Cooperative Information Systems Engineering

Matthias Jarke, Manfred A. Jeusfeld, Peter Peters, Peter Szczurko
Informatik V, RWTH Aachen
Ahornstr. 55, 52056 Aachen, Germany
e-mail: {jarke,jeusfeld,peters,szczurko}@informatik.rwth-aachen.de

Abstract:
Cooperative information systems (CIS) aim at continued cooperativity between user groups through componentized networks of information systems. Change management is therefore a definitional part of CIS. We advocate a conceptual modeling strategy for addressing this task, and illustrate it with experiences gained in WibQuS, a project aimed at CIS support for Total Quality Management in manufacturing organizations. These experiences emphasize the role of meta models in focusing the change process. Specific meta models and supporting environments are presented for: cooperative business process modeling in distributed organizations; simulation analysis of short-term and long-term effects of information flow designs; forward and reverse mappings between a distributed (relational) system interoperability layer and the information flow model. Models are not just analyzed at change time, but also support planned and unplanned information flows at runtime.

1 Cooperative Information Systems and the WibQuS Project

Information systems have traditionally been characterized as hardware/software/people systems that maintain data about a specific subject domain for one or more users, sometimes within a formal organization. The database community has dedicated much work to subject domain modeling (e.g. relational, object-oriented and semantic data models) and efficient systems implementation (e.g. query processing, concurrency control, and recovery).

Relatively less attention has been paid to the usage side, both at the system level of user interface research and at the design level of modeling usage by individuals, teams, and formal organizations. Recently, this has begun to change due to massive complaints by user organizations that their central needs are not being adequately addressed by information technology.

One of the responses raising to this challenge is the vision of cooperative information systems (CIS [3, 10, 5]) which see information systems as a communications medium among user groups in and across organizations. On one hand, this brings groupware and organizational research into the information systems fields. On the
other, it changes conventional database wisdoms about the required information modeling, system implementation and integration technologies.

A CIS is a layered network of user and system components as sketched in figure 1. At the system level, we observe a trend towards componentization of software (including the 'wrapping' of legacy software) into small and easily re-configurable objects. Coordination between these units is no longer hardcoded in applications but dynamically achieved by workflow mechanisms.

At the usage level, we observe very similar phenomena. Formal organizations are being decomposed into small autonomous units with market-oriented rather than hierarchical coordination [17]. Each of these units have their own local information systems configuration, either from new or from legacy components. But they may also be customers or suppliers of other units with respect to information services. Thus, in a CIS, we have necessary interactions between user groups, between system components, between user groups and system components, and – most importantly for us – between user groups through system components.

Why is all this happening? The answer – at both levels – is reactiveness to change [8, 30]. Organizations have to react quickly to ever-changing market requirements. System technology has to react quickly to organizational change as well as technical innovation. Hierarchies have turned out to be too clumsy, therefore the trend towards small largely autonomous units that can react quickly.

Total Quality Management (TQM) is one of several business philosophies that can be associated with this trend. It aims at continuous improvement of all processes in a company by emphasizing customer orientation throughout, relying on local ideas and improvement initiatives, propagated through the organization via cleverly designed feedback cycles. Therefore, TQM appears as a prototypical example of a (not necessarily computerized) CIS.

The question of how to design and implement such CIS was investigated since 1992 by a consortium of five German engineering centers, an organizational science group, and ourselves in a project called WibQuS\(^1\) [13]. Figure 2 shows how the CIS levels are instantiated in TQM [28].

\(^1\) WibQuS is the German abbreviation "Knowledge-based Systems in Quality Management"