

Content Management Systems Based on GNU GPL License as a Support of Knowledge Management in Organizations and Business

Łukasz Przysucha 

Wroclaw University of Economics, Komandorska 118/120, 53-345 Wroclaw, Poland
lukasz.przysucha@ue.wroc.pl

Abstract. Content Management Systems are an increasingly popular form of publishing content on the Internet. Its popularity gained by a large intuitive, rich diversity of graphical representations and great functionality. The author focused on a characterization of free systems based on GNU GPL license which have high prospects for growth and development. The main goal of this article is to find common ground between knowledge management and content management systems. Author believes that area of content management is not sufficiently exploited and would greatly assist the process of knowledge management in organizations. The article includes possible scenarios and development steps of Content Management Systems implementation in area of Knowledge Management. There were also defined the different points of view of knowledge management depending on the assumed perspective. This chapter is divided into 4 areas, which were finally assembled: content management, content management systems, GNU GPL license, knowledge management and implementation of content management systems in area of knowledge management.

Keywords: CMS · Content management system · Open source · GNU GPL · Knowledge management · Flow of information

1 Introduction

For several years we have seen higher interest of knowledge management and the use of artificial intelligence in organizations and companies. It is closely related with development of technology and networks that support an information flow. Free solutions quickly become an alternative and competition for paid services. The main goal of this article is to find common ground between knowledge management (KM) and content management systems (CMS). Author believes that area of content management is not exploit enough and would greatly assist the process of knowledge management in organizations. Article focused on Content Management Systems working on GNU GPL license because free systems highly support development and prospects of content management process. The secondary objective is related with popularizing importance, universality and many developments of CMS. This paper explores the place for Content

Management Systems available remotely on the network within organizations and business places.

In recent times, it has written several works related with CMS and GNU GPL license. Mainly it was the university work but sometimes business too. Dimitrios Michelinakis from University of Warwick prepared the report “Open Source Content Management Systems: An Argumentative Approach” [1], submitted for the award of MSc Electronic Business Management. It was one of the first looks at the essence of Web content management. Another thesis, “Content Management Systems - Business effects of an implementation” by Therese Karlsson and Jennie Boije af Gennäs from IT University of Göteborg and Chalmers University of Technology contains analysis of the implementation of system in a business.

First section of this work focused on the importance of content management. There are positive effects of the implementation of content management system with IBM and PPL Energy Company. The second section shows usage of content management systems. There are located technical issues, the differences between dynamic and static pages and financial terms of system implementation. The next part is about GNU GPL license as a tool supporting CMS developing. At this point it shows the positive attributes of open source software and future prospects of development. The last 2 sections are related to knowledge management and Deployment of CMS in Knowledge Management. In the last section author proposed action and vision for further development of content management for supporting knowledge management.

2 Meaning of Content Management

At the beginning, it is worth discussing idea of the creation of data and content management working in the network. Content management (CM) is the sum of processes and technologies supporting the management, processing, gathering and publishing information in different forms [2]. In the case of network CM, users manage the electronic form of documents. There are many types of content in CMSs [3]. It is mainly text, graphics, charts, videos, animations, and interface of system. Regardless of display content server has equivalent of the contents displayed, their components, generators and elements of database. Content management is not just about sorting the content, collecting and publishing but on effective content storage, recovery and reuse. Administrator of content management systems can set the connection between CMS and data warehousing for better management of large files and advanced data structure. For the proper management, the user has to elaborate the appropriate rules, instructions and the ways of action for users of the system. Systems that support content definitely raise the awareness of individual employees in the whole structure of the organization, clear the scheme of action and exchange of information, organize and support the organizational hierarchy (Fig. 1).

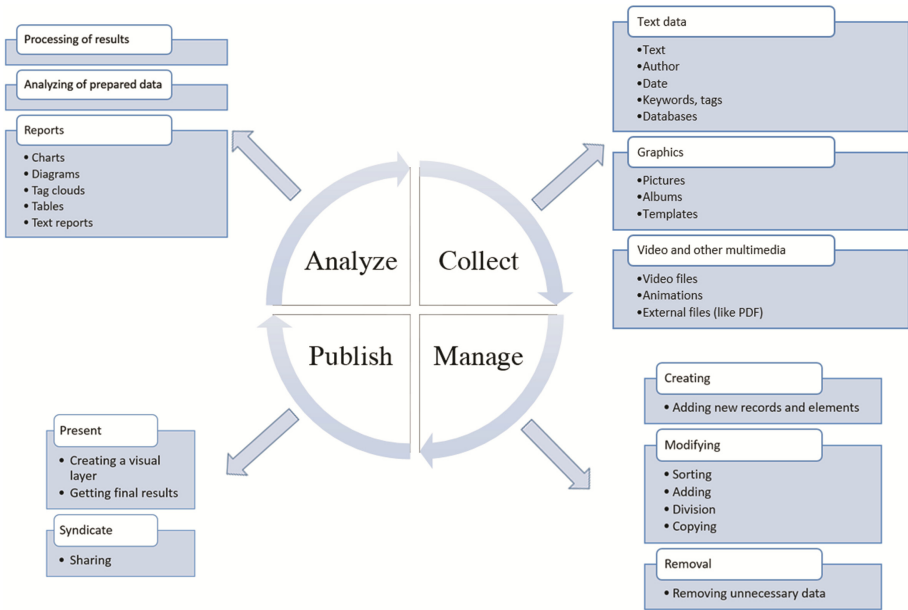


Fig. 1. Content lifecycle

The entire content management process has many meanings in different perspectives. In business aspects content management can be considered as a goal to increase profits. Preliminary analyses give possibilities to check what system is the most appropriate for tasks carried out in the organization. System for content management reduces the time to provide information as well as the data rate increases which has a direct impact on increasing organizations profit. Content Management can also identify missing information and data, thus strengthen the company's position. The consequence of content management at a higher level is a Business Intelligence, which processes data and provides analysis. It can also be an extension of the system on the network. On the other hand, content management can support structure of company and give the division of labor at different positions. Segregation of work according the granted rank and employee level in the organization hierarchy as well as the possibility of verification by higher levels of employees may support organization structure and identify performed tasks. In many ways systems can have the capability of individual work and development of employees and thus provide autonomy of action for the particular employee. From a conceptual point of view content management is the acquisition of information, management and publication of the final results that have been put to the processes of sorting and modifications. Technically this is the architecture of both the user and the server side.

The company is perceived by external organizations mainly based on resources and values. A very large part of information is unstructured. In case of their separation and sorting employees can bring new business value. With the appropriate actions presentation, content can be revived and manipulated. IBM presents examples of content

management applications in their offer [4]. PPL Energy Company in the United States decided to introduce a solution that abolished problems associated with processing paper documents, reduced their loosing and improper use as well as reduced access time to files structured and unstructured. That software made it much easier to find data documents. Their selection time was reduced from five days to a few seconds. In addition, about 75% decreased time extracting the data necessary for current projects. Employees also can verify whether the messages inside the company, as well as documents, are properly stored. The second example is related with implementation at Iowa State University. Content management system that was installed by IBM definitely improved the transmission of documents by students and data security also increased. The university saves approx. \$ 40,000 per year in print. As you can see CM is widely applicable to companies, underscores the value of their business and reduce fixed costs.

3 Usage of Content Management Systems

Web CMS is a part of content management systems that can be used in a variety of organizations and enterprises. Currently, most CMSs are dynamic pages. Static pages were popular in the 90's of the last century, but currently they are abandoned as standardization of static websites. Static pages don't change content during displaying by user. If there are any changes on the page, an administrator is forced to overwrite the files manually. HTML-based site has advantages and disadvantages. It's very easy and fast to prepare that kind of site. Preparation of static page does not require much effort, thus it is quite cheap. The biggest applications for this kind of websites are simple web business cards. It doesn't require PHP and MySQL database installed on server. Hosting can also be for free. The biggest drawback is the lack of interaction with users. These pages are intended only to provide information unilaterally without any action on the user-administrator. They are therefore generally less interesting than dynamic. The main difference between static and dynamic Web pages is based on the technology of their production. Each static page being part of a larger website must be prepared by the web creator first. The final shape and structure of such a service must be known at the stage of design and preparation (Fig. 2).

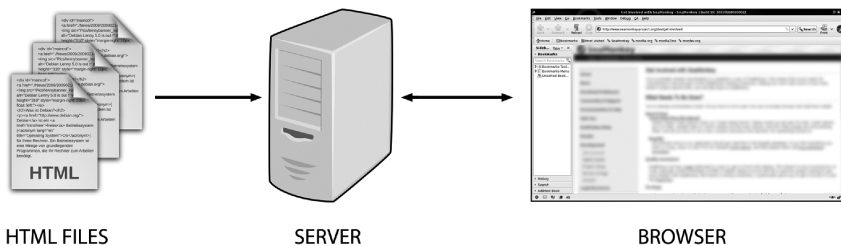


Fig. 2. Scheme of a static page

Dynamic pages, as opposed to static pages are generated on the fly by the HTTP server on the basis of variables and parameters provided by the web browser. Resident

module or other external program is responsible for generating the above-mentioned page. It interprets the commands contained in the script. The entire code generated in this way is based on HTML (tags). How much help is the technique of dynamically generating web pages, let clearly shows a very simple example. The University wants to have a library website. Book collection consists of tens of thousands of items. In the first case designed site have to consist tens of thousands handwritten pages. Any change is going to force overwrite the particular HTML file. In the case of dynamic pages there is one page which allows user to add contents without obligation of adding new files designed from the outset (Fig. 3).

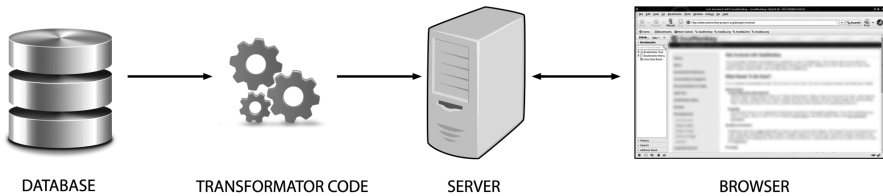


Fig. 3. Scheme of a dynamic page

Once pages are generated in real time in front of the HTML server based on the data provided by the program for browsing the Internet. These sites are dependent on the actions taken by the user is currently browsing them. For example, after adding a comment on the page there is a new entry, date and an author. Sometimes they are also given additional user identification data such as IP, browser and version of system. An administrator can change the contents in two ways - first method, client-side use of scripting languages like JavaScript and ActionScript, which make direct changes to elements (DOM. Document Object Model). The main benefits of this method are shorter response times, much less server load and improved interactive effect of the application. It is not required to interact with database, making it easier when employee want to change the code. The second method is called server-side, using programming languages such as PHP, ASP and Perl. This processing is useful for a contact database and a permanent memory, for example validating the user or data exchange.

There are two types of systems in financial terms. The first are paid systems that are usually created for dedicate projects. Paid, commercial CMSs as opposed to base on open source have a high consistency of the whole system [5]. Technology is created in one company or developer. Work in one place or contact through video conferencing and communicators increases compatibility and professionalism of the program because the code is more consistent. Unfortunately, in this case, developers can draw conclusions only after detecting errors. It's impossible to integrate free plug-ins and templates with pay solutions. In the case where a company goes bankrupt it is uncertain support and reduced safety. Work in one room or in constant contact through programs and video conferencing, communication is of a high standard, which significantly increases efficiency in the future and synchronize the entire final product. Content Management Systems under the GNU GPL license are more attractive. Users don't pay for the system and add-ons available on the Internet. Also many templates resources are public and

free of charge. The code is regularly updated in the case of most systems like WordPress or Joomla. A huge community operating on platforms strengthens security against possible attacks from hackers. Systems offer easy migration between servers. Current standards of free CMS allow simple export and import data between servers. User needs just to install the plugin and copy the generated files. Free CMSs have intuitive interface developed by thousands of users. Both the administrative panels as front-end pages have a simple scheme adapted for the standard user. Using the website does not require any advanced programming knowledge.

4 GNU GPL License as a Tool Supporting CMS Developing

WordPress, Joomla and Drupal operate on public license. GNU General Public License says that the program is free software if it performs 4 assumptions [6]:

1. The freedom to run any program under this license, regardless of the purpose.
2. Freedom to analyze and modify the program for improvement.
3. Freedom to provide a program to help other users.
4. The freedom to improve the program and distribute their own modifications. It refers to the entire community.

Table 1. Advantages and disadvantages of CMS based on the GNU GPL license

CMS based on open source	
Advantages	Disadvantages
Users do not pay for the system and add-ons available on the Internet. High availability of free templates	Getting more unwanted messages commonly called spam, such as advertising, system notifications from the creators
The code is updated regularly for the most popular type systems like WordPress or Joomla. With a massive community security attacks is high	No custom applications. For individual processes and mechanisms, an open system may not include such functionality
Easy migration between servers. Current standards of free CMS allow import and export database and files to another server. User have to install the plugin and copy generated files	Not all platforms are constantly updated and supported by developers and the community. Only the most popular have the full support and round the clock help among users and the administration
The intuitive interface developed for several years, with thousands of users. Both panels - administrative side and front-end page have a simple scheme adjusted for the standard user. There is no required advanced programming knowledge	There is no warranty in case of a break-in and other adverse reactions. The user runs the risk of installation on his own responsibility. In case of problems he must contact with a private companies supporting systems or community trust system

Open source code means that the whole system and additional plugins are integral and all users can use without paying money. [7] That greatly reduces cost of ownership by administrator. In the current economic situation, these systems have gained in value.

Authors give us the ability to view and modify system code. Therefore, users can fully customize the CMS to their needs. Free Content Management Systems have a high utility and application. The same system can be used simultaneously for simple website, which showcase the individual as well as sophisticated management platform for example at the university. Many different commercial organizations use a free content management services. In most cases, open source CMS means better quality [8]. The code is created by thousands of people [9]. Upgrades improve the code and protect the whole system. Open code creates a new community of developers supporting systems. There is many platforms and boards with support in the Internet. Local user groups provide thousands of free templates, designed for system administrators [10]. Skins are divided thematically, and each user will find something for themselves.

The following Tables 1 and 2 compare the advantages and disadvantages of systems based on open source and commercial platform:

Table 2. Advantages and disadvantages of commercial CMS

Commercial system	
Advantages	Disadvantages
Commercial systems have more niche use in projects where standard solutions are not enough. For a fee, buyer get any desired product	The user of the system must pay for its acquisition, often for technical support and maintenance. Manufacturers also are demanding fees for additional extensions and plug-ins, as well as a new graphical interfaces
High consistency of all modules. If the system is created by a developer or a single team all the elements are more consistent and matched to one another	Managing such a system is often more difficult than the free solutions, because it is based on original ideas and assumptions, it is not adapted to the standards
The creators of commercial solutions have an individual approach to the customer. Larger companies give a warranty on the product and in case of failure the immediate technical support and compensation. User is confident that programmer will verify the problem	Proprietary systems are difficult in personalization. For open source systems user can view available extensions and build a page by adding existing modules. In the case of commercial applications usually tools are written from scratch, and the final result can be seen only after the completion of the order
The user can secure the uniqueness. When paying for an exclusive license, buyer is sure that the graphical user interface or mechanism of action is not used by any other website on the Internet	For small business systems cannot be fully secure, due to the many possibilities of attack and a small number of computer support system

Systems based on GNU GPL license have many advantages. Their use is widespread in business. For example, the website of the White House, www.whitehouse.gov regularly use Drupal for manage their website. The most popular news media like The New York Times, CNN, Forbes and Reuters have pages based on the WordPress engine while Joomla applicable on linux.com or cloud.com. However, these systems are used only for publishing content and have a function of transfer and delivery information.

5 Deployment of CMS in Knowledge Management

During the implementing of content management system employees have to verify metadata system that is abstract layer supporting the activity of the platform.

Organizational interests of group can be divided into 8 separate entities [11] (meta-data):

- Goals and Requirements,
- Access Structures,
- Audiences,
- Workflow and Staff,
- Acquisition Sources,
- Authors,
- Publications,
- Content Types.

Defining the objectives and requirements is necessary to create the system. In this case they must clearly identify the use of system and its benefits. A goal is something that an organization wants to accomplish. A requirement is a thing that the designed system must do, be, or have to meet organization goals. The requirements and objectives are closely linked and the system design must be specifically defined. In order to determine the objectives and requirements manager downloading the full reports on the functioning of the organization from all locations. Audience's layer defines target audience. The system interface should be adjusted depending on the type of customers/users, its functionality and performance. All the layers are linked to each other and have appeal. It should be noted that the audiences mainly define external users who are merely recipient of system. For example, if the bank's website, in which a group of employees will put information from a particular area of the company, most customers will have read-only attribute information without interfering with them. Publications and content types are an important part of the scheme of the whole content management system. Publishing of content and the way of system managing have a big impact for the functioning of the entire organization. It can be archive old data, exchange of current information and publication of reports or other type of data. The systems are currently compatible with the most of file types including videos, photos, graphics, XML files and so on. The authors are a group of people who have an access to back-end website. They can edit and modify the content in the whole system. Note that the attributes of individual users of the system are different. Team Manager must have more attributes than members of his team to verify and control work. Acquisition sources are needed to provide a source files implemented in the system. An important issue is the compatibility of the external media with hardware and software that supports system. Workflow and staffing - workflow is an event or a sequence of events that are performed in the CMS. It defines a constant user activity or one-time execution of the element. Access structure informs about privileges of users and provides list of users. It also contains relationships between them. Systems allow create the groups of users with broader availability.

Content management systems fully support the idea of knowledge management in companies and organizations. Knowledge management is a modification of tacit

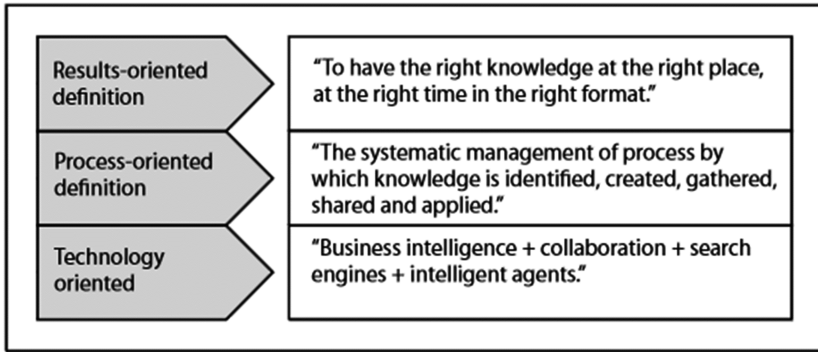


Fig. 4. What is Knowledge Management (source: Benjamins, V.R., Knowledge Management in Knowledge-Intensive Organizations, 2001)

knowledge into explicit knowledge and sharing it within the company/organization [12]. It is an attempt to make the best use of the knowledge that is available in organization, create new knowledge and increase its understanding. Knowledge management can also be regarded as a process which operates the acquired knowledge. This perspective of understanding of knowledge management is described in [13].

Knowledge accumulating: known as knowledge acquisition, data mining and machine learning – can be automated for extracting knowledge from relevant documents or simply - database files.

Knowledge creating - knowledge modelling, knowledge representation (in fact, all activities useful in a development process) are phases arising from methods elaborated in "knowledge engineering environments".

Knowledge sharing – modern technologies (including intelligent browsers) offer almost unlimited access to knowledge resources from any place. For example: a well-conceived e-commerce application contains knowledge on products and services, is able to explain how to use products in given contexts, how to connect several devices together, etc.

Knowledge application – completing the whole process with practical using knowledge-bases in specific environment. In other words, some patterns how to use knowledge to solve different problems are proposed and implemented.

Therefore, from a technical point of view, knowledge management can also be a process of acquiring knowledge, later processing and sharing and finally implementing. There are also other points of view of term knowledge management (Fig. 4).

CMSs increase finding speed of knowledge, organize current scheme the storage and work as a tool for management of information thereby increasing the capacity for knowledge management. Additional functionality like an expert systems built-in content management systems such as WordPress, Joomla, Drupal can support fully the process of knowledge management in the company [14]. Resources are properly stored and delivered with user access levels. Knowledge management is an interdisciplinary field.

Operating systems on a network can assist in this process in various aspects. Open CMSs help to operate with data stored in files and repositories. Many plugins can support with decision making and help desk working. Expert systems added as a plugins represent artificial intelligence and advice for users/workers [15] (Fig. 5).

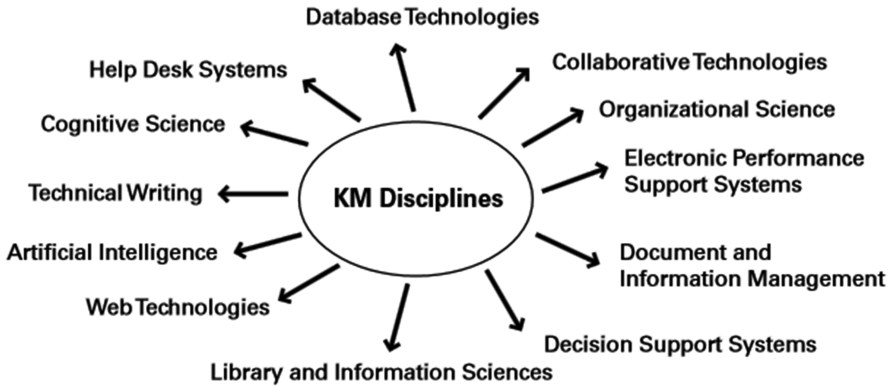


Fig. 5. Knowledge Management Disciplines (source: K. Dalkir, Knowledge Management in Theory and Practice, second edition 2011)

What is necessary to “open” Content Management Systems for Knowledge Management?

1. Development schemes and operating instructions.
- Research what elements of Knowledge Managements can be implemented in Content Management Systems

Content Management system is a tool that will be aimed at supporting the process of Knowledge Management. As a preliminary we have to estimate future functionality and usability of system. The prototype of system supporting knowledge management should be based on a specific example. During the implementation in a particular industry or company, we are able to determine the success of the subsequent implementation. After the final installation we can fully understand sense and utility the entire project. Theoretical assumptions can only be the basis for the later creation of the system. The main elements of knowledge management, which can be used in creating a system for an organization, are focused around the use of current knowledge and acquiring new knowledge. We can group them in several areas. The first is about generating and acquiring new knowledge from both organizations as well as from the external environment. The system should encourage contributors to share knowledge and enable information transfer between all of them. Issue what goes hand in hand is related with security of information storage and exchange of knowledge. The administrator must ensure reliability and safety.

In case of the most popular systems based on open source like WordPress there is build-in security and updates. The administrator should ensure compatibility for those who have access to the organization, mainly available in all browsers and operating

systems. Getting the information, we need to organize representation of knowledge in documents, databases, external files and software. Success of the system is depending on final product. Last area is focused on measuring the value of knowledge, adequate and reasonable use of knowledge and streamlining the flow of knowledge throughout the system.

- Study what parts of Content Management have common areas in Knowledge Management.

We need to verify what elements supporting knowledge management can be implemented into the system. Some of them such as sorting parts, storage and aggregate elements and expertise systems are already in the early stages of use and can be implemented to create a new system.

2. Development of extensions for systems.

- Create new elements of CMS supporting organization in Knowledge Management like artificial intelligence widgets, plugins and scripts.

The area of knowledge management in content management systems is still undiscovered and there are no designed concepts that can be exploited. The system should be modified in the organization and include intuitive interface for all users. In the initial part of implementation, users will get testers status and the administrator should increase the frequency of database backup.

Ruddy Ruggles prepared a report – The state of the Notion: Knowledge Management in practice, source: [16] saying what are desirable actions during the implementation of projects which can support knowledge management.

All tasks were divided into three groups: projects in a company that have already realized and current projects that are currently being implemented in the enterprise, intentions purposes to be carried out and what they should prepare to streamline work (Fig. 6).

In case of content management systems most of the objectives can be achieved by an appropriate modification of the system. Executives acknowledged that current activities are focused on the implementation of intranet, creating knowledge repositories based on data warehousing, implementing decision-support tools creating groupware to support collaboration. The first one – intranet can be achieved in CMS by setting the system in local server or sharing in the Internet but reserving access relevant rigidities. The platform could serve both assumptions - intranet and extranet but only if a low degree of secrecy of data. Banks and other organizations that store customer data they cannot afford to provide data beyond the walls of the institution. Most of content management systems are prerequisites for data warehouse. Using the database, mainly MYSQL, fulfills this (Fig. 7).

The graphic above shows location of database in the interaction between CMS and server. Content Management System consists database, html files which are located mainly in PHP files and other files and multimedia like pictures, PDF files and so on. All these elements are put together and displayed by the server in an intelligible form for the user. System interface supports user and administrator to manage large amounts of data. Media and other external files can be classified as a data. The third project is

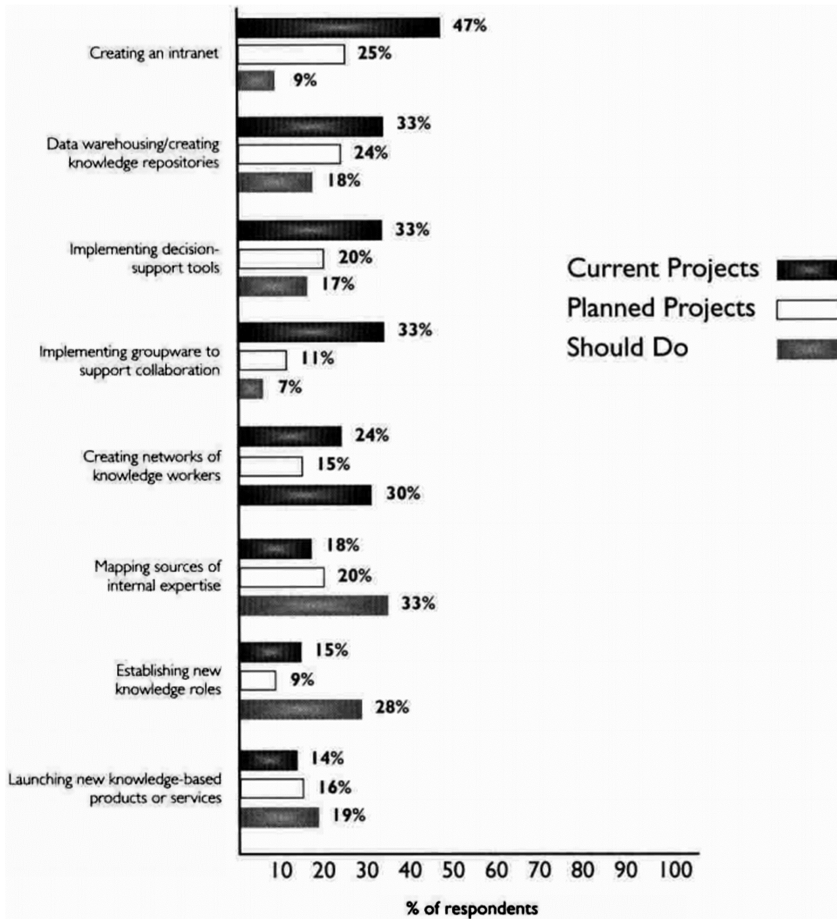


Fig. 6. Knowledge Management Disciplines (source: Ruggles R.: The State of the Notion, Knowledge Management in Practice. California Management Review vol. 40 no. 3, Spring 1998)

focused on implementing decision-support tools. Support tool for knowledge is an essential component for organization to begin the process of knowledge management. If there is no specific rules and workflows for decision-making employees have a limited range of help and support. This is detrimental for process of knowledge management. What is interesting executive need to implement mapping sources of internal expertise and establishing new knowledge rules. One of the main tasks in organization enabling effective use of their knowledge is finding and defining a knowledge resources. Knowledge maps help in the future in developing business plans, planning, managing time and tasks, reporting, project management, analysis, preparation offers and many others. Content Management System could be a perfect tool to create such a map. Diagram shows the steps in creation of knowledge map (Fig. 8).

3. Testing new ideas for case study in business.

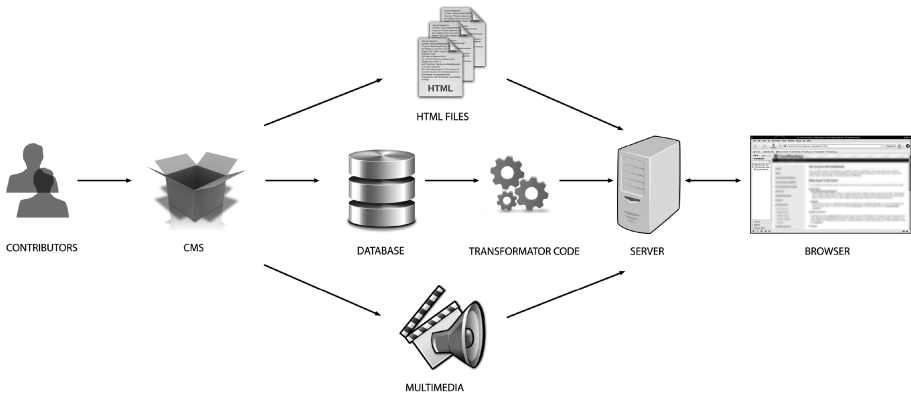


Fig. 7. Database location in CMS

- Test of widgets and plugins installed on the server and cloud.

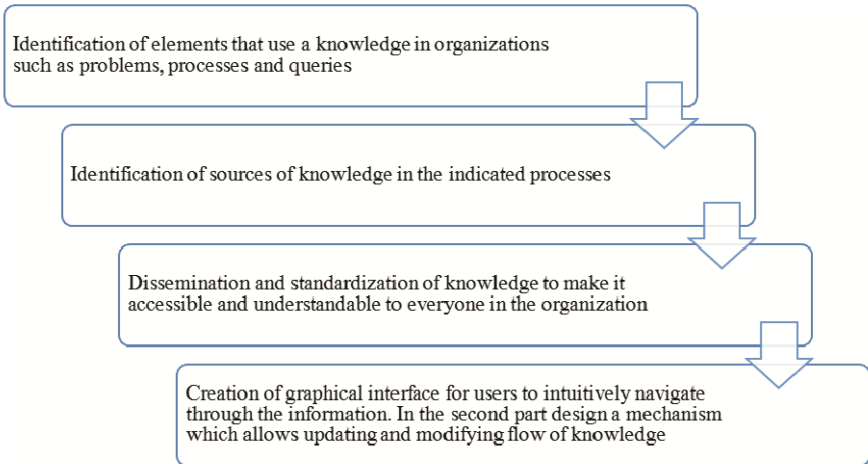


Fig. 8. Knowledge map creation process.

Business greatly supports and promotes science. Companies and organizations can create and test a case study that will indicate the right way of development of the system. They must provide a layer of practical use both before the implementation and during the testing. Case study can also answer the questions what elements of the company have to virtualize.

4. Implementation of developed solutions in enterprise.

- Analysis of the implemented elements in organization.

The next post-implementation step is related with assessment of compliance with the assumptions. Workers prepare reports and analyze changes in the system.



Fig. 9. Components needed for knowledge management

- Conclusions and improvement.

After the completion of entire cycle designer should apply patches on the system and draw up a final report and conclusions.

6 Conclusion

The article presents a role of content management systems in knowledge management. To understand the importance of systems application author defined a content management, cycle of content in organizations and showed the priorities and objectives of the organization from information and data perspective. On theoretical grounds it was created last chapter which contains information how to merge both of areas. Author decided to divide explored issues into the following steps: Development schemes and operating instructions which can be specified between research what elements of Knowledge Managements can be implemented in Content Management Systems and study what parts of Content Management have common areas in Knowledge Management. The next step is focused on extension to the system which includes creating new elements of CMS supporting organization in Knowledge Management like artificial intelligence widgets, plugins and scripts. This is the practical part of the action based on the findings of theoretical. Then testing new ideas for case study in business and implementation of developed solutions in enterprise. These steps include full study of content management systems for knowledge management. Nowadays, managers and directors are increasingly aware that the role of management in the organization is fairly important, how it can positively affect for organizational structure, enterprise profits and performance of employees. From the perspective of a market it could have a positive impact on ahead of the competition.

It is not possible to achieve the organization's objectives without the use of knowledge, technology and employees (Fig. 9).

Diagram defines the constituent parts necessary for knowledge management. It shows that Content Management Systems belonging to the area of technology are just a part of components needed to successfully carry out the process of knowledge management. It is definitely still undeveloped area which can support knowledge management in the enterprise and pursue its objectives, which are usually improving the organizational structure, increase profits and proper management of information and knowledge.

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