all performance objectives can be met from the very first day of production.

Notes

- 1 It should be mentioned that more than any other means information technology is able to provide a structure to an organization. With the increasing virtualization previously described this role of IT grows in importance.
- 2 "Business blueprint" is a term coined by SAP ASAP methodology to describe the sum of business processes to be implemented.

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Figure 5 Success in system implementation

