Organizational Metaphors as Lenses for Analyzing Workflow Technology

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ABSTRACT
We analyze possible organizational use of workflow technology based on contemporary organizational theory for the purpose of understanding flexible workflow. Organization theory is entered through Gareth Morgan's "Images of Organization", which describes eight metaphors that can be consciously applied for the study of organizations. All metaphors contribute to this study, but some give more important contributions. Based on the brains-metaphor, we show how workflow is linked to organizational learning and how it can be extended to actually support aspects of it. Inspired by the culture-metaphor we focus on social reality construction and how user oriented process models may contribute to support the construction of shared realities and shared meaning. Utilizing the flux and transformation-metaphor, we argue against "generic" business processes except as templates for adaptation.

Keywords
Flexible workflow technology, Organization theory, CSCW

INTRODUCTION
Workflow technology (WfT) is a particular kind of IT intended to support (office) work by enacting explicitly modeled and represented business processes. Morgan's organizational metaphors [37] are used as conceptual lenses to analyze and derive some observations and requirements for (flexible) workflow technology [1, 32, 34, 48]. Based on these organizational perspectives this paper contributes to understanding the concept of flexible workflow technology. A grounding is also provided for existing "flexibility" features in current products and prototypes [1-3, 8, 14, 46].

Morgan's metaphors are organizations as *machines*, as *organisms*, as *brains*, as *cultures*, as *political systems*, as *psychic prisons*, as *flux and transformation* and as *instruments of domination*. Each metaphor implies a way of perceiving and thinking of organizations. Consciously applying several metaphors for organizational study decreases the likelihood of overlooking important organizational aspects and ensures we are not becoming trapped in favored ways of thinking. As Morgan points out, many organizational problems rest in our ways of thinking, and there is a close relationship between the way we think and the way we act. Morgan's images and metaphors are more than just interpretative constructs useful for analysis; the creation of images might lead to the creation of actions. As he states it: *"Organization is always shaped by underlying images and ideas; we organize as we imaginize; and it is always possible to imaginize in many different ways."*

Just as organizations are many things at once, so is WfT! It may seem strange to apply the metaphors to technology, but WfT is organizational IT, i.e. a particular kind of IT to be utilized at organizational levels ranging from self-managed teams to business processes crossing functional borders of the organization.

We start by covering related work, then we briefly present the metaphors as an analysis framework and we continue with their application to WfT. Observations presented should be of interest to practitioners facing organizational implementation of workflow systems, but also to IS professionals and toolmakers. A report covering this work to more depth is available from [10].

RELATED WORK
Walsham [47] applies Morgan's metaphors to Information System (IS) research. The recommendation that future IS research -- and corresponding IS practice prescriptions - would benefit from a pluralist approach breaking out from the "traditional" mechanistic and organismic metaphors is in line with our findings.

Kendall et. al [25] apply metaphors as cognitive lenses for understanding IS development. Their framework differs from Morgan's in two ways. First, organizational *culture* is

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taken as a starting perspective. Second, the particular metaphors are identified from *observed language usage* of IS users in different organizations. For a specific organization, language usage observation selects dominant metaphors. The metaphors identified are *journey*, *game*, *war*, *organism*, *society*, *machine*, *family*, *zoo* and *jungle*.

To our knowledge no similar analysis based on organizational metaphors is reported for WfT. This work represents a novel approach to understanding flexibility in the context of WfT and its organizational use.

METAPHOR ANALYSIS FRAMEWORK

The *Machine* metaphor

This metaphor has its roots in military command and control systems and the industrial revolution. Focusing on control [16], it views organizations as highly routinized and mechanistic, performing programmed repetitive work done by specialized, replaceable workers. The metaphor covers classical management theories for designing bureaucratic organizations as well as scientific management theories.

The *Organism* metaphor

This metaphor historically represents the next step from the "organization as machine", or a break from the mechanistic way of thinking about organizations. Using biology as a source of ideas [37], one can develop parallels between molecules and individuals, cells and groups, complex organisms and organizations, species and species of organization, ecology and social ecology. Central to this metaphor is the theory of *open systems* that are "open" to their environment, and must achieve appropriate relations with their environment to survive. The metaphor covers *contingency theory*, seeking to establish a situation dependent "good fit" between organization and environment. It also covers the *sociotechnical systems perspective* and corresponding approach to organization design [40], focusing on the joint optimization and adaptation of an organization's technical and social subsystems.

The *Brains* metaphor

Features of the brain are sources of inspiration for this metaphor:

Flexibility and self-organization: The brain can tolerate severe damages to its structure, repairing or substituting other parts without major deterioration. As such, it approximates principles of self-organization. A necessity for this self-organization is the ability to learn in order to adapt and (re)configure the various available parts and subsystems.

Information-processing and decision-making capability: Organizations may be viewed as information processing brains. As Morgan states, organizations are information systems, communication systems and decision-making systems at the same time.

Holographic systems; the whole in the parts: The holography, as known from physics, shows the possibility of creating processes where the whole is encoded in all parts. Just like brains, parts of a holography may be removed, but the whole "picture" still can be seen. A prerequisite for a holographic system is the ability to self-organize based on learning. Organizational learning has been described from various perspectives [4, 44, 39], and is essential to organizational development and change.

The *Culture* metaphor

Culture is related to patterns of development reflected in a society's system of knowledge, ideology, values, norms, laws and rituals. Shared meaning, understanding and sensemaking are all ways of describing culture [37].

The *enactment view of culture* leads us to see *organizations as socially constructed realities*. Organizational structure, rules, policies, goals and job descriptions all can be viewed as social artifacts whose primary role are to help shape reality construction. Culture is not imposed, but develops through social interaction. Development of science and technology can also be viewed as social reality construction [7, 27]. Both social context and technical content are essential for understanding scientific activity. "Science in action", as opposed to "ready made science", is not only concerned with an objective scientific truth waiting to become discovered, equally important are social processes striving to interest others, create allies and keep interested groups in line [27].

The *Political Systems* metaphor

Organizations are systems of cooperation and competition at the same time, and can be viewed as systems of political activity [37]. Organization politics can be analyzed as relations between interests, conflict and power. Of particular importance are sources of power in organizations.

The *Psychic Prison* metaphor

Human beings tend to get trapped in webs of their own creation [37]. Organizations and technology can be viewed as psychic phenomena created and sustained by conscious and unconscious mental processes. This also means that organization and technology as socially constructed realities get an existence and power of their own; controlling their creators.

The *Instrument of Domination* metaphor

Organization can be associated with social domination based on asymmetric power relations and exploitation of workers. Of particular relevance here is Weber's rational-legal dominance, based on rationalization through establishing laws, rules, regulations, procedures and control systems [37]. This metaphor also is associated with deskilling and problems of multinational corporations and exploitation. It balances power with moral and ethics.

The *Flux and Transformation* metaphor

Organizations are in a constant state of flux, including permanence and change. Morgan discusses 3 "logics of change" which we can use to understand change processes [37]:

Autopoiesis - the logic of self-producing systems: is based on a systems theory approach to biological systems arguing that living systems are organizationally *closed* and autonomous systems that make reference only to themselves [33]. The idea of "open systems" is replaced with a new idea of "closed systems" as seen from the system's inside (only *external observers* see the system in interaction with an external environment). Living systems are characterized by three principal features: *autonomy*, *circularity* and *self-reference* leading to an ability to self-create and self-renew termed *autopoiesis*. The idea of interacting with an "external" environment is replaced by the idea of reflecting on one's own organization. Living systems create images of reality as expressions of their own organization, and interact with these images.

Loops not lines - the logic of mutual causality: is based on cybernetics and theories of positive and negative feedback loops. Dating back to "system dynamics", any system can be viewed as a network, or patterns of relations, where subnetworks of positive feedback-loops are stabilized and balanced through negative feedback loops. Senge's approach to learning organizations includes *systems thinking* as a major discipline [44].

Contradiction and crisis - the logic of dialectical change: is based on Marxist dialectical method in studying contradictions and opposites. The three principles of dialectical change are *mutual struggle of opposites*, *the negation of the negation* and *revolutionary change.*

IMPLICATIONS FROM METAPHOR FRAMEWORK

In the context of organizational *use* of WfT, for each metaphor we present some chosen observations and implications from the interpretative framework consisting of the images implied by the particular metaphor.

We start by briefly covering the "traditional" *machine* and *organism* metaphors, continue with the *instruments of domination*, *political system* and *psychic prison* metaphors, then finish with the *brain*, *culture* and *flux and transformation* metaphors leading to the most significant implications. The chosen sequence of presentation may give the initial impression of an overly negativistic view of WfT, which is balanced by application of the last three metaphors.

Workflow as "Machines"

A dominant way of thinking: "Workflow automation" and "workflow engine" are commonly used terms. WfT can be used to *automate* business processes; required organizational behavior for performing a business process might be *programmed* and described in a *business process definition* and *plugged in* to be supported and *executed* with the help of a *workflow engine.* WfT shares the mechanistic organizations obsession with *technical* and *bureaucratic control* [16], as exemplified by "Administration & Monitoring Tools" in the reference model [48] from WfMC (Workflow Management Coalition). In WfMC's proposed terminology there is a clear separation between "manual" and "workflow" process activities, where the latter are subject to *automation.*

The need to break out: WfT can be successfully utilized to support highly routinized and choreographed work in high volume transaction settings. In order to support knowledge workers and contribute to empowerment in the workplace, WfT needs to break out from today's dominant mechanistic view of organizations and organization of work. This is covered by application of the other metaphors below.

Workflow as "Organisms"

Traditional process models resemble organizations viewed as open systems. Traditional "procedural" or "transformational" process models, also known as "Input-Process-Output" (IPO) models [12], are congruent with organizations viewed as open systems; as promoted by organization development professionals [13]. A main problem with such models is that organizational "actors" become part of an external environment since they are "external" to a computerized IS. This leads to problems regarding capturing human interaction as part of business process models.

Adapting to an external environment: Workflow to a greater extent needs to take into account, and integrate, feedback loops continuously adapting business processes to the external environment. This idea is further pursued below, where the "Brain"-metaphor gives a more holistic perspective on (organizational) learning than simply adaptation to an "external" environment.

WfT crosses organizational subsystems: When it comes to organizational subsystems, WfT as IT plays a special role as it belongs to the technical subsystem, while at the same time it is offering pervasive support to the social subsystem in communication, coordination and cooperation.

WfT and organizational species: WfT and organizational variety has been studied utilizing Mintzberg's framework [36] of "organizational species" in [5, 41]. We support the opinion that a main challenge for future flexible WfT should be to move beyond *bureaucracies* and target *adhocracies* too [35].

WfT and process model species: There is an interesting parallel and complement to Mintzberg's organizational species and process model species. Today's lack of a common consolidated business process ontology can be seen in a contingency view, where species of process modeling languages map to various organizational species (i.e. IPO models correspond to Mintzberg's Machine Bureaucracies, Role oriented models correspond to Professional Bureaucracies, speech-act (language action) or mixed-paradigm models correspond to Adhocracies etc.).

Workflow as "Instruments of Domination"

Depending on how we use WfT, there is a possibility of gaining an unprecedented level of control resulting in alienation, strict division of labor, bureaucratic routinization and de-skilling. We can utilize the technology to:

Force compliance, by predefined, detailed breakdown of work to be performed exactly as specified. Patterns of human communication and the exchange of utterances in an electronic conversation can also be rigidly pre-specified.

Pace work, by monitoring the execution time of tasks, filling up workers "electronic inboxes" at a rapid rate.

Reduce human communication and coordination, by trying to design work in order to reduce the need for coordination through human communication, as Leffingwell tried when applying scientific management to office work [50].

Build sophisticated bureaucracies, with a close, "real-time" work control and a division of labor resulting in "de-skilled computer users" accessing regulating computer interfaces.

Create "electronically narrowed jobs", again by limiting access through rigid, task-specific user interfaces.

"Standardize" on process definitions: There is a danger of multinational and "franchising" corporations trying to standardize on "boxed-in" process definitions with limited discretion for national branches, groups and workers.

Balancing this "ugly face" of "production" workflow with its focus on "replaceable workers", new generations of flexible WfT to a larger degree enable *adaptable work settings* where organization is based on the continuos growing of skills harvested in an organizational setting to enable organizational learning as well.

Workflow as "Political Systems"

WfT is not only an enabling solution but also a *system of government*, controlling organization of work and distribution of power in the organization.

WfT as an escalating power source: The power source "control of technology", when it comes to IT and WfT in particular, can give access to other power sources like [37]: control of resources, decision processes, boundaries, symbolism and informal organization, alliances and networks.

Model power and workflow process models: Control and access to various interfaces in WfMC's reference model is of vital importance. An aspect of power relevant to process definitions is "model power" [9, 18]: Users may be trained to understand and read business process models, but this does not need to imply an ability to *make* or *change* models. If process modeling is left to IS professionals, an unintended power imbalance can result. This imbalance influences stakeholders' ability to *participate* in organizational learning and social reality construction (see the sections on Workflow as "Brains" as "Cultures" respectively). Power imbalance also may occur if the ability to "execute" process models by the workflow engine is seen as more important than model comprehensibility. A compromise between various desired process model properties can result from power struggle, or from a pragmatic decision to buy a commercial workflow tool where process model constructs (at the meta level) are fixed, thus favoring workflow enactment to other desired properties.

Control of the use of desktop applications: WfT implies control over what programs individual users are allowed to run ("invoked applications"), which may lead to narrow "electronic work environments" where the workflow backbone decides all the programs that *can* be run, according to contexts selected by process models.

Political perspectives of IS development and deployment: The development and deployment of workflow solutions could benefit from knowledge in the area of IS development and politics, like paradigms of IS development [23] and theories of resistance [31] to guide organizational implementation strategies.

Workflow as "Psychic Prisons"

Getting trapped in one's own creation: Process support through WfT can *cement* processes and a given way of organizing work if the process is not continually assessed, evaluated and improved. Expensive and inflexible workflow solutions may not be changed in a timely and cost-effectively manner, thus *creating organizational slack.*

Imprisoning business process model concepts: The particular ontology, i.e. basic concepts and constructs available in a given process modeling language, may represent a prison. Most commercially available workflow systems are based on variations of the IPO-model where the human actors and their interaction are weakly represented. Tools based on alternative ontologies like *ActionWorkflow* [34] may result in other traps; its precursor product *The Coordinator* [17] was criticized for mainly working in hierarchical and stable organizations, with a clear role-structure and shared interests [6, 15].

To achieve models that represent real business processes better, there is a need to integrate a traditional procedural approach with models including a richer description of group dynamics and human communication and interaction. Creation of "flexible" models is linked with CSCW research. Robinson [42] cites useful concepts for describing and criticizing (process) models at a "meta-level" like *articulation work*; *situated action* [45]; *mutual influence*; *shared information space*; *shared material*; *double level language*; *equality* [19, 20]; *flipover*. This knowledge is not sufficiently taken into account by the vendor dominated workflow area.

Imprisoning process enactment: Even if the underlying process models are really flexible, new problems occur when these models are utilized and enacted through WfT.

Iden states [24]: *"models that are to support human enactment need other qualities than models that are to support machine enactment ... when it comes to coordination, it is extremely important that people's needs and concerns are put into focus. ... The result of an "almost solution" could be an information system that disrupts and hinders coordination, more than supporting it. ... a designer does not only design a computer system. What he in fact really designs is a work organization system."*

A crucial distinction between various technical solutions (and organizational philosophies) will be how one is supposed to deal with exceptions at runtime, like [1]: reassigning work, overriding the process definition, sending work items back (not accepting), negotiating new deadlines etc. Exceptions can be left to a manager authorized to "change" running business processes, authorized users can be allowed to view the process definitions as *advisory* only, thus letting the process definition serve as a *guide* instead of being strictly regulating and enforcing [1], or the workflow system can be coupled with conversation support to deal with exceptions [3, 14].

Workflow as "Brains"

Here we focus on the learning capabilities implied by the metaphor.

Integrating workflow and organizational learning: The organization's technical subsystem needs an integration with the organization's learning system in order to support the evolution of the total system. Here the technological infrastructure at the same time might play the role as both an enabler and an object of the total system's evolution.

Workflow complemented with groupware applications supporting argumentation and discussion can support organizational learning, in general and as applied to process models. The coverage of organizational learning by WfT can support the movement towards an "O-II organizational learning system" [4], where organizational learning agents also are able to involve in an *open organizational inquiry*, questioning underlying organizational norms.

Process models should include intentional aspects: The norms or "goals" of business processes, i.e. the *reason* for performing the business process, must exist *in addition* to the process model itself. If one is only concerned about performance issues etc. for the process -- and not the reason why the process exist - learning can only be single-loop (negative feedback) thus focusing on "doing the things right" instead of "doing the right things".

We are aware of no system, neither commercially available nor a research prototype, that enact business process models covering intentional aspects. However, at least one contemporary modeling framework [49] includes intentional aspects of business processes.

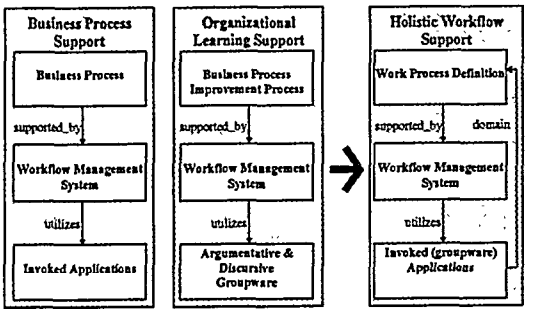

Figure 1: Supporting improvement processes

Improvement processes should be supported too: If we are to support organizational learning, then essentially organizational processes operating on the "normal" business processes should be supported. We can imagine such a solution where (graphical) process model elements are annotated and the object of discussion supported by argumentation groupware as an "invoked application" in the context of an *improvement process* supported by a workflow system. This is depicted in figure 1 above.

The need for comprehensible process models: Deploying workflow in an organizational learning context has consequences for the comprehensibility requirements of process models. Relating a novel framework for understanding quality of conceptual models [28, 11] to the theory of action perspective of organizational learning [4], *semantic model quality* is linked to stakeholders' ability to perform an open organizational inquiry, while *pragmatic model quality* is linked to model comprehensibility across groups of stakeholders and may also be linked to power struggle between groups of stakeholders.

Process models as a knowledge creation arena: The creation of process models and process model fragments corresponds to Nonaka's *externalization* mode of knowledge creation [39], while the *combination* mode corresponds to process model *reuse* in allowing combination of newly created and existing model fragments. In a WfT context, Nonaka's *socialization* mode conforms to communities of practice developing the necessary skills for utilizing WfT, while *internalization* mode conforms to actually using WfT as a natural way of working both for articulating work and have work supported.

Organizational roles are important to work organization and WfT, but it is unclear how to interpret them. A role can be seen as something formally described as part of a job-description [16]. It implicitly and explicitly defines scope of work, responsibility and decision making authority. On the other hand, roles can be seen as expectations regarding personal or professional *skills* (which are *acquirable*) necessary to engage in or perform specific tasks.

Applying holographic system principles to workflow: Morgan proposes four interacting principles for designing holographic organizations [37]. Below we briefly try to apply these to a total organizational system consisting of the technical subsystem, the social subsystem and the organizational learning subsystem. In particular, a mature use of the role concept in the technical subsystem is required:

Get the whole into the parts: Ad-hoc workflow normally includes supporting interaction among the human role-playing actors. Hence, there should be a possibility of supporting discussions about the running business process instances and the process models (with accompanying goal- or product model) they are based upon; cf. figure 1. The total system should have a learning capability facilitating implementation of improvement proposals based on such discussions.

Create connectivity and redundancy: By definition, WfT itself can be used to create connectivity; redundancy can be achieved through creating role flexibility where the skill component of roles are focused. Providing *information access* is a vital part of the required connectivity that makes it possible for people to involve in other people's work and act on behalf of one another. Redundancy in information access, interpreted as access to information beyond immediate operational requirements, is one of Nonaka's knowledge creation enabling conditions [39].

Create simultaneous specialization and generalization: This can be done by supporting a division of work based on a description of the skills of available human actors and matching of skills to task requirements in a more dynamic fashion than what is achieved through a matching based on various "static" organizational roles. One may also take into account skill development plans for individuals in matching actors to tasks; supporting "on-the-job" training.

Create capacity to self-organize: This aspect is tightly linked to the organizational learning system. As argued, the learning system could be supported by the same WfT that supports the other business processes.

Workflow as "Cultures"- Social Reality Construction

Organizational culture manifests itself in the use and access of WfT. The actual use and access of the technology through the five WfMC interfaces [48] reflect "corporate culture" with respect to openness for inquiry, empowerment of individuals, mechanisms of control etc.

Development of WfT itself should be considered social reality construction. As it is technology in a premature state, attempts to "blackbox" it too early -- for instance as part of WfMC's standardization work - may be dangerous.

Organizational use of WfT is social reality construction. Deployment, implementation and improvement of workflow solutions in an organizational setting also should be viewed as social reality construction. The important question then becomes: Who are the architects? Are they primarily IS professionals and MBAs, or should we rather view it as an ongoing, collective, cooperative, communicative and discursive process involving all stakeholders?

WfT should support the construction of shared realities and shared meaning. This is linked to moving towards more holographic workflow solutions supporting open inquiry and organizational learning with resulting adaptation. In particular, encoded business process models should be open for organizational inquiry, and the continuos cooperative process of (re)constructing images of reality should be supported as an "improvement-process" operating on and shaping other business processes.

As presented by Dietz in [15], Habermas proposes that communicative action -- as developing and agreed upon through utterance of speech acts and using language to coordinate non-strategic action - is based on an *orientation towards mutual understanding and the achievement of consensus through negotiation.* In [15] the concepts of *mutual understanding* and *mutual agreement* seem to be treated as equal, but mutual understanding does not have to imply mutual agreement. This is linked to diversity and pluralism in an organizational setting, and has consequences for WfT as discussed below.

Using a social action perspective -- also funded on theories of Habermas - Lyytinen et. al. demonstrate how Office Information Systems (OIS) should contribute to the creation of organizational reality through developing shared meaning, understanding and sense making [29]. We here see several arguments, theories and proposed technological solutions converging towards reality construction through *orientation towards mutual understanding / agreement*[1].

Supporting communicative and discursive actions is vital to supporting the collective shaping of reality [29, 38]. As mentioned, this can be done in a workflow setting by allowing "invoked applications" to be groupware designed to support discussion and argumentation in general, and argumentation around the process definitions in particular. This would imply a richer reality construction than narrowing it down to budgets, goals and statistic techniques for analyzing the business process performance only.

Morgan warns that all enactment is on some stage. In an organizational setting, this stage may be "fixed", it cannot be freely chosen [37]. The implication for WfT trying to support social reality construction, is that the reality to be cooperatively constructed and reconstructed may be too narrow, resulting in attempts of ideological control.

WfT and self-managed teams: Growing and sustaining self-managed teams is a vital aspect of today's move towards "flatter" organizations and empowerment. Such teams should be given some control over their own organization of work, implying that team members should be able to actively participate in the team's own local collective shaping of reality; in general and applied to their work processes.

Linking group learning and organizational learning: Transition towards flatter organizations with self-managed teams implies decentralized decision making. Comparable self-managed teams, perhaps geographically dispersed, then should have some mechanism for sharing experience with each other; turning team learning into organizational learning. Otherwise there would be a danger of multiple organizational agents having to learn by performing the same errors. This is an area where groupware supporting inter-group communication can come to rescue in order to share experience across groups; to ensure individual agents' and groups' learning are reflected in organizational learning.

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[1] [29] has a technology view not conform with the social reality construction perspective: only instrumental actions apply in a technology context, while remaining social action types (strategic, communicative, discursive) are discussed in a language and organization context.

Pluralism and diversity - the need for local adaptations: On the other hand, utilization of shared experience should be used only when relevant. Subcultures must also be supported, work processes standardization might hinder healthy pluralism. Pluralism even may be needed due to local variations, for instance in customer requirements. Self-managed teams should enforce their own control over process definitions. Locally adapted processes reflect subcultural and historical aspects of (sub)organizations. Standardized process models may reflect management's attempt to recreate organizational reality and impose changes. Discrepancies between normative and descriptive (adapted) process models can reflect that learning has occurred at a team (subcultural) level. Even if organizational learning is well developed, and a mechanism for continuous assessment of processes is established and utilized for continuous improvement, it may not lead to *local* improvements for each team responsible for process performance. Thus standardized processes may be said to correspond to *mutual agreement* (consensus) while allowing local variations correspond to pluralism and *mutual understanding*.

The harvesting and reuse of process model components: An important implication of this is that WfT needs to take into account the problems of keeping track of versions of business processes and their components, and allow for local variants of business process definitions which share some features with their "parent" processes. This raises some high expectations to the reuse of components of business process models.

Growing libraries of invokable organizational action: An important distinction is that between *rule following* and *rule enactment*. Ability to apply rules (of behavior) calls for more than knowledge of the rule itself; rules are incomplete themselves and embedded in a larger context. In some cases, rules are not blindly followed, but consciously *invoked*. In a workflow system users may have to follow certain rules, encoded as part of the process models. In a more flexible system, especially with respect to exception handling, users can have the ability of selectively invoking such rules. Empowerment with respect to workflow process models and their encoded rules of behavior then should imply an ability to browse available "rules" and to create one's own libraries of rules (or organizational actions) to "invoke" when they are found suitable. This resembles "advisory" process models [1]. It is also related to layered policies in business process definitions as in [8] and to an organizational handbook of business processes [30].

Workflow as "Flux and Transformation"

Implications of the "change logics" are presented below:

Business processes have no existence in themselves, they are always embedded in a unique organizational setting. This leads to a further observation: attempts to derive and utilize "generic" business process models as hinted in [30] are not likely to succeed unless used solely as *templates* for a more complete organizational implementation, where they are put into an adaptation and change context. Use of pre-built or "off the shelf" process models is based on mechanistic thinking and a "machine metaphor" of the 90s with machines accepting pluggable modules.

Social reality construction is essential for organizational change: According to the autopoiesis logic of change, organizations play an active role in constructing images of their environment as part of constructing their own identities. Organizations and individuals *choose* the self-image that guide their actions and help shape their future. The implication is that the ability of organizational agents to actively participate in social reality construction is essential for organizational change.

Process models should be linked to environmental images: Another implication is that the process models to be enacted -- but also to be discussed and argued around - should include more references to *environmental* images. Supporting the social construction of reality should not be limited to the process definitions, but include mechanisms for collective interpretation of the environment as well to assist shaping shared environmental images. Currently process models, through a dominance of the IPO modeling paradigm, have a tendency to view the environment as being on the "outside". The capacity for self-production termed autopoiesis depends on self-references. These include references to internal images of an "external" environment. Environmental images that are too limited or simplified may result in self-organization that is not able to sustain larger changes originating in a complex and dynamic environment perceived to be simple and stable. Thus lack of self-references can disable abilities of self-production, hence the self-images may be egocentric and destructive for the organization.

Dialectical opposites in a context of BPR and WfT: Organizational use of WfT is full of conflict as dialectical opposites:

- Adhocracy vs. bureaucracy.
- Commitment vs. compliance.
- Informate vs. automate [50].
- Empowerment vs. control
- Supporting instrumental/strategic vs. communicative/discursive social action [38].
- Mutual understanding vs. mutual agreement.

Business processes can enclose dysfunctional behavior in a systemic sense: According to systems thinking, it is possible to have systemic failures even if no actors of the (organizational) system can be blamed [44]. Attempts to explicitly represent and support processes through WfT can lead to systemic dysfunctional behavior being "boxed in".

Systems thinking is a useful modeling addendum: Business process models in the context of WfT are made in order to *support* the business processes with IT. As such, models are "tailored" for process enactment. Systems thinking ap-

plied to separate business processes or processes in interaction is a valuable and useful addendum to the models; even if it may not contribute to their enactment.

A workflow vision: workflow as a rich work context: Workflow can be seen as a context for work since process models show various tasks in a web including a wider context. It is a context for other software since tool usage becomes linked to tasks. It should be possible to utilize workflow as a partial context for *other* groupware applications like argumentation systems, electronic meeting rooms, desktop video conferences, application sharing and whiteboarding. This includes an ability of invoking other groupware applications within a business process oriented context. Thus today's groupware will become more than "islands of interaction" and organizational use of other groupware will benefit due to an increased awareness of suitable context. Finally, flexible workflow also should contribute to reality shaping through supporting communication and discussion about goals, work tasks and organization of work. WfT thus can support organizational change and development through providing support for organizational learning and social reality construction.

CONCLUSION

Workflow as a technology area may be neutral in the sense that the technology domain does not dictate or limit its organizational use. However, specific contemporary workflow products are not neutral. Being a relatively new field, today's products are inflexible and carry with them assumptions, of which some were reported from early work in the OIS field [26] and some are documented in the CSCW literature [14, 42, 45]. Some assumptions relate to process model building blocks, others relate to enactment support. They combine to limit the organizational enactment stage.

The actual organizational *use* of WfT will carry with it assumptions, values and norms that become enclosed and institutionalized as part of software and the organization's IS. There is a danger of WfT actually hindering organizational change and development. Several more or less well-known dangers of the use of WfT result from the application of the more "traditional" metaphors.

On one hand, WfT can be deployed in order to pace work; assure strict adherence to regulations and procedures; monitor and control workers; consciously limit face to face communication and coordination; implement "ideal" bureaucracies where most aspects of work are routinized; standardize a "way of doing work" across multinational corporations and franchising businesses. On the other hand, the "same" technology can be used to let employees participate in continuously defining their own way of doing work, let them apply their intellectual skills and judgment in dealing with exceptions bound to happen in work that cannot be fully choreographed.

We briefly summarize some of the more positive implications from our work. Based on the *brains-metaphor*, we focused on how WfT is linked to organizational learning and how WfT could be extended to support aspects of it. Forming such a link influences the process models to be enacted; in particular models need to include intentional aspects of business processes, and process model comprehensibility (beyond IS professionals) is of vital importance.

Inspired by the *culture-metaphor* we focused on social reality construction. Both development and organizational use of WfT can be considered socially constructed, central to which is the construction of shared realities and shared meaning. In particular, encoded business process models should be open for organizational inquiry, and the continuos cooperative process of (re)constructing images of reality should be supported as an improvement process operating on and shaping other business processes. Supporting communicative and discursive action in a workflow context may be achieved by allowing "invoked applications" to include groupware designed to support discussion and argumentation, in general and around process models in particular. Growing and sustaining self-managed teams is a vital aspect of today's move towards "flatter" organizations and empowerment. Such teams should be given some control over their own organization of work, implying that team members should be able to actively participate in the teams own local collective reality shaping. The consequence is that more systematic mechanisms and tool support is needed for the building, harvesting and reuse of process model components. Stronger mechanisms for reuse of process model components also would enable the growing of libraries of *invokable* organizational actions to support ad-hoc work processes [11].

Utilizing the *flux and transformation*-metaphor, we argued against "generic" business processes except as starting points for organizational adaptation. The concept of autopoiesis implies that process models should include references to richer descriptions of the organizational environment and the environment the work process is situated in. We also hinted at systems thinking being a useful modeling addendum even if irrelevant for process enactment.

Based on organizational perspectives as selected by metaphors, our work contributes to understanding flexible workflow technology and at the same time provides a grounding for existing "flexibility" features found in current products and prototypes. During enactment, it should be possible to treat the process definitions as advisory only [1], and then, through (technology supported) social interaction, change or detail them in order to gain flexibility and empowerment [8, 46]. Local process model adaptations may be based on nested layers of policies that are not fully detailed [8]. The supported social interaction must allow for reference to messages in previous and other current conversations [2, 14]; all part of and contributing to the context of the particular work process task.

We are currently designing a flexible workflow architecture including a process modeling language called APM (Action Port Model) where some of the requirements are based on our revised understanding of flexible workflow. In particular, APM is a *visual* modeling language based on a "traditional" IS conceptual modeling language called PPP [22] that has been enhanced primarily to increase model *comprehensibility*. Enhancements include resource modeling, coverage of interactions and a structured approach to the reuse of process model components. APM resource modeling covers actors, tools (both as *invoked* and *available* applications) and artifacts available through a shared workspace; the latter is also used to increase model comprehensibilty through minimizing detailed information flow. APM interactions are based on speech-act modeling. By grounding APM in the visual PPP modeling language family, we will be able to include and reuse advanced model validation techniques like explanation generation [21] and complexity reduction [43]; important means for establishing models of high pragmatic quality [11].

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