Improving Work Autonomy in Workflow Systems: A Configuration Choice

Irene Vanderfeesten, Technishe Universiteit Eindhoven, PO Box 513, 5600 MB Eindhoven, The Netherlands; E-mail: i.t.p.vanderfeesten@tm.tue.nl
Hajo A. Reijers, Technishe Universiteit Eindhoven, PO Box 513, 5600 MB Eindhoven, The Netherlands; E-mail: h.a.reijers@tm.tue.nl

INTRODUCTION

Some 40 years ago, software engineers had to take care of implementing each piece of the information system they were developing themselves, including the operating system, database routines, and user interface. Workflow systems (WfS's) have been positioned as the latest step in a trend where generic tasks are taken out of applications (Van der Aalst and Van Hee, 2002). Just like there are now off-the-shelf system solutions for data management, workflow takes care of coordinating the steps in a business process – freeing programmers from the need to hard-code this logic.

The principal advantage of employing a WfS is that it brings back the focus of IT support for business operations to the *entire* business process, instead of its elementary processing steps. This *process-orientation* or *process-awareness* in present WfS's is also pleaded by advocates of movements that emerged in parallel to workflow management, like Business Process Redesign (Davenport and Short, 1990) and Supply Chain Management (Christopher, 1992). Organizational advantages of process-orientation have clearly materialized in the form of improved business performance, reduced number of inter-functional conflicts and an improved "esprit de corps" (McCormack, 2001).

However, there are also indications that the use of a WfS may not be received with enthusiasm alone. Employees (the potential users) and work psychologists fear that WfS's might lead to a mechanical approach to office work, where man is seen as an exchangeable resource (like a machine) and not as a human being. In a study by Küng (Küng, 2000, p. 310), an interviewee at an organization described the effects of a WfS introduction like this: "Jobs became more monotonous. The system forces the employees to work strictly according to the process definition. Through the use of the workflow system, we now have some kind of 'chain production' in the office." Interestingly, the same empirical study has concluded that overall job satisfaction across the 5 various studied WfS implementations was influenced positively!

This is a paradoxical situation, which has not been dealt with satisfactorily so far. The main premise of this paper is that workflow systems are so inherently flexible, i.e. they can be configured in so many different ways, that the effects on job satisfaction may be highly dependent on the chosen configuration, e.g. compare (Poelmans, 2002). In earlier exploratory work (Vanderfeesten and Reijers, 2006), we identified a number of WfS "tuning" options that may influence the job satisfaction of employees positively (in particular their autonomy), while keeping the essence of the delivered support from a business perspective intact. The current paper builds on this work by proposing a fine-grained model of work distribution, which helps to understand how different configuration decisions may influence job satisfaction. Limited case studies within three organizations using this model indicate that in practice very restrictive configurations are in effect, which offer much room for improving the autonomy of employees using WfS's.

This paper is organized as follows. First we give more background for the two areas on which this research is built: workflow and job design. These two areas are linked by looking at the impact of workflow systems on task characteristics, mainly autonomy. Next, we focus on a very specific part of workflow systems: the distribution of work in a workflow system. We elaborate on the configuration options a workflow system has in this respect and on their impact on work autonomy. The paper ends with some concluding remarks and limitations of this approach.

WORKFLOW SYSTEMS AND WORK AUTONOMY

In this section we first clarify a number of important concepts in the area of workflow systems. Next, we elaborate on the area of job design and finally we summarize related work in the combination of these areas.

Workflow Systems

A workflow system is a software product that supports the specification, execution, and control of business processes (Ellis & Nutt, 1993; Georgakopoulos, Hornick & Sheth, 1995; Jablonski & Bussler, 1996). It is a proactive system that manages the flow of work and that defines, creates, and manages the execution of workflows through the use of software that is able to interpret the process definition, interact with workflow participants and where required, invoke the use of IT tools and applications (WfMC, 1999). Commercial WfS's have been around since the early nineties; while their conceptual predecessors can be traced back to the seventies (see e.g. Ellis, 1979). They have become "one of the most successful genres of systems supporting cooperative working" (Dourish, 2001, p.52).

To enable a workflow system, a process model has to be defined. Such a process model is a static representation of the steps (*activities*) in the process and the order in which they have to be executed. Moreover, the process definition also contains information about the people (*resources*) that are allowed to execute the steps (e.g. information on authorization, roles, knowledge, capabilities that are needed).

The process model describes in general the way how incoming *cases* are handled step-by-step. A certain case has specific characteristics that determine its right way through the process model. When an activity in the process model has to be executed for that case the workflow system checks which resources are allowed to execute the *activity instance* and it sends this piece of work to the individual or shared worklist of the authorized employees. The employee selects the piece of work, performs it and finishes it. Depending on the configuration of the workflow system the control of the execution process is entirely with the system or for large parts with the employee.

Job Design

From the area of job design a number of studies is available that deal with the impact of jobs having certain characteristics on the humans performing this job. By job design we mean the content of the job that an individual or group undertakes (for example the tasks and roles they fulfill) and the methods they use to undertake their work (Holman, Clegg & Waterson, 2002). The most dominant framework in the area of job design is developed in the 1970's by Hackman and Oldham (Hackman & Oldham, 1975, Hackman & Oldham, 1976). This model is used to define task characteristics and to understand their relationship to employee motivation, performance and satisfaction. According to this theory a job can be characterized in terms of five core job dimensions:

- **Skill variety** – the degree to which the job requires a variety of different activities so the worker can use a number of different skills and talent.
- **Task identity** – the degree to which the job requires completion of a whole and identifiable piece of work.
- **Task significance** – the degree to which the job has a substantial impact on the lives or work of other people.
- **Autonomy** – the degree to which the job provides substantial freedom, independence, and discretion to the individual in scheduling the work and in determining the procedures to be used in carrying it out.

- **Feedback** – the degree to which carrying out the work activities required by the job results in the individual obtaining direct and clear information about the effectiveness of his or her performance.

Workers who have jobs that score highly on these task characteristics are more motivated, more satisfied and work harder (Robbins, 2001). Thus, when a job scores high on these task characteristics this has a positive influence on, for instance, the productivity of the employee. Autonomy seems to be the most important task characteristic.

The Impact of Workflow Systems

Implementing a workflow system in an organization can have great effects on various parts of this organization. Remember for instance, the quote of the employee in the interview that stated that his work had changed to a more chain production like environment.

According to Sarmento this impact of the implementation of a workflow system can be observed in several domains (i.e. productivity, knowledge, collaboration, coordination, and communication), and at different levels of abstraction (the organizational level and the task level) (Sarmento, 2000a; Sarmento, 2000b). In this paper we particularly focus on the impact on users' productivity on the task level.

There is a large body of academic research that is focused on examining the determinants of computer technology acceptance, (e.g. Moore and Benbasat 1991, Taylor and Todd, 1995). Utilization studies are rare in the field of WfS's, although a seminal case study on the (lack of) acceptance of a WfS is reported by Bowers et al. (1995). User satisfaction with information systems, i.e. the extent to which users believe the information system available to them meets their information requirements, has also gained much research attention (e.g. Ives et al., 1983; Gelderman, 1998), but not in particular in relation to WfS's. A notable exception is the work by Poelmans (2002), which includes the tentative conclusion that not the selection of the right WfS, but the way it is configured and implemented is crucial in the success of a workflow implementation. Success is measured in terms of perceived usefulness, quality of information, and end-user satisfaction.

In our previous work we have generated a number of general tuning measures to reconfigure a workflow system according to the users' needs (Vanderfeesten & Reijers, 2005, Vanderfeesten & Reijers, 2006). These tuning measures mainly focus on improving the autonomy of the employee working with a workflow system, to overcome the problem of very rigid systems and boring, monotonous work. After the more general tuning measures, a detailed focus on the process of working with a workflow management system is taken in this paper. In the remainder of this paper we will specifically look at the work distribution in a workflow system and its effect on autonomy.

DISTRIBUTION OF WORK IN WORKFLOW SYSTEMS

A workflow system is driven by a static and abstract model of the business process that is supported by the system. As we have seen earlier such a process model consists of a number of activities and their respective ordering. When a new case (e.g. an insurance claim of a specific person for a specific accident) arrives at the process it will follow a route through this process model**.** All the abstract activities in the process model are instantiated for this specific case and for every activity a *'work item'* is created.

The course of instantiating and executing a work item is explained in Figure 1. When a case arrives at a certain step in the process model the right *'activity instance'* is generated. Next, the resources that are authorized to execute the activity instance are assigned, which makes it a *'work item'*. The work item then is distributed to the right resource(s) and, finally, is selected and executed by the right resource(s).

For this research we specifically focus on the distribution procedure of a work item, because we believe this part of the execution chain has the highest potential to improve work autonomy. Going into more detail for the distribution procedure, we identify three steps: notification, receipt, and scheduling. In the *notification* step the system notifies the authorized employee(s) that a certain work item is ready to be executed. In the *receipt* step the employee(s) receive(s) the work item on his/her worklist. Finally, the work items to be executed are *scheduled*, either by the system or by the employee, and the execution is started (see Figure 2).[1]

Figure 1. The relationship between cases, activities, and resources

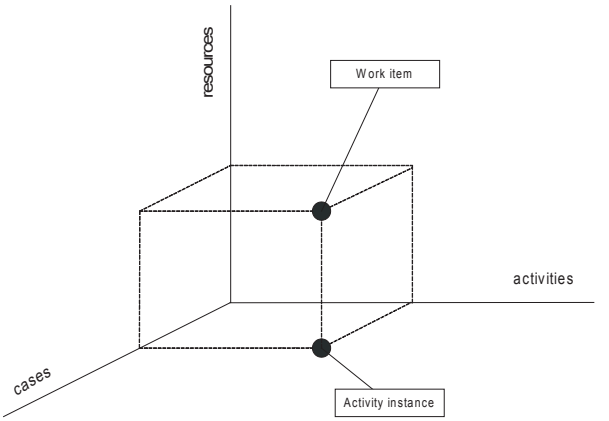
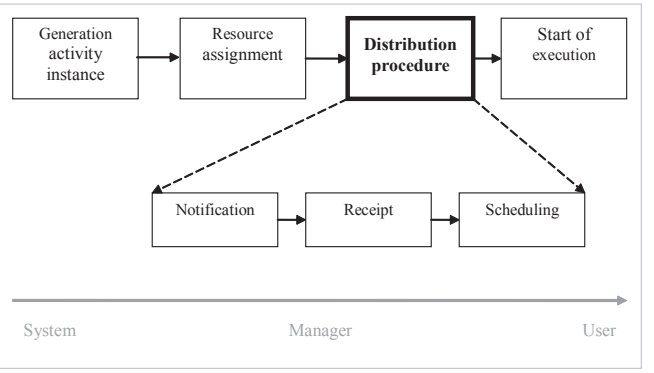


Figure 2. The steps of the execution chain, that are taken for the execution of an activity instance



Note that the influence of the user changes in the chain of steps that is described in Figure 2: the generation of an activity instance and the resource assignment is completely done by the workflow system itself, while the receipt, scheduling and start of execution require an increasing involvement from the user.

For each of the steps in the distribution procedure several configuration options are available. These configuration options are identified by critically assessing several theoretical descriptions of workflow systems (zur Muehlen, 2004; Zeng & Zhao, 2005; Russell, ter Hofstede, Edmond & van der Aalst, 2004). Due to space limits we will not elaborate on all of them but we will give some examples to show their meaning.

In the notification step for instance the work items can be *allocated* or *offered*. In case of allocation, the workflow system puts the work item on the worklist of an employee, while in case of offering the work item is presented to the employee and the employee himself/herself decides whether it will be put on his/her worklist. It is clear that the latter case increases the autonomy of the user.

A second configuration option in the notification step is the notification to *one* or *more employees*. In case of more employees, the employees have the freedom to choose work items, which will increase their autonomy.

One of the configuration options in the receipt step is the *selection* or *acceptance* of a work item. When a work item is notified to the employee(s), the employee can select it from the list or accept it. By selecting, the employee makes a conscious decision, which also will improve the sense of autonomy.

Another option is the transportation to the individual worklist in the receipt step. This can be done directly to the *individual worklist* or through a *shared worklist* from which the employee can select one of the items. Through a shared worklist

the employee has an overview of all the work and the work that is performed by his/her colleagues, which will improve autonomy and task significance.

Finally, one of the options in the scheduling step is the *time of execution*. When execution has to be started immediately after notification and acceptance, the employees have less freedom than when they can determine themselves at which time they start execution of the work item.

Of course not every arbitrary combination of configuration options is possible; some choices exclude others. For example, when choosing a notification to one employee the transport to the individual worklist cannot go via a shared worklist. And in the case of individual worklists (without a shared worklist in between) in combination with the allocation of work items, the employee will only be able to select work items instead of accepting them.

The two most extreme distribution scenarios are:

(1) a work item is offered to more employees on a shared worklist, one of them selects the work item, puts it on his/her own worklist and starts the execution of the work item whenever he or she feels like doing it.
(2) A work item is allocated to only one specific employee. The employee has to accept it (rejection is not possible) and has to start working on it immediately.

From these two scenario's it is clear that the first one provides the most freedom and autonomy to the employee.

Case Studies

As a first step in our empirical investigations on the distribution of work in workflow systems, we have conducted six exploratory case studies. In these case studies three organizations were involved: a Dutch banking and insurance company, a Dutch bank and a Dutch municipality. For each organization two important processes have been studied on the distribution patterns that were used. The first company uses two different workflow systems: COSA and SAP. The other two companies use only one system for both processes: Staffware.

First, we examined whether the configuration options were really present in the systems. Next, we investigated the situation for the specific processes, by studying the process models, interviewing system developers and other stakeholders, and by checking documentation about the configuration options. Among the results of these case studies are two remarkable conclusions:

(1) In *all* cases, some kind of standard configuration of the workflow system was used, which provided little autonomy. This standard configuration consists of a shared worklist from which all authorized employees can select the work items they are going to perform. Indeed, the employee has some autonomy, but it could still be increased. For instance, in the Dutch banking and insurance company, the COSA system provides for a way to select work items an employee wants to work on from a shared worklist, transfer them to the employee's individual worklist and start execution of the work item whenever the employee prefers. However, this configuration was not used in our case study.
(2) The type of software program seems to be an important determinant for the available configuration options. In the cases of the Dutch bank and the Dutch municipality, the Staffware system was used. Staffware does not provide a facility to reject a work item or send a work item to another employee. Thus, all possible configurations with an offering pattern are not valid, which restricts the number of possibilities to increase autonomy.

CONCLUSION

In this paper we argued that the human side of IT is very important and that it does not need to be difficult to take people into consideration in the development of a workflow system. By only making small configuration changes in a workflow system, the system can be much more pleasant to work with. We believe that the degree of work autonomy is very important for employees, so that problems of chain production work in the office can be overcome (i.e. very mechanistic and boring work).

In earlier work we already identified some general 'tuning' measures to increase the autonomy of employees working with workflow systems. In this paper, we deepened the focus of these measures on a specific part of the workflow system: work distribution. We presented our hypotheses on several configuration options and we conducted six exploratory case studies to investigate the current situation of work distribution in organizations.

The most important limitation of this work is that we look at a small and very specific part of the workflow system. However, we feel this is the most important part of the system concerning people, since the work distribution is the step in the whole process where the work is actually offered to specific employees. Thus, this exactly is the part where autonomy is created for employees or where it is reduced.

Another limitation is that this is still a very theoretical approach, only supported by a small number of exploratory case studies. Therefore, it would be good to conduct a bigger field research, investigating the possibilities that current systems offer to adjust their configuration and the degree to which these possibilities are actually used in organizations to avoid monotonous and boring work.

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REFERENCES

Aalst, van der, W.M.P. and Hee, van, K.M. (2002), Workflow Management: Models, Methods, and Systems, MIT Press, Cambridge.

Bowers, J. M.; Button, G.; and Sharrock, W. (1995) 'Workflow from Within and Without: Technology and Cooperative Work on the Print Industry Shopfloor', in H. Marmolin, Y. Sundblad, and K. Schmidt (eds.): *Proceedings of the Forth European Conference on Computer-Supported Cooperative Work (ECSCW'95)*, Kluwer, Dordrecht, pp. 51-66.

Ives, B.; Olson, M.H.; and Baroudi J.J. (1983) "The measurement of user information satisfaction", *Communications of the ACM,* vol. 26, no. 10, pp. 785-793.

Christopher, M. (1992) *Logistics and Supply Chain Management*. Pitman Publishing, London.

Davenport, T. and Short, J. (1990) The new industrial engineering: Information technology and Business Process Redesign. Sloan Management Review 31(4):11-27.

Dourish, P. (2001) "Process descriptions as organizational accounting devices: the dual use of workflow technologies". In: Ellis, C.A., and Zigurs, I. (eds.), *Proceedings of the ACM 2001 International Conference on Supporting Group Work*, New York, ACM Press, pp. 52-60.

Ellis, C.A. (1979) "Information control nets: a mathematical model of office information flow". In: Roth, P.F., and Nutt, G.J. (eds.) *Proceedings of the ACM Conference on Simulation, Measurement and Modeling of Computer Systems*, New York: ACM Press, pp. 225-240.

Ellis, C.A., and Nutt, G.J. (1993) "Modeling and Enactment of Workflow Systems". In: *Application and Theory of Petri Nets*, Lecture Notes in Computer Science nr 691, Springer-Verlag, Berlin, pp. 1–16.

Gelderman, M. (1998) "The relation between user satisfaction, usage of information systems and performance". *Information & Management*, vol 34, no. 1, pp. 1-53.

Georgakopoulos, D.; Hornick, M.; and Sheth, A. (1995) "An Overview of Workflow Management: From Process Modeling to Workflow Automation Infrastructure". *Distributed and Parallel Databases*, vol. 3, pp.119-153.

Hackman, J.R., and Oldham, G.R. (1975) "Development of the Job Diagnostic Survey". *Journal of Applied Psychology*, vol. 60, pp. 159-170.

Hackman, J.R., and Oldham, G.R. (1976) "Motivation through the design of work: test of a theory". *Organizational Behavior and Human Performance*, vol. 15, pp. 250-279.

Hammer, M, and Champy, J. (1993) *Reengineering the corporation: a manifesto for business revolution*, Harper Business, New York.

Holman, D.; Clegg, C.; and Waterson, P. (2002) "Navigating the territory of job design". *Applied Ergonomics*, 33. pp. 197-205.

Jablonski, S., and Bussler, C. (1996) *Workflow Management: Modeling Concepts, Architecture, and Implementation*, International Thomson Computer Press, London.

Kueng, P. (2000) "The Effects of Workflow Systems on Organizations: A Qualitative Study". In: Aalst, Wil M. P. van der; Desel, J; and Oberweis, A. (eds.), *Business*

Process Management, Models, Techniques, and Empirical Studies, Lecture Notes in Computer Science 1806, Springer Verlag, Berlin, pp. 301-316.

Kueng, P., and Hagen, C. (2004) "Increased performance through business process management: an experience report from a Swiss bank". In: Neely, A. et al. (eds.), *Performance Measurement and Management – Public and Private*, Cranfield, pp. 1-8.

McCormack, K. (2001) "Business process orientation: do you have it?", Quality Progress, Vol 34 No 1, pp. 51-58.

Muehlen, M. zur. "Organizational Management in Workflow Applications – Issues and Perspectives". *Information Technology and Management Journal*, vol. 5, no. 3, pp. 271-291.

Moore, G.C. and Benbasat, I. Development of an instrument to measure the perceived characteristics of adopting an information technology innovation. Information Systems Research, 2(3), 192—222, 1991.

Poelmans, S. (2002) *Making Workflow Systems Work: An Investigation into the Importance of Task-appropriation Fit, End-user Support and other Technological Characteristics*. Ph.D. thesis. Doctoral dissertation series Faculty of Economic and Applied Economic Sciences nr 161., Katholieke Universiteit Leuven.

Robbins, S.P. (2001) *Organizational behavior,* Prentice Hall, New Jersey.

Russell, N., ter Hofstede, A.H.M.; Edmond, D.; and van der Aalst, W.M.P. (2004) Workflow Resource Patterns: Identification, Representation and Tool Support. In: O. Pastor and J. Falcao e Cunha, editors, *Proceedings of the 17th Conference on Advanced Information Systems Engineering (CAiSE'05)*, volume 3520 of Lecture Notes in Computer Science, pages 216–232. Springer-Verlag, Berlin, 2005

Sarmento, A., and Machado, A. (2000a) The adoption of workflow systems: proposal of a model for a methodology to analyse the impact of workflow systems in organizations. In: *Proceedings of the 2nd international conference on Enterprise Information Systems (ICEIS'00)*, pp. 349-355. Stafford, UK.

Sarmento, A., and Machado, A. (2000b) Impact Evaluation of organisational changes enabled by workflow systems. In: *Proceedings of the 6th international workshop on groupware (CRIWG '00)*, Madeira, Portugal, pp.134-137. IEEE Computer Society.

Taylor, S.A., and Todd, P.A. (1995) "Understanding Information Technology Usage: A Test of Competing Models". *Information Systems Research*, vol. 6, pp 144-176.

Vanderfeesten, I., and Reijers, H.A. (2005) A human-oriented tuning of workflow management systems. In: Aalst, W.M.P. van der, et al (eds.), *Proceedings of the 3rd International Conference on Business Process Management (BPM 2005)*, Lecture Notes in Computer Science 3649, pp. 80-95. Springer Verlag, Berlin.

Vanderfeesten, I., and Reijers, H.A. (2006) "How to increase work autonomy in workflow management systems?" *Management Research News*, vol. 29, no. 9 (to appear).

Workflow Management Coalition (1999). Terminology and Glossary (WFMC-TC-1011). Available on: http://www.wfmc.org.

Zeng, D.D., and Zhao, J.L. (2005) "Effective role resolution on workflow management". *Informs Journal on Computing*, vol. 17, no. 3, pp. 374-387.

ENDNOTE

[1] Note that the work items in a workflow system usually are presented to the employee in a clear way. The worklist often looks like the inbox of an e-mail program.