

A Comprehensive Approach to the Realization of Knowledge Portals

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ABSTRACT

A fully functional knowledge portal requires not only a Web site but also supporting processes, people, and technology. This means the collaboration of different disciplines is needed to realize a knowledge portal. A structured approach is needed to coordinate the complex multidisciplinary realization project.

Our approach uses a matrix to manage all products needed to realize a knowledge portal together with its supporting system. This matrix combines portal areas with time phases. Workflows connect different products in the matrix. The coordination between the cells of the matrix is handled by using an interdisciplinary team.

From the challenges in the field of knowledge portals five requirements for the realization of a knowledge portal can be identified: product overview, concurrent development, design for change, content management, and user-centered design. The matrix with the workflows demonstrates that our approach addresses all five requirements mentioned.

Keywords: knowledge portal, concurrent development, design for change, content management, user-centered design, interdisciplinary team

1. INTRODUCTION

A knowledge portal, in our view, is a Web site that offers customers, employees and business partners access to high quality information sources in an organization; uniformly: through one single interface, and transparently: without required knowledge about location and format of systems or information. The term knowledge indicates that the portal exceeds the simple information offering of a company brochure. Knowledge portals offer convenient access to information for

knowledge workers.

More and more organizations become aware of the possibilities of knowledge portals. Employees can share knowledge to improve productivity and efficiency. Customers can be attracted to products and services by the added value of information. Business partners can be tied to the organization by providing them with useful knowledge. As with other types of sites [1, 2], organizations discover that realization of a knowledge portal is quite complicated [3]. We will concentrate on three challenges that organizations may face:

1. The realization period of the knowledge portal has to be as short as possible, because of the fast changing Web environment.
2. The knowledge portal involves multiple departments of the organization. The information from different sources has to be presented in a uniform and transparent way.
3. Interaction with the users is needed to make the portal a success. The knowledge portal has to present the information the users want in a way that makes sense to them and it also has to be easily accessible for users in order to add information to the portal.

The next paragraph describes the challenges in detail. The challenges indicate that a knowledge portal has a lot of different aspects and that it has to be realized in a chaotic environment. To reduce the complexity of knowledge portal realization, a structured approach is needed. This approach should identify all subproducts needed to realize the knowledge portal in all its aspects and manage the dependencies between the subproducts. We have developed such a product-based approach for projects that take approximately six months (from analysis through evaluation) with a capacity of eight fulltime project members. Our approach is applied after the definition of the e-business strategy and the business case. We will concentrate on projects that are started to

implement the business case. We will call this knowledge portal realization.

From the challenges we identified five requirements for the realization of a knowledge portal. We will describe our approach and demonstrate that it addresses all five requirements. We will conclude our paper with experiences and research issues.

2. KNOWLEDGE PORTAL CHALLENGES

The following challenges have to be faced in the field of knowledge portal realization:

1. *The Internet environment is highly complex and changes rapidly*

The technology used for building Web Sites changes rapidly [4]. New technologies offer new business opportunities. Together with the increasing demand from society for more, better and quicker, this makes that the e-business economy changes fast. Organizations form their e-business strategies based on the current environment and their vision of the future. The realization of a knowledge portal is an implementation of that e-business strategy. The environment, and thus the vision of the future, will inevitably change during the realization project, which could make the organization's e-business strategy change. It is impossible to incorporate all the changes in the same realization project. To keep the discrepancy between the realized knowledge portal and the e-business strategy as small as possible, the realization project should be kept as short as possible.

2. *The information offered stems from multiple heterogeneous sources*

The knowledge portal offers transparent access to the information that is present in the organization. This information is not only stored in several different types of information systems, but also in the heads of employees. The systems and employees may belong to different departments of the organization. Different departments can use different technologies in their information systems and different information systems can have different owners. The knowledge portal should form the central place from which all information is easily accessible. The information should be presented in a uniform way. This creates a complex information structuring and management problem.

3. *The cooperation of users has to be obtained for the success of the knowledge portal*

The World Wide Web has given an unprecedented power to the customer [4]. It makes it possible to compare organizations and switch between them with one mouse-click. When the Web site of an organization is chaotic or too slow, the customer will go to the competitor to get what he wants. Organizations offer information at the portal as an added service to customers. Customers are under no

obligation to use the knowledge portal.

Organizations have more control over their employees and business partners than over customers. However, the sharing of knowledge is a voluntary process. An organization can enforce knowledge sharing only to a certain extent. There is no way to keep employees and business partners from getting the information they want from other places and from keeping information they have to themselves.

3. REQUIREMENTS FOR A KNOWLEDGE PORTAL REALIZATION APPROACH

To face the challenges and reduce the complexity of knowledge portal realization, a structured approach is needed. From the challenges in the previous paragraph we deduce the following requirements for an approach to realize a knowledge portal:

1. *All products needed to realize the knowledge portal have to be clear from the outset*

A product-based approach identifies products that are needed to reach the end product. To keep development time as short as possible, it should be clear to everyone involved in the project what product has to be finished when and by whom. The scope of the projects needs to be clear and definite from the outset. Enough time should be spent at the beginning of the project to identify all products needed and the result should be a clear overview to use as project communication tool.

2. *The portal and supporting system have to be developed in parallel*

A fully functional portal requires not only a Web site but also supporting processes, people, and technology. By supporting system we do not only mean the physical infrastructure, but also the organizational structures and processes around the site. Not only the Web site has to be built, but also the organization has to change to incorporate the knowledge portal [4]. Because the time-to-market has to be short, there is no time to first change the organization and then build the Web Site. Web Site, infrastructure, processes and structures have to be developed in parallel. The cultural organization change needed to make the knowledge portal a success is an important point of attention during the whole project.

To make the development period as short as possible, software development methods like Rapid Application Development [5] can be used. However, the principles from these methods should be extended to the whole supporting system of the site.

3. *The knowledge portal has to be designed for change*

To keep development time short, changes as result of the changed environment during the project have to be incorporated in later versions of the knowledge portal. This calls for a flexible architecture and a

Design for Change [6] of all portal aspects.

4. *The management of information and information sources has to be accounted for*

We define content as the information that is offered through the Web Site. The content comes from different sources and has to be inventoried and collected. The collected content will be in different formats and has to be converted to the common format for the portal. To make the content easy to find for the user of the portal, a good Information Architecture [7] is needed.

After the Web site has been published the content has to be kept up-to-date and relevant. Technologies, people and procedures have to be set up to do this. This is called Content Management [8].

5. *The user has to be attracted to use the portal*

Because users are not obligated to use the portal, it has to be made as attractive as possible for them. This can be achieved by adjusting all aspects of the portal to the requirements of the user, which makes User-Centered Design and Usability Engineering [9, 10, 11] important.

The user should be the central starting point for the design of the portal and explicit efforts should be made to promote the portal to the prospective users, whether employees, business partners or customers.

We have developed an approach to the realization of knowledge portals to meet challenges like the ones we mentioned in the introduction. Our approach is based on the above requirements and will be explained in the next paragraph.

4. AN APPROACH TO THE REALIZATION OF A KNOWLEDGE PORTAL

Our approach provides a structured overview of the products needed to realize a knowledge portal and its supporting system. The dependencies between the different products can be identified and managed. An interdisciplinary team should be used to execute the project, which averagely will take about six months. We will explain our "divide and conquer" approach in the following paragraphs.

Knowledge Portal Areas

A lot of different disciplines need to work together on the knowledge portal and its supporting system. The project involves for instance a graphical designer to design the user interface, a marketing specialist to promote the site to the users and a system engineer to build the infrastructure of the site. Together the disciplines realize all aspects of the knowledge portal. The disciplines can be divided in groups that concentrate on a common area of the portal. We identified six areas:

- *User*: the user of the portal. Involves user analysis, marketing & communication and usability testing.
- *Content*: the information offered through the portal, including both static content and data generated from

different data sources. Involves content management, content acquisition, content modeling and content maintenance.

- *Business*: the primary process and structures the portal supports and the secondary processes and structures that support the portal. Involves change management, process engineering and employee training.
- *Functionality*: the software of the portal. Involves graphic design, software development & testing, and maintenance.
- *Technology*: the infrastructure of the portal. Involves infrastructure engineering and maintenance.
- *System*: the portal with its supporting system. Involves quality and security. Note that this sixth area combines the disciplines that concentrate on the first five areas.

The approach realizes the knowledge portal on all six areas in parallel.

Realization Matrix

To reduce the complexity of the realization, we divide the project into five phases: Analysis, Conceptual Design, Development & Testing, Deployment, and Evaluation. We create a matrix of the six portal areas together with the five phases:

| | Analysis | Conceptual Design | Development & Testing | Deployment | Evaluation |
|---------------|----------|-------------------|-----------------------|------------|------------|
| User | | | | | |
| Content | | | | | |
| Business | | | | | |
| Functionality | | | | | |
| Technology | | | | | |
| System | | | | | |

We position the products needed for the realization in the cells of this matrix, to give an overview of what is needed when and in which area. The set of products is largely the same in all knowledge portal realization projects, but should be adjusted to meet the specific requirements of each individual project. We have currently identified over sixty different products.

Interdisciplinary Team

As explained, each area involves a number of disciplines. Experts from various disciplines have to collaborate to deliver a common product. We call this an interdisciplinary team. For each area a representative is chosen that leads the team of people in his area. This team manager reports to the project manager and communicates the decisions back to his team. In this way, the project manager only has to deal with a maximum of six people (different areas could have the same representatives) and at the same time all major decisions are made by representatives from each area. The team managers can consult a member of their team when a specific discipline is needed for a decision.

Thus we have a central interdisciplinary team above the different interdisciplinary area teams. Working with interdisciplinary teams for Web development is common

practice and requires special management techniques [12, 13, 14].

Workflows

The division of products over matrix cells does not eliminate the dependencies between them. Products are needed as input for activities that create other products. We call the sequence of activities that connect products that have input-relations with each other a workflow. All activities together form one big workflow that we have divided in sub-workflows.

As in [15] we use the notion that coordination can be defined as managing dependencies among activities. There are three types of coordination issues with respect to the sub-workflows:

- *Horizontal*: The sub-workflow falls within one area. The products have to be finished in the order of the time phases they have been placed in. This is standard project management procedure [16] that can be handled by the team manager of the area.
- *Diagonal*: The sub-workflow can go across areas. Products within one area and time phase can be input for activities that create products in a different area and the same or next time phase. The coordination in time is still standard project management procedure [16], but now the team members from different areas have to collaborate. The central interdisciplinary team helps to obtain input from other area disciplines where needed.
- *Vertical*: All sub-workflows have to be synchronized. Products within the same time phase that belong to different workflows, have to be finished at the same moment. The project manager leads the central interdisciplinary project team with the representatives of each area. These interdisciplinary team meetings realize vertical synchronization.

The matrix with the products helps identify all dependencies of the three types in a realization project. The interdisciplinary team in combination with standard project management techniques [16] can be used to manage them. The techniques we use may sound fairly obvious, but the examples in the next paragraph will show that the complexity is in the identification of all required products and their dependencies, and in the management of the workflows.

5. EXAMPLE WORKFLOWS

We have developed a number of best practices for the instantiation of the matrix in our projects. To illustrate these best practices we define standard products and describe the dependencies between them. All dependencies together form one big workflow, but we have identified various sub-workflows within the matrix. We will describe three sub-workflows that illustrate how we face the challenges we mentioned in our introduction. The complete matrix contains over sixty products, but for the sake of readability we only show relevant products. An arrow from product A to product B symbolizes an activity that has A as input and B as output.

Develop Site Functionality and Business Processes in Parallel

As said, in traditional software projects the software is developed after the business processes have been set up. When building a Web site the development time has to be kept as short as possible. The functionality of the site therefore has to be developed in parallel with the business processes to shorten the project. Primary business process is the sharing of knowledge and secondary business processes are for example the publication process, the maintenance process and the editorial process. The functional design is partly derived from the user requirements, and partly from the process design. First making the part of the functional design that is derived from the user requirements and continuing with the other part of the functional design when the process design is ready can achieve concurrent development. The processes can be designed in parallel with the first part of the functionality.

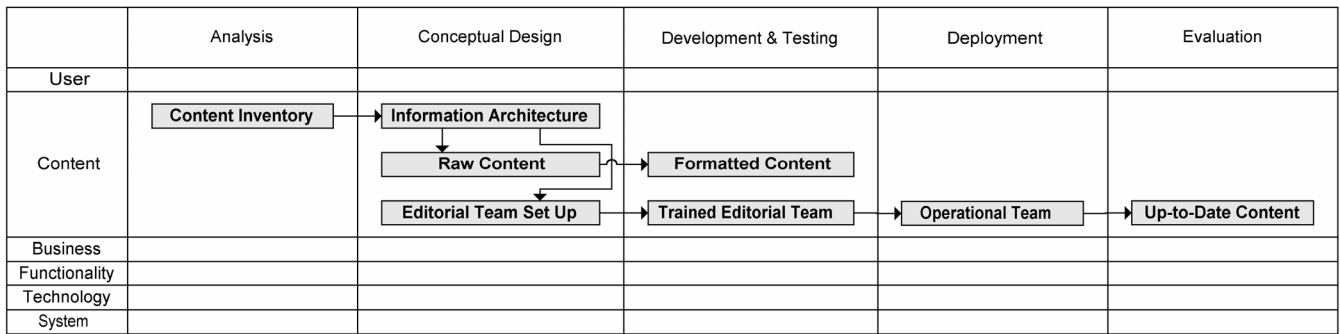
Matrix 1 shows the sub-workflow that demonstrates concurrent development.

Structure and Manage Content

The problem of users getting lost in the site can be solved by using a good Information Architecture [7] to base the site structure on. As soon as it is clear what content is needed on the site, the content collection should start. There is no time to wait with content collection and conversion till after the Web site is finished [12].

| | Analysis | Conceptual Design | Development & Testing | Deployment | Evaluation |
|---------------|-------------------|-------------------|-----------------------|------------|------------|
| User | | | | | |
| Content | | | | | |
| Business | Process Analysis | Process Design | | | |
| Functionality | User Requirements | Functional Design | Site Software | | |
| Technology | | | | | |
| System | | | | | |

Matrix 1: Concurrent Development



Matrix 2: Content Modeling and Management

To keep content up-to-date an editorial team should be set up. This team is responsible for the maintenance and quality control of the content. The structure and processes for the editorial team can be set up in parallel with the rest of the knowledge portal. The information architecture indicates for which content areas team members are needed.

Matrix 2 shows part of the content modeling and management sub-workflow.

Attract the Users

To attract the users to the site, it should be actively promoted. This means a communication plan has to be developed that describes the actions that will be taken. When the site has been launched, continuous interaction with the users is needed to check if the portal still fulfills their wishes.

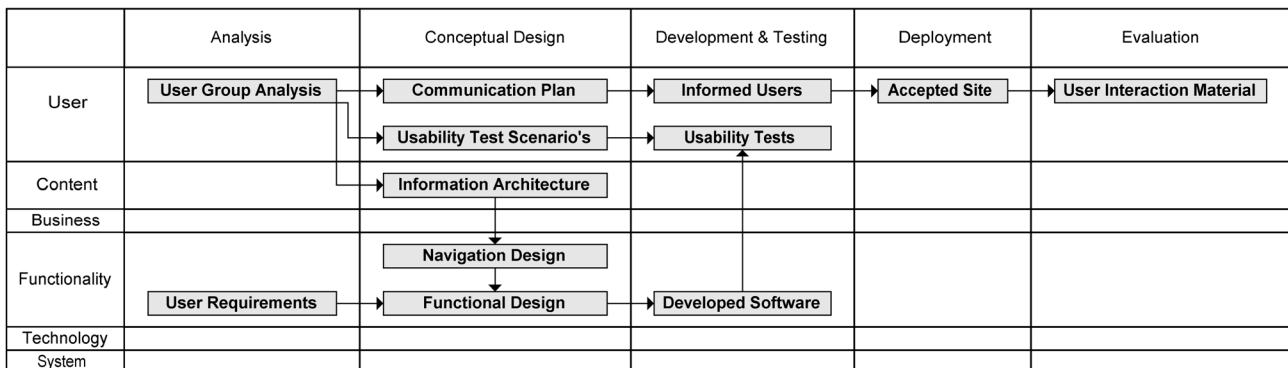
To make it attractive for users to use the site, they should be put at the center of the design of all knowledge portal aspects. The information architecture mentioned in the previous example should be made on basis of the needs of the user groups and the functionality of the site should be based on the users' need as well. During and after the development, the portal will be tested by representatives of the users, to check if it fulfills their requirements and expectations.

Matrix 3 shows the sub-workflow that demonstrates the user-centered design and the promotion of the portal.

6. FULFILLING THE REQUIREMENTS

As we stated in paragraph 3, for the realization of a knowledge portal a structured approach is needed, which fulfills at least the five requirements we mentioned. Our approach is based on these five requirements, as can be seen from the matrix and the way we fill it with products:

- Overview of all products needed is given in the matrix. The matrix is used during the project to communicate which products have to be completed when and by whom.
- Concurrent development is achieved by dividing the products in areas that all follow the same time phases. The sub-workflow in paragraph 5.1 shows the parallel development of processes and functionality.
- Design for change is emphasized by the separate conceptual design phase, where designs on each area are made. Analysis and design take one third of the project time. The separation of functionality and technology areas stimulates infrastructure engineers to not only consider the current knowledge portal, but the entire present and future ICT initiatives of the organization. This builds a flexible infrastructure.
- Content modeling and management are given explicit attention in the separate Content area. Paragraph 5.2 shows the corresponding content sub-workflows.



Matrix 3: User-Centered Development

- User-centered design is emphasized by the separate User area. The user-centered sub-workflow (paragraph 5.3) shows the user analysis and requirements as the starting point for design and promotion.

Our approach is structured because the filled matrix gives a complete overview of all products needed to realize the portal, but this is done in a way that makes it possible to divide the overall project in manageable portions. The coordination between these portions is handled by the central interdisciplinary team.

7. CONCLUSIONS

The basis of our approach is the use of areas and time phases to group products, and an interdisciplinary team as coordination mechanism. We have investigated some similar approaches. The Integrated Architecture Framework [17] has a division in areas, but only addresses architectural design. e-DSDM [18] has a division in time phases, but does not group disciplines into areas. Our approach is different from software development methods like (e-) DSDM [18, 19] and Rational Unified Process [20] because it addresses the realization of the knowledge portal in all its aspects, including e.g. promotion, content management and a monitoring system.

Our approach has been used in several projects that Ordina N.V. has carried out for customer organizations (for an example see the knowledge portal at <http://www.novem.nl>). These organizations were all very enthusiastic about the approach, because it gave them a clear overview from the outset of what needed to be done for the realization of the portal. The projects have given us a lot of input to improve our approach and the products we identified.

The approach presented here only describes what needs to be done and not how it should be done. We are currently trying to synthesize and standardize the most common products in the matrix. We try to fit frequently used tools and techniques to the cells of the matrix. We realize that the challenges we identified are not unique for knowledge portals. We are investigating if and how the matrix and products have to be changed, when our approach is used for other sites than knowledge portals. We continue to apply our approach in real-life projects to assure that it stays up-to-date and relevant.

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