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APPLICATION OF KNOWLEDGE MANAGEMENT SYSTEM TO INJECTION MOLD DESIGN AND MANUFACTURING IN SMALL ENTERPRISES

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Abstract

This paper present the solutions that a company introduced to tackle the problems that it faced during the engineering design and manufacturing of plastic injection molds. The company took an approach of introducing knowledge management system for risk reduction and avoiding problems that had already been recognized in the past. Based on preliminary analysis, knowledge management system model has been developed and potential solutions have been tested with respect to identified requirements. The most suitable system was later implemented in the company.

Keywords: knowledge management, information management, small and medium size enterprise (SME)

1. Introduction

The survival of manufacturing enterprises nowadays depends on the optimization of the manufacturing process in terms of time, costs, quality and adaptability to the market. Having the right information at the right time requires managing and processing large volume of data. Increasing complexity triggers an increasing demand for systematic management of information and knowledge. Knowledge management is of strategic importance to a successful management of an enterprise, which is of vital importance when the key staff changes.

Lean product development is knowledge based, so the emphasis is on learning and capturing knowledge to be applied to current and future products. Learning minimizes the failures and rework loops encountered when designs are based on insufficient knowledge. This may seem counterintuitive to reducing development time, but the time invested up front to understand issues and make the right choices is much less costly in time and resources than fixing problems in production or in the field (Morgan and Liker, 2006).

There are several commercial software solutions for knowledge management. The introduction of any software solution requires a detailed analysis of what the enterprise needs. In large systems, it is easy to justify an investment in information systems and better knowledge management. Such an investment brings a competitive advantage (Wibowo and Waluyo, 2015). Small and medium-sized enterprises are often faced with the dilemma of investing into information solutions that do not yield the same benefit, compared to large systems.

Knowledge management tools have a very broad scope of functionalities. Miklosik and Zak (2015) have shown positive correlation between knowledge management and innovations in processes, innovations in products, and continuity of innovations. They define knowledge management as a source of competitive advantage, together with optimizing business processes and social responsibility. Other benefits of knowledge management system (KMS) include:

- Improved availability of information and sources
- Learning from mistakes and continual improvement of the process
- Promotion of good practice
- Quicker and improved decision-making within the enterprise
- Improved atmosphere and dedication of the employees
- Reduced effect of losing experienced staff
- Protection against knowledge copying
- Reduced time, required for developing a product and its launch onto the market
- Improved brand awareness
- Earlier detection of possible changes on the market
- Improved detection of new business opportunities

The contribution of this paper is the methodology for selecting the optimal KMS for small industrial enterprise and example of application of KMS into injection mould design and manufacturing company. Information flow and process analysis of a mould life-cycle were conducted first with the goal to recognise points where new knowledge is generated and documents in which knowledge is stored. The result of workflow analysis is list of functions and criteria for KMS. The paper also presents and evaluates the results obtained by this methodology and so provides some clues and guidelines for other similar industrial cases.

1.1. Knowledge management

Defining knowledge, Thierauf (1999) defines three components: (i) data is lowest point, an unstructured collection of facts and figures; (ii) information is the next level, and it is regarded as structured data; finally, knowledge is defined as information about information. Volume relationships between the three components are shown in Figure 1 (Frost, 2017).

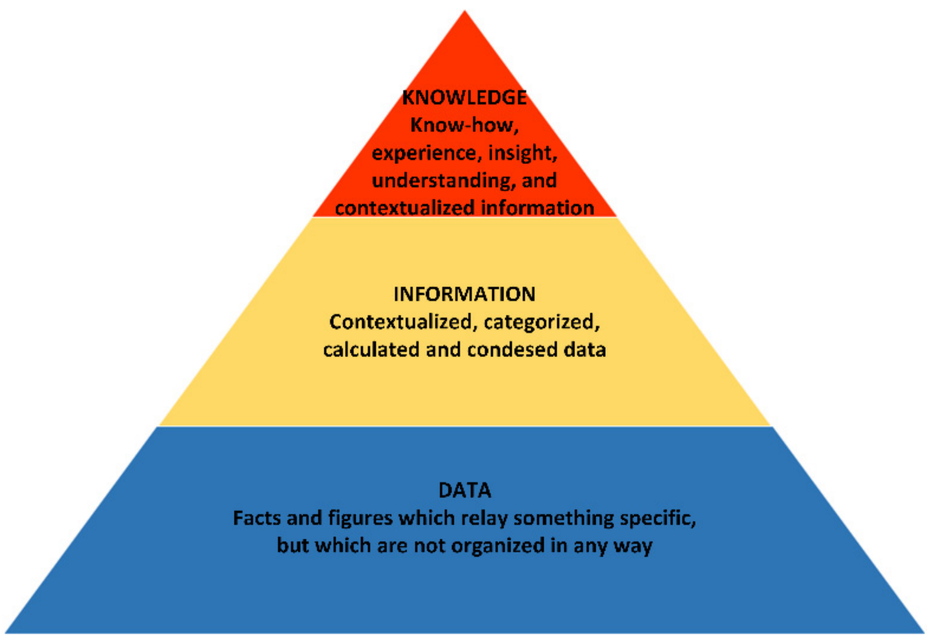

Figure 1. Three components of knowledge (Frost, 2017)

One of the first knowledge management theorists is the Japanese Ikujiro Nonaka. He introduced the notions of explicit and tacit knowledge (Nonaka et al., 2000; Nonaka 2007). The first one refers to personal skills and the other one to written documents. Knowledge management is based on the interaction between both types of knowledge. This concept was developed in the 1990's and remains the core of this discipline. In practice, knowledge is a matter of a combination of both tacit and explicit knowledge, rather than a single one.

Knowledge management (KM) is a term that refers to the techniques of systematic collection, transfer, security and management of information of an organization. KM is defined as a process of capturing an organization's collective knowledge from various sources and using this knowledge base to the benefit of the organization. The objective of KM is to increase the added value of the knowledge created within the organization. This added value is reflected in improved functioning of the enterprise in all areas: business functioning, customer service, discovering new market opportunities, improved internal processes etc. (Demarest, 1997).

In our case, KM methods will be used for the needs of a design department. Within the processes taking place inside an enterprise the vital ones should be identified. In order to capture the processes, taking place in an organization from the KM viewpoint over a longer period, the notion of KM life-cycle is introduced. This concept is based on the interaction between three components (Grey, 1996): (i) People: It refers to the design department staff, their interpersonal relations, their attitude to work, sharing the knowledge, teamwork, motivation, organization of individuals, organization of the enterprise, enterprise vision, etc. (ii) Knowledge: Anything that helps the design department do its job better. (iii) Process: The process of knowledge transfer from technical infrastructure to the user. Knowledge and its sources should be in the right place at the right time. Knowledge sharing can be referred to as "push and pull". The pull mechanism takes place when and employee actively searches for sources of knowledge (archives, professional assistance, colleagues), while the push takes place when knowledge is pushed against the user (design guidelines, instructions, scripts).

1.2. Background – case study

A small private enterprise, which started small-scale production 25 years ago, now employs over 60 people. Their activities include the sales of high-quality and technologically advanced tools for the injection moulding of thermoplastics and production of thermoplastic products. Being a specific type of production, the products are custom-made for an individual buyer.

Through years, the employees have learned to efficiently solve specific problems; however, the solutions have never been recorded as there was no need for it. At a sudden change in personnel, the knowledge was lost and the new people were again engaged in solving old problems. Although work archive was being kept, it was not arranged in a systematic way to allow using it as a source of solutions for the current problems. As projects are arranged according to work orders, the first problem is locating the document if the designer of this tool is no longer employed with the enterprise.

The tool manufacturing process involves no rework loop into the design. This means that upon submitting the final documents, the design department shall not receive sufficient information on its product from the subsequent phases of tool manufacturing. The problems that occur are fixed locally and information on a fault shall not reach back to design, the first step of tool manufacturing. Consequently, the same faults are repeated again and again. Most of these faults can be corrected; however, they extend the manufacturing time and incur additional costs. It is a known fact that the costs of solving problems in later phases increase exponentially, which means that quality design documents often make a difference between a profit and a loss. The rework loop represents the flow of information back to the design process and learning (Figure 2).

As decisions are made on the basis of conversations, there is no systematic record on the decisions and changes. There are misunderstandings during the communication, which incurs additional costs. Activities occur that are not in line with an optimum way of creating a tool, and in later manufacturing phases the reason for a particular activity or decision is no longer clear. This has the most noticeable effect on the changes on a tool. Later it is no longer clear what changes had been made and what their consequences had been. Sometimes not everyone is informed about a change. The costs of faults justify the application of tools for recording activities and the time required for data entry.

The analysis has shown that KMS needs to enable user-friendly and fast recording of knowledge with text and pictures. Recording has to be enabled at different locations - where it is created (in workshop, at meetings, at product development). Simple recording and possibility for fast retrieval of knowledge is the key functionality requested from KMS.

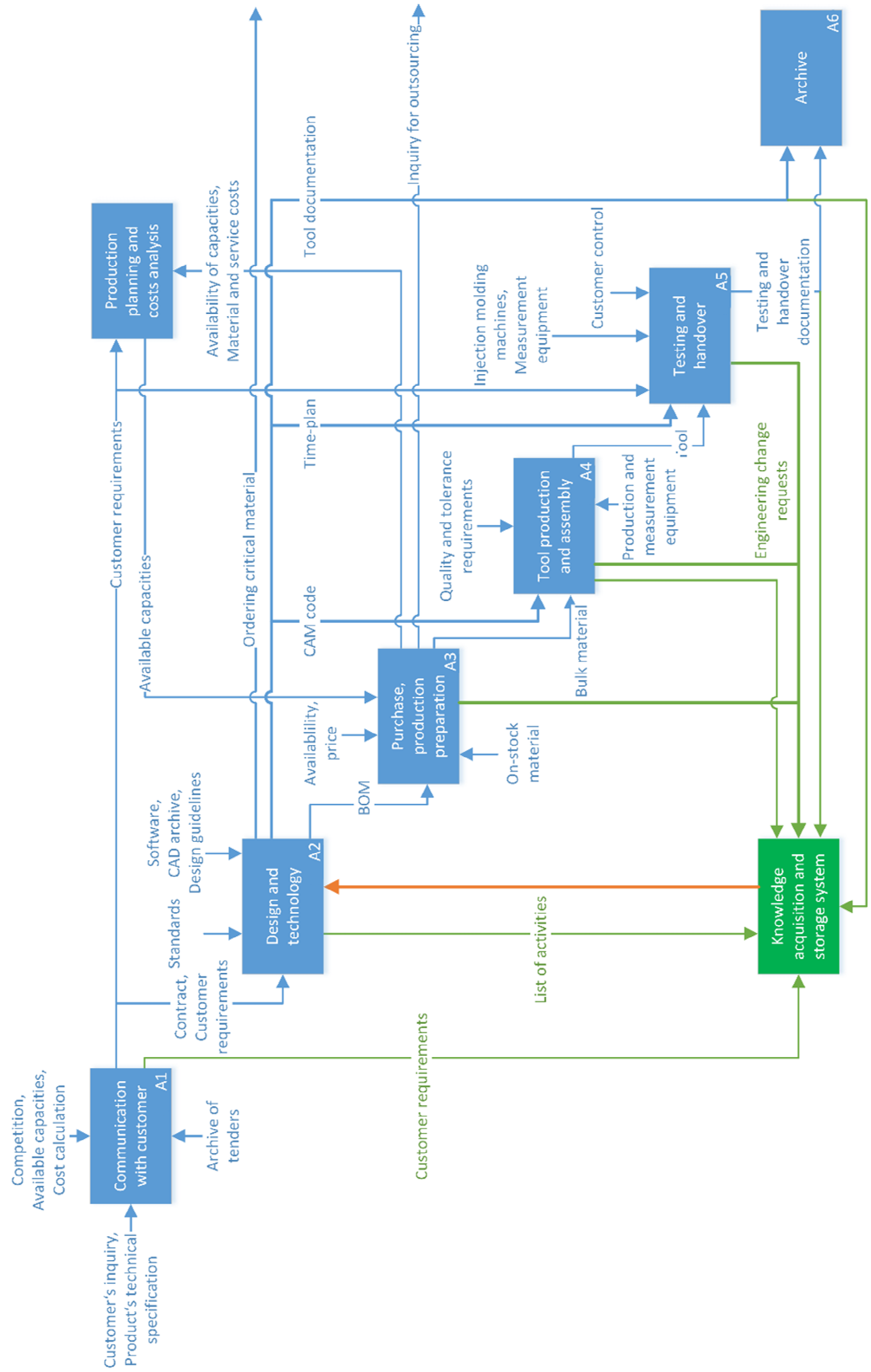

Figure 2. Functional diagram of tool manufacturing with integrated rework loop for capturing and storing knowledge

2. Methodology

The objective is to introduce a software tool that will solve the described problems in the enterprise. First, the current situation in the enterprise was modelled and its functioning was analysed. Interviewing of senior engineers was the basic research method. Additionally, records on engineering changes were systematically checked. The senior engineers were later involved in assessing the proposed solution, final solution is a result of several iteration.

The crucial steps in the model were identified where knowledge is generated and which documents created inside a particular step, involve particular knowledge. These documents were then stored and systematically arranged in order to provide assistance in the steps where this information is required. At a physical level of abstraction, the functioning of the model was transferred to the information system. The existing solutions were reviewed, a detailed analysis of four possible solutions was performed and the most appropriate selected. The required functionality was achieved by means of proper configuration and method of use. The system was implemented in the enterprise. Efficiency of the solution was assessed according to the response to the use of the system in the enterprise. Discussion comments on the contribution to the enterprise and use in the future.

3. Results

Developing a new information system with the required functionality is not sensible, as there are several solutions available on the market, but they need to be adequately configured. The selection of an information system requires a systematic approach, beginning with defining the requirements. It has been concluded that a knowledge management system is not suitable to take up the role of an electronic archive or PDM. CAD files in particular require a lot of data space, which would make KMS slow and rigid. For the purpose of the task, KMS will capture the documents, presented in the model, while other documents will continue to be stored in a conventional electronic archive. The key requirement for selecting a system is its compatibility with the existing system in terms of hardware and software. The database should be stored on a server. The system is accessed via local computers or mobile devices, where access rights can be arranged. Criteria for the selection of a suitable system are divided into three sets: the user aspect, the practical aspect and benefits to the enterprise. All criteria and aspects are shown further in Table 1.

The first set of criteria assesses the user aspect of executing the system, i.e. efficiency of working with the system. Documents need to be captured easily and quickly. Documents are then stored in a prescribed structure, accessible to multiple users. If a particular document is not available, KMS should clearly indicate that documents are incomplete. KMS should allow reviewing the documents. It is desirable that the documents in the system allow editing. From the data, contained in the uploaded documents, new documents are created in KMS, with a higher density of useful information. If necessary, any part of KMS can be exported to a document in a standard format. Along with text and tables, KMS should also support images.

KMS should improve communication between the designer and the customer, usually taking place by e-mail. Taking minimum extra effort, the system should capture the messages and clearly show progress in negotiations and agreements. A designer should spend less time on working with KMS than he or she now spends on browsing old e-mails and searching for information. If during the design phase the customer requests a change, not consistent with the initial requirements, the designer can quickly notice the customer's inconsistence via KMS.

KMS will create a folder for each work order. Searching the database will require a capable browser. Required is the option of searching inside documents, word order folders or inside the entire database. Search queries can contain either a single word or several words. Quick searching through the database is desirable, as well as generally highly responsive system, also with large volumes of entered documents.

The practical aspect involves criteria for assessing the costs of implementing the system. Implementation should not be overly demanding in terms of temporal and financial aspects, as well as in terms of staff training. A criterion for selecting a system is its capability of upgrading KMS in the future. Upgrading will be advantageous in order to improve the system's functioning, while on the other hand it will be vital for compatibility with new versions of operating systems that will appear. When changing KMS, database should be transferrable to a new system.

The third set of criteria assesses the system's benefit to the enterprise. It assesses the suitability of data capturing, their extent and simplicity of its conversion into knowledge. One of KMS's tasks is to raise awareness about the importance of knowledge and expanding the environment for its management. The effects of KMS are reflected in several areas. Reducing the number of faults results in reducing the number of modifications on tools and consequently the time required to manufacture a tool. As a result, the ultimate cost of a tool is also reduced. A detailed description of a project will gradually lead to improved time- and cost estimation of the project. This is important when business is being made.

3.1. Possible solutions

3.1.1. Wiki system: Mediawiki

Wiki is a possible method of group work. In principle, this is a website that allows free modification of its content. Content is usually entered in wiki syntax, while in recent years, WYSIWYG (what you see in what you get) interfaces have appeared. They make work considerably easier, for the less software-oriented users. One of the features is hyperlinks to other pages. Each wiki system has its browser, allowing efficient browsing through the content. The first wiki platform appeared in 1995 and was followed by many others, including Wikipedia. As early as in 2000, wiki became popular for the use in enterprises. In principle, such system is more useful in large corporations but below, it will be analysed also for our case (Al-Ghamdi and Al-Ghamdi, 2015).

3.1.2. PLM system: Aras Innovator

PLM systems are a strategic innovation for a business company. Aras Innovator is a software suite for managing product lifecycle data. It is a typical example of a PLM system. The software is based on Microsoft.NET Framework and SQL server. PLM affects the functioning of all departments within an enterprise but in our case it would be used only for the purpose of the design department. On completion of each activity, it requires the user to enter metadata in order to allow searching for documents and information at a later stage. Innovator has no integrated text editor; however, it is smoothly integrated with Microsoft Office. After installing extensions, Office software allows saving forms directly into Aras's system. It makes sure that a document in the system is created and located in the correct position.

3.1.3. MNM system: HiPlan

A few years ago, the enterprise purchased HiPlan software by the Italian producer Logical System. The system is adjusted to optimizing activities in the area of manufacturing tools for the injection of thermoplastics. It assists in meeting delivery times, it arranges resources, reduces costs, and takes account of priorities and capacity of processing machines. Using Gantt charts, it identifies critical activities and paths. In its initial years, the software yielded no benefit. Later, the enterprise employed an administrator, responsible for accurate functioning of the system. There is a realistic possibility that the system should be upgraded for storing knowledge.
Currently, in the enterprise they use of the HiPlan system: Each employee can access the portal with his or her username and password. The senior staff within a system assigns the employees tasks according to priorities and capacities. The system allows sending messages, a calendar with the option of adding tasks, and a daily and weekly timetable, which is currently not being used, though. After a working day, the employees log on to the system and report on the performed tasks. There is an option that the content of the activities could be stored centrally, which would allow elimination of possible faults and greater clarity of changes.
The system allows monitoring the costs. The project manager sets deadlines, the line manager divides work. The project manager and authorized individuals can monitor the progress of the entire project. Once the project has finished, there is an option of automatic generation of reports and cost analyses.

3.1.4. Word processor: OneNote

OneNote is basically software for collecting notes and has been part of Microsoft Office since 2003. It allows creating simple or complex notes, their organization into a form that makes searching easy, and synchronization with different platforms. Data entry can be performed in different forms and formats, such as handwriting, typing, sketching, screenshot, images, pdf documents, Office files, audio files etc. The enterprise has installed the SharePoint portal, which allows using OneNote for group work. Records are stored on a server, which allows editing by several users, but with there being only one file, data are not replicated, which provides functionality of a wiki system. With cloud storage, OneNote online allows accessing the records and documents from anywhere.

Table 1. Criteria and assessment values for capturing software solutions knowledge

	Criteria	Weight	MediaWiki	Aras Innovator	HiPlan	OneNote
User aspect	Visual appearance of user interface	1	2	4	1	3
	Speed of information acquisition	2	5	2	3	4
	Simplicity of content editing	2	1	3	2	5
	Document upload speed	2	3	4	3	5
	Shared use of documents	3	2	5	1	3
	Adjusting data structure	2	3	0	0	3
	Using standard forms	3	3	5	0	2
	E-mail storing	2	0	4	3	5
	Simplicity of comments	2	2	5	3	4
	Creating a document about a change	1	3	5	2	4
	Browser	2	3	5	2	4
	Data export	2	4	3	2	4
	No replication of data	1	1	4	2	3
	System speed and its responsiveness	2	5	3	2	4
	Allowing versions of documents	1	5	4	2	3
Total user aspect			73	101	48	101
Practical aspect	Possibility for outside users	1	4	2	0	4
	Simplicity of implementation	3	2	1	5	4
	No extra training required	3	3	1	4	3
	Low maintenance costs	2	5	1	3	2
	Adjusting to needs	1	5	1	1	3
	Simplicity of system upgrade	1	5	2	2	3
	Database transfer to another system	2	4	2	1	3
	Functioning after upgrading other systems	1	5	1	2	3
Total practical aspect			52	18	40	44
Benefit to design department	Extent of captured data	1	2	5	3	3
	Knowledge detection	1	2	5	4	2
	Conversion of data into knowledge	2	2	4	4	3
	Tacit knowledge capturing	1	2	4	4	3
	Encouragement of cooperation	2	4	4	1	2
	Lower chance of faults	3	2	4	3	3
	Improved temporal assessment	1	2	4	5	2
	Improved financial assessment	1	1	5	4	1
	Improved organization of design department	1	2	4	2	3
	Improved culture of knowledge management	2	4	4	2	3
Total benefit to the enterprise			37	63	45	39
Total			167	186	135	187

3.1.5. Assessing solutions

The criteria for assessing four possible solutions have been divided into three groups, as follows:

- The user aspect of executing the system: These criteria assess the user's experience with working with the system. They strive to estimate how much time and energy it will take the user to do the extra work. Consequently, they will assess the staff's attitude to using the system.
- The practical aspect of the system: Assessed is the effort that an enterprise will put into bringing the system to life and risk of problems in the future.
- Benefits to the enterprise: The last set of criteria compares the efficiency of solutions and their effect in the enterprise.

The assessment criteria were defined by researchers based on systematic software analyses and on pilot installations. One of the researchers / authors works permanently in the company as design engineer, therefore communication was easier and retrieving of needed information faster.

Table 1 shows the results of assessment. For each criterion, a solution is assessed with a value of between zero and five. Five means an excellent solution or property, and zero the absence of it. Due to their importance, some criteria were weighted with a factor of two or a maximum of three (Kai, 2011 and Wang et al., 2014).

Mediawiki is a very stable solution for storing text and images. It works fast and is not dependent on an operation system, which guarantees smooth functioning after upgrades or changing software in the future. Data entry and editing are slow but browsing is quick and efficient. As it allows using templates, each new page can have an agreed form. It does not allow uploading Office documents and because it is not designed for data storing, each standard form entry requires rewriting the data. Rewriting is time consuming and data can be replicated.

Aras Innovator has typical features of a PDM system. It has been designed for an environment where many people take part in a project. It is designed for assigning tasks, following activities and joint discussion. In our case, the number of designers is too small as to make it sensible to assign tasks via a PDM system. It would work for communication with the customer, however, no customer currently uses Aras. One of our problems being archiving the activities, using the Innovator would nevertheless significantly extend the duration of an activity. Using the full potential would require changes in working methods and training. Compatibility with other software provides high efficiency, but it also carries some risk of problems. Due to the extensiveness of the system, its knowledge capturing is the best of the suggested solutions. It is also acceptable for capturing tacit knowledge.

HiPlan has a significant advantage as it is already being used in the enterprise. It is only its use that should be adapted. However, there is no guarantee that it will continue to operate properly in the future, when other components are replaced. The software has no efficient user interface, which discourages the users from its use. It also does not allow file sharing. The system is useful for planning manufacturing activities but not so much for the design process. Because the system is used anyway, vital information can be copied from it into a KM tool.

Following the criteria of benefits to the enterprise, OneNote is not a perfect solution, however – due to a small investment – it is rated the best. The software is installed, it is easy to use and relatively robust. The environment is familiar and managing large documents is not a problem. Drag and drop feature saves a lot of time. It surprises also with the functions, such as the algorithm for converting images and pdf documents into text. The browser is efficient and documents are always in shared use mode, which prevents any confusion with different versions. Updates are expected every several years and we can rely on compatibility with other Microsoft tools. So far, the system is being used to the benefit of the design department. Subject to positive response, other departments in the enterprise can join the use.

3.2. Implementation

3.2.1. Intended use of OneNote in the enterprise

As part of Microsoft Office, OneNote is already installed on all computers. The configuration had to be set up in the way that documents are stored on the server and are in shared use. A separate workbook is created for each work order, and there is also a workbook for general knowledge. Using a template for the entire workbook, identical structure of documents for each work order is achieved. For consistent storing of correspondence with the customer, e-mails can be sent directly from Outlook, with the shortcut in the Outlook's toolbar: send to OneNote and selecting the location in the workbook where the mail is to be stored. For remarks on a CAD model during working with modelling software, a screenshot can be sent automatically to OneNote. With drawing tools there, a detail can be then marked and commented on. Avoided is the use of a third software program, which is happening now. A document about a change is no longer created in PowerPoint but the image and remark are directly stored in the test notes tab. Later, it is possible to trace back what and in what order has been modified. All remarks can be quickly found with the browser and if there is something of particular significance, a mark can be added. At the end of the project, significant issues from the entire workbook are summarized in the knowledge tab. Here, it is marked what has been learned and faults are exposed as a warning for future activities. Using a system for capturing and storing knowledge consists of six steps, shown in Figure 3. After creating a new workbook for a new work order the responsible designer receives two documents from the customer and stores them in the system. After that, he or she receives from the project manager two more standard documents that are also stored in the system. The second and the third steps are intended for capturing the data that are important later on in the project.

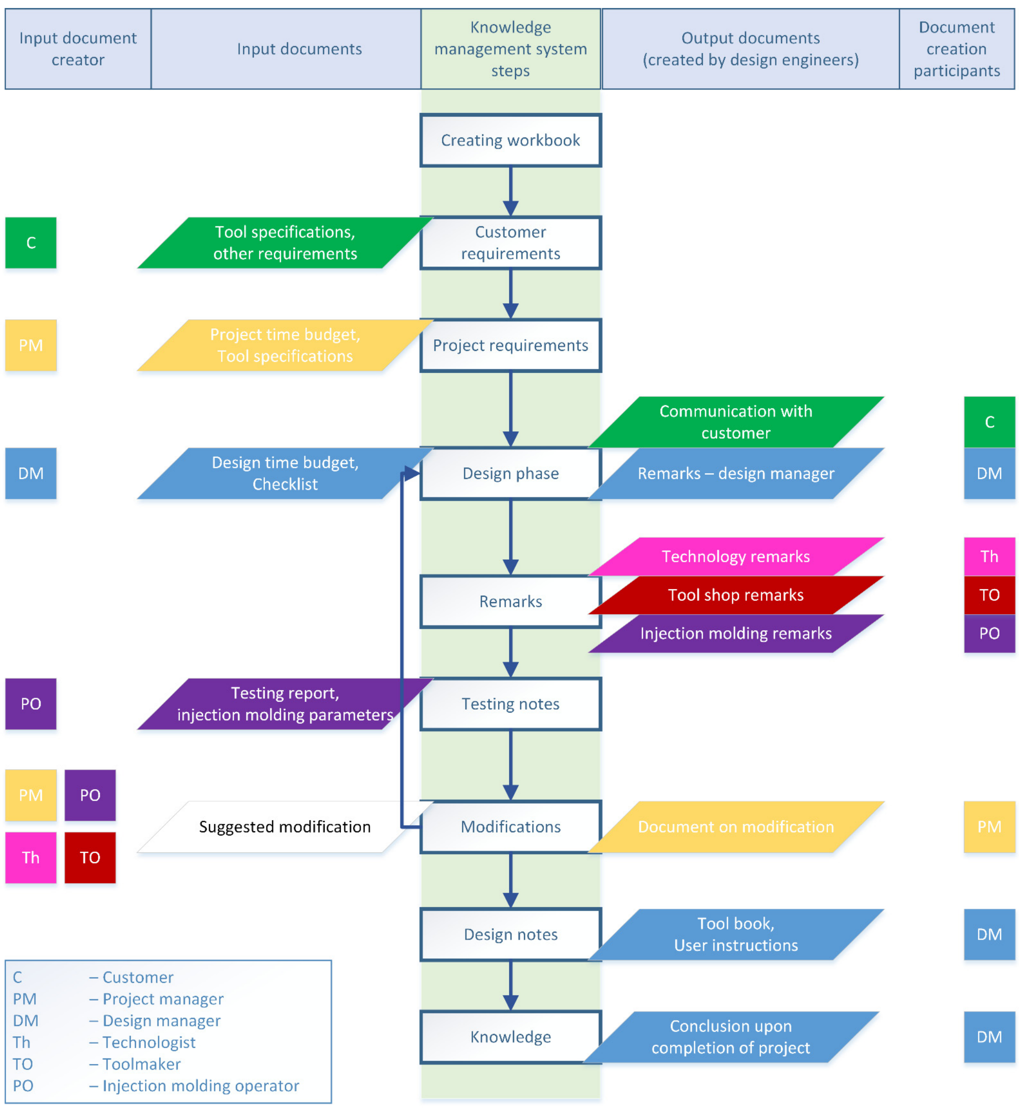

Figure 3. Steps of using KMS with typical points for knowledge capturing

The design phase begins with input data. In this phase, the designer is supported by an internal checklist and is bound by the time plan. The created design concept is assessed by the design manager and later also the customer. It is the designer's personal responsibility that the remarks of both are precisely entered into the system. Systematically recorded faults that occurred in the concept will in the future warn other designers to avoid them. Upon completion of the documents, approved by both C and DM, design documentation makes its way to the next phases of tool manufacturing. The designer's task is again to enter into the system all remarks that a technologist, tool maker or anyone from the plastics department has. After a test, the injection moulding department generates a report on the test and submits it to the designer who enters it into the system. If a product is not suitable, the project team makes a modification. The designer enters a precise description of the suggested modification into the system before modifying the tool model. After the modification, a new test is carried out and the designer updates the modification document and comments the result of the modification. If necessary, another modification follows. Once a product is acceptable, the designer creates standard documents for the customer. Upon completion of the project, the designer writes in the knowledge step what has been learned during the project. The completed project folder is stored in the system and can be accessed and made use of anytime.

The KMS has been installed and configured recently. The first response from end-users is positive, however there is not yet enough evidence and data to confirm advantages of KMS. Application of KMS is a long-term investment and it depend a lot on human involvement. There is already a long-term plan for maintaining KMS in the next section.

3.3. Long-term functioning of knowledge management system

The basic principle of KMS functioning is based on constant learning and improvement in the functioning of the enterprise. Upon completion of each project, the captured data are analysed and the findings – that include new knowledge – are recorded. New findings complement the knowledge base. The content of the captured knowledge should be checked periodically and the analysis should be followed by corrective measures. The measures can refer to the system of capturing knowledge or, for example, training the staff due to recurrent faults. We believe that an analysis of KMS functioning should be performed at least once a year. Assessing KMS functioning is shown in Figure 4.

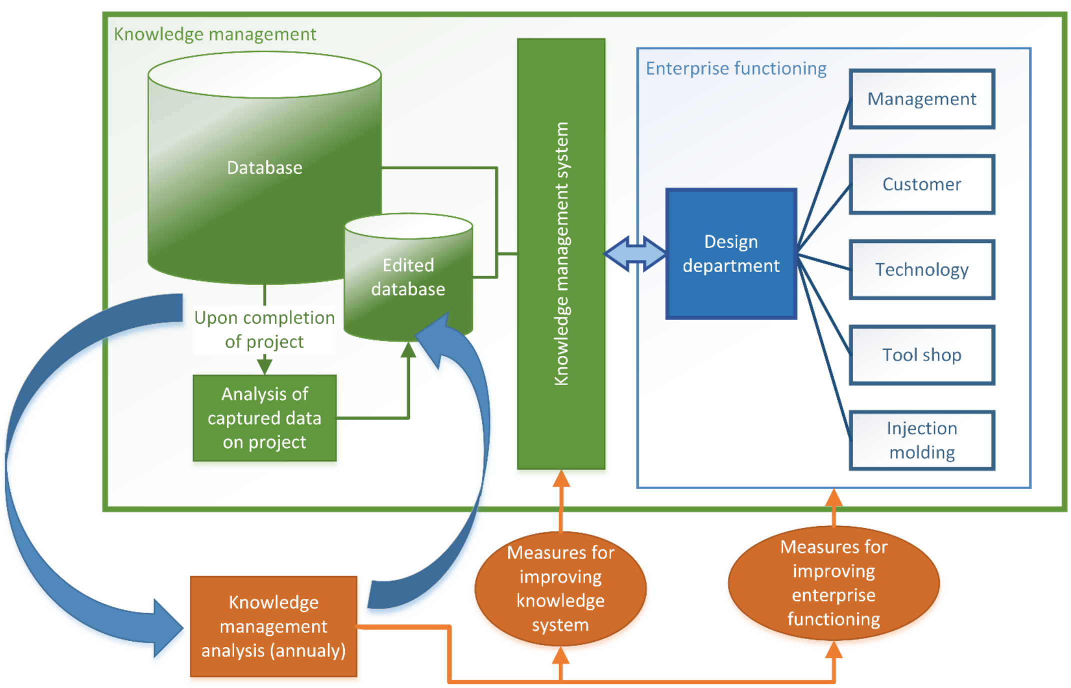

Figure 4. Assessing KMS functioning

For the purpose of analysing knowledge management, the indicators for assessing suitability of the functioning of the system can provide some additional assistance. Four criteria, each including two indicators, have been set to assess the functioning of the system. Assessment criteria are described below:

- The first set of indicators assesses the intensity of using KMS. Immediately following the implementation, these two indicators are important, as the system users demonstrate their persistence and need some time to adjust to a new method of work. If the system is not used regularly there are no KMS benefits. These two indicators are the total volume of captured data in the work order's workbook and the number of remarks from other departments to the submitted design documentation. Even in the case of a simple tool there is always room for improvement, and so the target value for these two indicators is gradually rising.
- The set of indicators for improving communication measures the number of reviews and remarks by DM and C in the design phase. With a regular use of KMS, these two indicators should be falling. Because communication with C is recorded, the designer on a new project can predict the buyer's requirements and takes account of them in advance. Consequently, there are fewer modifications to the design concept due to the buyer's remarks.
- The final criteria – the reason why KMS was introduced in the first place – assess improvement in the functioning of the enterprise. By analysing the data, captured in KMS, the easiest way to measure it is by means of the number of executed technical modifications per a completed tool and by means of time overrun. The values of both indicators should decrease in the future.
- Finally, there are two indicators measuring the user's experience. Although it is subjective, these two indicators can contribute to improvement of the efficiency of KMS when a trend is detected. The fist indicator is simplicity of use and the second one estimation of time, spent on working with the system. With regular improvements, simplicity will increase while the time spent will decrease. It the current OneNote system fails to yield target functionality in the future, it will be replaced with some other software solution, better suited to the needs of the users.

Assessment in the OneNote environment takes place for each project separately in the knowledge section. Together with conclusions for improvement in the functioning of the enterprise, KMS is assessed separately on a new page. Using the Onestatic add-in allows using the tools for creating a content table of an active workbook and word count. Below is the description of obtained values of indicators for any project. They are shown in Table 1.

4. Conclusion

An important criterion for choosing a knowledge capturing system was the ratio between the benefits of its use in the enterprise and costs of implementation. Besides the financial costs, costs also include time used for implementation, time for staff training and extra time that the employees will spend for working with the system. By choosing this criterion, priority was given to the tools that support information management but are not intended for working with CAD files. Given the requirements and current situation in the company, OneNote appears to be the most suitable solution. The tool is suitable for managing documents and has proved to be efficient. It has been estimated that in an 8-hour workday an employee will spend a maximum of 20 minutes on working with the system. Quicker access to information results in about 10 percent time saving at the level of a project.

Knowledge within KMS is currently structured by projects. In the initial phase of creating knowledge database, this is the most suitable way of structuring data. After a system has been in use for some time and with larger volume of data, knowledge will have to be arranged into sets, according to the type of a problem. The knowledge about problem solutions will additionally be arranged in the form of a manual, where a user has direct access to a solution.

In the literature there are many cases where KMS implementation failed. Although the tool has been installed in the enterprise, its proper use and positive results are not guaranteed. A successful implementation of KMS takes a strategy, a plan, that requires a holistic approach. The people, processes and technology should be dealt with together, not focusing on a single element. Many enterprises fail at this point because they see KM as technical implementation. Successful implementation consists of three main components (Shannak et al., 2012):

- Creating an environment for spreading knowledge
- Implementation of KM processes
- Implementation of a KM information system

All these components should develop simultaneously in order to create an integrated system for data capturing and management. With implementing a technical system usually requiring a mere ten percent of the effort, the strategy should include a campaign to build awareness, understanding the skills for improving knowledge, developing an award scheme, and resources for measuring performance (Shannak et al., 2012). Once the system is installed in an enterprise, the key responsibility is with the management, who is responsible for motivating the staff to use it.

We believe that with proper use, the system will – at practically no costs – contribute to better work in the design department, quicker development of new staff and lower loss of knowledge at staff turnover. A suggestion for further activities is extending the use of the system, currently focused on problems in the design department, over the entire enterprise. The first step of extension is recording the problems that occur anywhere in the company and the solutions at their elimination.

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