WORKFLOW MANAGEMENT SYSTEM FOR THE PROCESS OF MANAGING ENGINEERED TOOLS OFFERS

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Summary: This paper presents the concept of implementing workflow tools into the process of preparing offers of engineered cutting tools at a sales department. The concept was deployed at an IT system based on web and data-centric technologies. That attempt has also been portrayed. The work described in this paper was done under a project at the Institute of Production Engineering and Automation of Wroclaw University of Technology.

Keywords: Workflow, document flow, IT system, integration, process.

1. Introduction

As part of the project at the Institute of Production Engineering and Automation of Wroclaw University of Technology, an IT tool was developed dedicated for cutting tools manufacturers. At the preliminary stage of the project, a number of meetings were arranged with selected tools manufacturers. Obtained opinions showed areas the application should support. Its main modules and functionalities were also agreed on. It was pointed out, that apart from a document and event register, the application should enable automated document and work flow in line with company procedures. An assumption was made, that an application of that type would prove best suited for departments charged with designing and manufacturing engineered cutting tools. Hence, first and foremost the requirements of those departments should be taken into consideration. As part of the project, an application was developed, which enables registration and management of data related to the process of preparing an offer. Different phases of that process were factored in – from registration through technical department's opinion to sending it to the client. Emphasis was put on the document to comprehensively cover customer expectations towards data enclosed.

At the first project stage, the process of preparing an offer was analysed and surveyed at two cutting tools manufacturers' facilities. Consequently, a concept of an IT system was created, which would streamline the process [1.]. Information concerning processes run and resources used was collected [1.].

The second stage involved implementing the concept in form of a computer programme, and then deploying it at selected cutting tools manufacturers' facilities. The system was named ONS - Obsługa Narzędzi Specjalnych (Engineered Tools Handling).[4]

At the third stage, the module automating workflow and document flow within the process was developed and implemented.

This paper presents the third, final stage i.e. the concept of implementing workflow tools into the process of preparing engineered tools offers. Over the course of the work, a module was developed and deployed at the selected enterprise.

2. What is *workflow*?

Most of decision making done at modern enterprises is reflected by relevant documentation. Almost on a daily basis, an employee either generates or uses documents at his workstation. A document both initiates an action and concludes it. Efficient document circulation determines to a great extent the overall enterprise performance. Thus, it comes as no surprise that documents circulation is often referred to as "circulatory system of business". Managing that system poses a considerable challenge. It involves not only keeping archives, but also ensuring correct and timely document distribution. Enterprises managed in a traditional fashion require personnel for that purpose, which would normally use notice boards, notepads or binders. Backups are also recommended, therefore creating a need for adequate office equipment. Research findings of institutions analysing managerial performance show, that searching through and exchanging documents take up to 50 percent of total time spent on working with documents. Moreover, sometimes their multiple copies can be created, which then go on to "have a life of their own". Consequently, they cancel each other out, causing confusion among decision makers and wreak chaos within company. Furthermore, human error need to be factored in, such as forgetting and loosing documents.

Fierce and ever-stronger competition, limited funding as well as planning high efficiency, are factors causing today's managers to constantly seek new and improved ways to operate. For years now, IT systems have been tools supporting the bid for improvement, *workflow management systems* in particular.

There are many definitions of *workflow*, however, the one most frequently used comes from *Workflow Management Coalition (WfMC)* and goes as follows: "The automation of a business process, in whole or part, during which documents, information or tasks are passed from one participant to another for action, according to a set of procedural rules."[2.].

Workflow management systems, are defined by WfMC as: "systems that define, create and manage the execution of workflows through the use of software, running on one or more workflow engines, which are able to interpret the process definition, interact with *workflow* participants and, where required, invoke the use of IT tools and applications."[3.].

The "*workflow* engines" referred to in the definition, are nothing more than an virtual environment, which enables a user to run and coordinate processes and actions, and pass work seamlessly between workstations according to a procedure, until its conclusion – Fig.1.
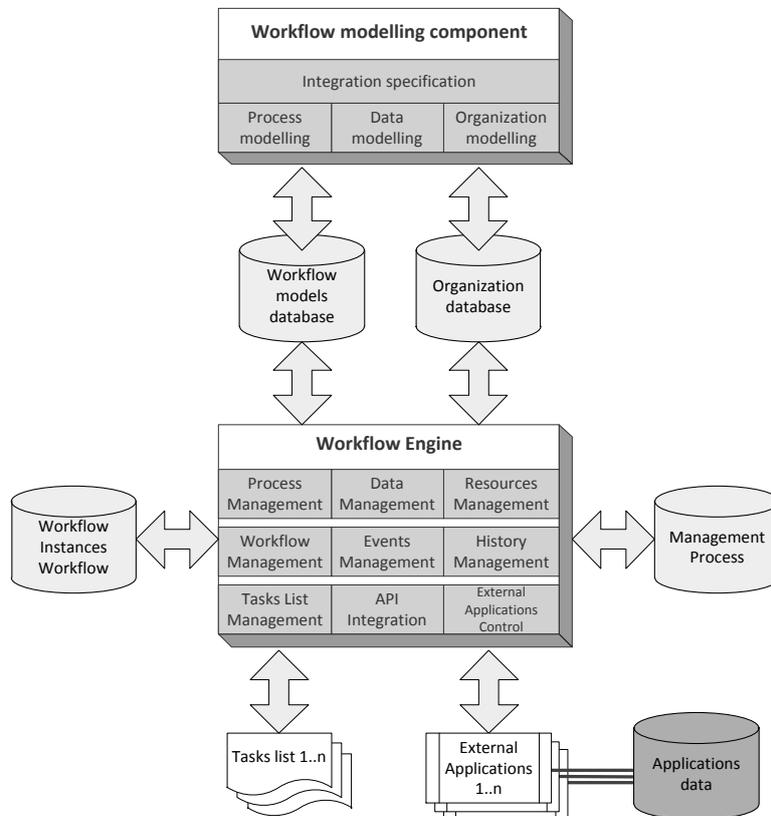
Fig. 1. Technical structure of Wf application

Multivariate work could be described using interconnected processes – tasks (*workflow procedures or process*). Lowest-level process steps are activities, which have to be completed by individual *workflow* participants – so called actors – in a predetermined order. *Workflow* systems can reproduce those processes and activities in computer environment, bringing competitive advantage for system users. Detailed design of a *workflow* application, is the consequence of submitting accurate system entries of tasks and activities carried out within an organisation. This is the first step to computerise the workflow, in a bid to increase proficiency and efficiency of work.

3. The concept of module, implementation and deployment

The above-outlined solution was attempted to be implemented into the process of preparing offers for the manufacturing industry. To demo the new solution, a sales department was selected at a cutting tools manufacturer producing mainly engineered tools. An assumption was made, that the solution developed should have a generating capacity of at least 300 engineered tools offers per month.

Analytical phase preceded the implementation. It involved describing and modelling circulation of work and business procedures within preselected departments by using cross-

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functional flow diagrams. Cross-functional diagrams also known as Swimlane-t diagrams were chosen on grounds they are often used to model production and logistics processes. Those diagrams enable to model processes cross-cutting different departments within company organisational structure. Those formalised descriptions can contain activities, documents and processes' progress - Fig. 2.

Competence schematics were also developed, which reflect real responsibilities and intertwining competences of employees and individual departments.
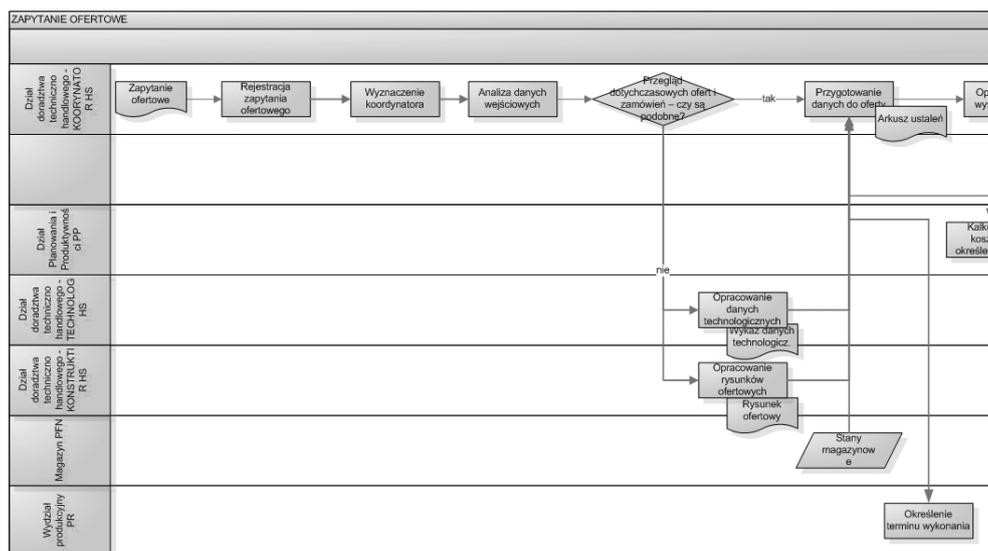
Fig. 2. Part of diagram illustrating a business inquiry being processed

Developed models subsequently became templates for business processes. *Workflow* tempates illustrated how they were to control circulation of documents and work.

The data was entered into the IT system according to the above shown procedure. Its WORKFLOW module was to supervise work of the sales department.

The WORKFLOW module enables organising and managing processes taking place at the enterprise. It controls their correctness and repeatability. The system empowers client to be involved in business processes, e.g. those related to business inquiries, services, product development, manufacturing, thus permitting client to have control over and actively influence processes within the company. This module enables all work to be carried out in line with standard ISO procedures and standard company business processes.

Features provided by the module:
- control over work,
- keeping track of workflow and document flow,
- keeping track of changes made to documents and
- document locating.

Describing company procedures provides the user with:
- guarantee the work will be carried out according to current standards,

- control over company structures and departments charged with specific activities and
- control over time to completion for individual activities.

Resources utilisation is also depicted by the module, which enables its optimisation by taking out of availability of individual process participant.

Built-in business procedure editor enables reproducing the most complicated company processes. It allows:
- creating alternative business paths,
- concurrent paths,
- synchronising paths and processes and
- embed business processes within each other.

That last functionality enables decomposition and modelling of the most complex business procedures, and thus successfully completing the most complex and distributed projects.

The basic functionality allows managing circulation of documents. Each document, e.g. a purchase order request, are allocated with defined flow processes, listing recipient participants, to-do tasks and their target time to completions. Any company department, suppliers, clients and other collaborators can be defined as recipients of the document. Based on roles given, they complete their assignments and automatically pass the document to the next process stage. Version control is applied at each stage, hence reasons for and scope of modifications introduced to the document can be determined.

Procedures, which were previously modelled were then modelled using the ONS systemPrior modelled procedures were then reproduced using the ONS system - Fig. 3.
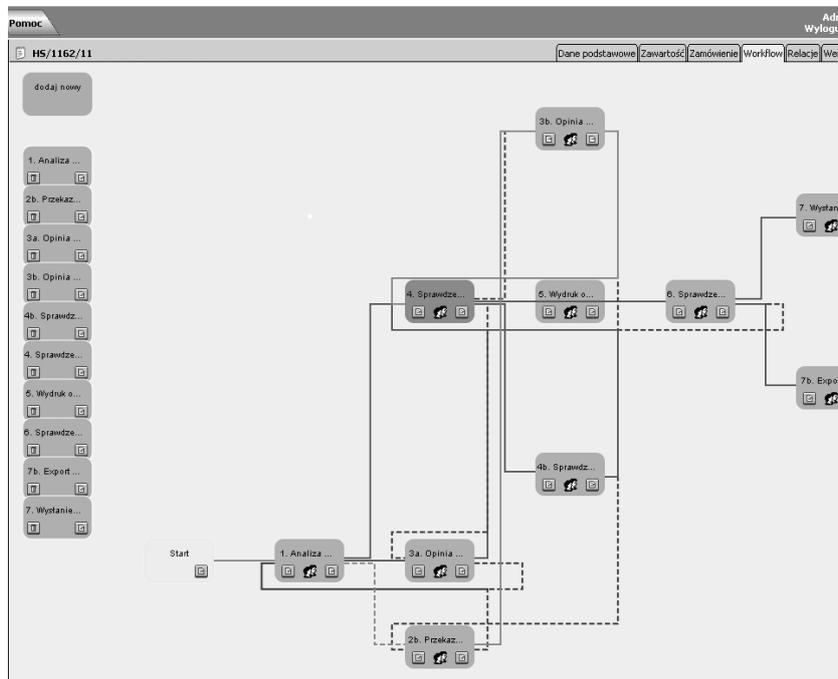
Fig. 3. Business inquiry - process map

Once all roles of departments and employees were defined, the system was deployed at a department preparing engineered tools offers.

The system was assumed to eliminate several basic operational issues straining the department, such as:

- inadequate or impeded access to information,
- working on paper documentation,
- no means to monitor offer work progress,
- no common repository for documents generated over the course of preparing an offer,
- no means to collate materials required for the offer with their cost,
- no means to quickly generate offers using templates based on previous offers,
- no planning support e.g. work allocation based on schedule and available funding.

The solution developed is integrated with inventory data held by a main IT system, thus facilitating decision making for process participants. The algorithm for automated inventory levels synchronisation, delivers information on availability of different materials composing the product and their prices. Hence, material management and planning in relation to engineered tools order flow could be systematised. Upon user request, or automatically once a day the syncing takes place.

All cells concerned take part in the process, but they do not have to share a single location - they can be scattered across company branches or sales departments.

4. Results obtained

Deployment of the system eliminated paper documentation from circulation. Time to completion for an offer was shortened. However, the greatest benefit of the deployment was the introduction of systematised business inquiry and offer register and unification of customer service procedures for particular customers.

The algorithm orchestrating *workflow* tasks carried out under the *workflow* module, enabled the standard work to be done in an orderly manner. It induced employees to carry out all activities planned for their task allocation. The algorithm did also aid information flow between company cells by means of e.g. comments added by users during working on the tasks in hand. Thanks to positive and negative process paths, the user was presented with an efficient aid supporting decision making about the stage, the process should enter.

Currently, all offers are being registered and stored in the IT system - the lost queries problem was eliminated and the offer at each stage of its preparation is monitored and controlled for changes made to already approved documents (Fig. 4).

Another tangible benefit is a means to exert control over each stage of the offer preparation process, which requires decision support by managers. The system both analyses and visualises design, planning, inventory and production data. Results are presented as collations and reports concerning e.g. design work progress, supplies timeliness, run capacity, workstation utilisation, production output etc.

The above-mentioned changes brought for the entire company:

- higher capacity to process requests made by customers,
- higher operational performance and efficacy of engineered tools order processing.

5. Conclusions

This paper has presented IT solutions for cutting tools manufacturers.

The *workflow* module has been described, which invokes process-centric work organisation. Process-oriented work yields a number of tangible benefits for the company: from full control over a process e.g. progress tracking and quick problem identification to a means of easily deploy *simultaneous/concurrent (engineering)* work solutions for single projects.

Furthermore, it enables accurate definition of activities, employee responsibilities, events and actions as well as their duration times, thus precise control over processes' progress and different departments' work.

The *workflow* system also enables external business partners to be involved in internal company procedures, effectively creating a common environment stimulating active collaboration and exchange of data and information.

Further development and deployment of the solution is planned. For example, it could manage work across all company departments. Hence, each and every activity within an enterprise could be determined time-wise. Consequently, this would mean time-managing every single employee and would enable utilisation reports to be generated for every workstation.

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