Abstract

Process monitoring allows organizations to evaluate the operation of business processes near real time and to initiate corrective actions whenever needed. As a result, organizations that monitor their business processes closely are able to gain competitive advantages by staying adaptive to environmental and internal changes.

Identifying the information requirements of process stakeholders is a prerequisite for the design of effective process monitoring systems. Because current process monitoring approaches are mainly technology driven, their functionality provides only limited utility for process performance improvement initiatives.

To address this issue, this paper focuses on determining the information requirements of internal stakeholders of Business Process Management Systems (BPMS), i.e., enterprise managers, process managers and process participants. We study their information profiles and evaluate to what extent BPMS can supply relevant process information. By mapping the information requirements of BPM stakeholders to the management decision activities at the strategic planning, management control, and operational control level, this paper uses the identified information requirements as a framework for the assessment of process monitoring system. Using this framework we illustrate possible extensions for current workflow-driven process monitoring systems. Such extensions might allow these systems to serve larger groups of process stakeholders in an effective manner.

Keywords:
Workflow, Business Process Management Systems, Process Monitoring, Stakeholder Theory, Business Activity Monitoring, BPMS, BAM

Information Requirements of Process Stakeholders

A Framework to Evaluate Process Monitoring and Controlling Applications

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I. Introduction

A business process is a set of logically related tasks performed to achieve a defined business outcome (Davenport and Short 1990). Business processes are of great importance in the sense that once an organization captures its business in terms of processes, it can reengineer each of the processes to improve it or adapt it to changing external requirements (Georgakopoulos, Hornick et al. 1995). Contemporary organizations are gradually transforming from function-oriented structure to process-oriented structure by moving the focus of management towards the coordination of individual work activities. Problems of function-oriented organizations such as frequent cross-departmental handoffs, long process cycle times, low product quality due to a lack of coordination and resulting customer satisfaction problems can be largely alleviated (Davenport 1993).

Business Process Management (BPM) addresses the efficient and effective execution of business processes and therefore helps organizations in transition towards process-oriented organizations (zur Muehlen 2004). It leverages existing technical platforms for process coordination, such as workflow management systems or groupware applications, and places them in the context of a management life cycle (See Figure 1).

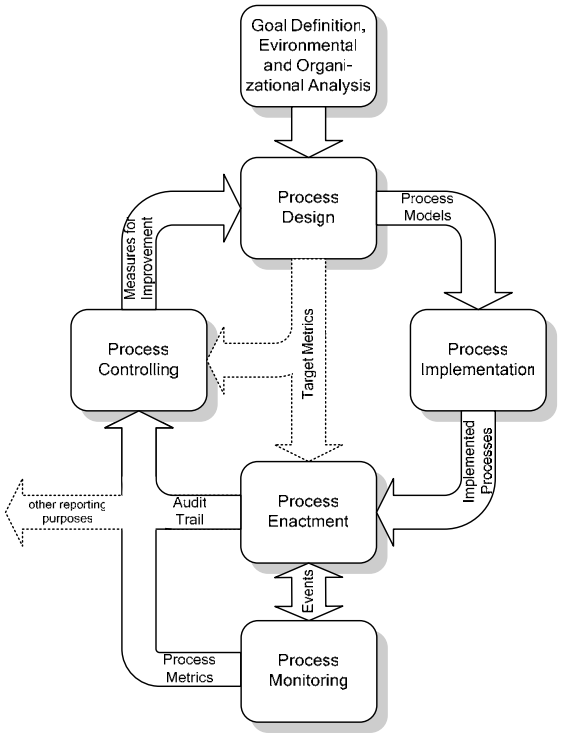

Figure 1: Business Process Life Cycle

The main Business Process Life Cycle consists of the phases Process Design, Implementation, Enactment, and Controlling. Process Monitoring relates to the supervision of running process instances and is performed during the Process Enactment phase. From a business perspective monitoring is significant, because it allows organizations to evaluate current operations and to take appropriate actions whenever needed (Hansen, Marin et al. 2004). Process controlling, i.e. the ex-post evaluation of completed process instances, allows organizations to identify structural issues and trends that the analysis of a single process instance would not yield. Various techniques, tools, and methodologies have been proposed to improve the effectiveness of processes monitoring and controlling in order to enhance the overall performance of business processes (zur Muehlen and Rosemann 2000; Kwon, Hong et al. 2001; McGregor and Kumaran 2002; Khaled, Noble et al. 2003; zur Muehlen 2004). While most of these articles focus on the technical facilities and formats necessary to build process controlling solutions, the question, who benefits from these solutions and by means of what information have not been discussed in depth so far. This paper discusses the perspectives of process stakeholders and the information they require to improve their dealings with business processes.

a) Business Process Management Systems

Business Process Management Systems (BPMS) are software tools for business process automation; they coordinate business processes to improve the efficiency of process enactment and reduce costs associated with manual coordination activities, such as information retrieval and work assignment (Kueng 2000; Fischer 2002). The term BPMS was coined relatively recently and its distinction from workflow management technology often remains fuzzy (Smith and Fingar 2003). For the purpose of this paper, we define a BPMS as a technical infrastructure for process management that extends the modeling and execution components of workflow management systems with facilities for the live monitoring and controlling of processes. Thus, BPMS rely on workflow technology, but provide added value via ancillary components. During the execution of a process instance, BPMS record the processing history in an audit trail. An audit trail typically contains time stamps recorded whenever a process or activity changed state (e.g. from ready to assigned, from running to completed). More specifically, audit trails are collections of run time events that occurred within the scope of the BPMS, and these events can be of technical or organizational nature. BPMS allow business users to monitor the operation of business processes by providing either access to audit trail information directly, or through predefined reports and analysis modules.

b) Process Monitoring Support in BPMS

Most BPMS products provide comprehensive support for the early stages of the business process lifecycle but often lack capabilities for providing feedback about the performance of business processes. Existing efforts have been primarily centered on the management and utilization of historical data from a technical perspective, while little focus has been given to the supply of business relevant process information to decision makers.

Current monitoring systems give management little visibility into the problems associated with a process instance, even if an associated event (e.g. an overdue task) is reported promptly. It is not only important to capture unexpected events, but it is also critical to notify the right person, i.e., the decision maker who can alleviate the

problem at hand. The purposeful filtering of desirable information from the huge amount of audit trait data has been identified as a crucial challenge for the design of effective process monitoring systems (van der Aalst and van Hee 2002).

c) Goal and Scope of this Paper

In practice, the usefulness of audit trail information for purposes of process monitoring is limited. One of the primary reasons lies in the missing linkage of process status information with business data such as the process object, customers or products. Because of this gap, stakeholders receive little help to identify appropriate actions towards solving processing problems. Stakeholders bearing different job responsibility look at the business processes from different viewpoints and therefore need different information sets to support their decision making processes. In order to design systems that support these viewpoints efficiently, we need to identify the information requirements of BPMS stakeholders.

In brief, our research question is: Who are the key stakeholders of BPMS and what do they want to know about business processes?

Our paper is structured as follows. Section 2 reviews related work in relevant fields. Section 3 contains an analysis of major stakeholder groups of BPMS, and we identify three internal stakeholder groups for the following discussion. In section 4 we formulate a framework for analyzing internal stakeholders' information requirements and we evaluate the current abilities of BPMS to meet these requirements. We give suggestions on how BPMS can improve their monitoring capabilities in section 5 and finish with an outlook in section 6.

II. Related Work

a) Stakeholder Theory

According to Freeman's classic definition, *"a stakeholder in an organization is any group of individuals who can affect or is affected by the achievement of the organization's objectives"* (Freeman 1984). A corporation's survival and success largely depends on its ability to create sufficient wealth, value, or satisfaction for all primary stakeholders, not just for shareholders (Clarkson 1988). Companies need to identify relevant stakeholder groups and their expectations in order to initiate activities to meet their requirements. The core ideas of stakeholder theory have been widely studied in the business administration literature (Telem 1988; Sun and Liu 2001; Schneider 2002). One of these follow-up studies develops "descriptive stakeholder theory" which posited that at a given stage certain stakeholders will be more important than the others, since they have the potential to satisfy critical organizational needs (Jawahar and McLaughlim 2001). COFF finds that internal stakeholders, rather than shareholders, appropriate a significant portion of the rent generated by an organization in that they have better information, critical skills and, accordingly, very high replacement cost (Coff 1999). These two studies highlight the importance of primary stakeholders for organizational performance.

SCHNEIDER (2002) explores leadership effectiveness issue in the radix organizations by developing a stakeholder model of organizational leadership. Schneider takes stakeholder theory as the theoretical base of this model and defines leader effectiveness as the collective sense of the leader efficacy perceived by multiple stakeholders. She makes a number of propositions on influencing factors of leader effectiveness, among which the smooth relationships between the leader and the stakeholders are proposed as the most critical factor.

b) Information Requirements of Stakeholders

Information Requirement Specification (IRS) has been identified as a vital step in systems design and implementation. MURDIC claims that the failure of MIS design efforts can be attributed to users not providing clear, specific information requirements more than any other factor (Murdic 1980). GILHOOLEY summarizes potential damages that can be caused by poor IRS (Gilhooley 1986). These damages can be a lack of flexibility to meet business needs; lacking management approval; difficult and costly maintenance; misfit with long-term company plans; and processes exceeding budget and time schedules.

Various models and methods to identify information requirements have been developed in search of successful systems design. For instance, TELEM proposed an approach combining brainstorming and Theory Z principles with the purpose of defining a maximal, feasible and effective IRS (Telem 1988; Telem 1988). Another technique to improve IRS, Stakeholder Analysis, as has received increased attention, especially on the softer side of systems development, such as social-technical (Mumford and Wier 1979) and participatory systems design (Schuler and Namioka 1993). ROBINSON et al. conclude that two major streams have emerged in formal stakeholder analysis. One is the development of various formalisms for describing stakeholder goals and relationships; the other is the advancement of assorted procedures for resolving stakeholder goal conflicts (Robinson and Volkov 1997). Other than for IS design, stakeholder analysis has been identified as a critical step for IS evaluation (Seddon, Staples et al. 1998; Turunen and Talmon 1998) in the sense that the perceived success of an information system may vary significantly across different stakeholder groups.

Identification of stakeholders as well as their information requirements for management decision-making activities is another research area, and most closely aligned with this paper. For example, LIN et al. detail the information requirements for management decision activities of different levels for healthcare institutions (Lin and Scheiner 1982). In particular, strategic-level decision support through stakeholder thinking has received significant attention (Ruohonen 1991; Sun and Liu 2001). However, to our knowledge, a stakeholder requirements identification for process monitoring purposes has not been conducted so far.

c) Event-based Monitoring and Performance Analysis

The field of event-based monitoring and performance analysis has been studied for information systems in different contexts. For instance, ChaosMon is a system for capturing and graphical presenting of program performance information (Kilpatrick and Schwan 1991). This framework supports the monitoring and evaluation of different applications on different machines which require multiple characterizations and associated analyses. ChaosMon serves as a tool for application-specific monitoring and the display of performance information for parallel and distributed systems. Another application-specific monitoring mechanism has been introduced by VETTER and SCHWAN (Vetter and Schwan 1998). They suggest monitoring assertions and instrumentation signatures as two new techniques to help improve the efficiency and usability of monitoring systems.

Other than monitoring systems, some examinations focus on monitoring events that occur in computer networks. Barghouty and Krishnamurthy introduce in two language constructs: Event context to capture the context in which an event occurs; and matching constraints to focus on the relevant events only (Barghouti and Krishnamurthy 1995). These two extensions enhance the ability in monitoring sequences of events of Yeast, an event monitoring system.

A number of studies explore the issue of IS monitoring and performance analysis by reconciling predefined systems requirements and run-time behaviors (Bates 1995; Chechik and Cannon 1995; Feather, Fickas et al. 1998; Cleland-Huang, Chang et al. 2002). Their primary strategy is to constantly compare the expected system behavior (i.e. the requirements) with actual system performance, and then to take responsive actions by employing different techniques. For example, NOGIEC et al. propose a Distributed Monitoring and Control System (DMCS) which is composed of a set of configurable communicating distributed objects (Nogiec, Desavouret et al. 1997). This system continuously monitors and controls operations through the implementation of a real-time database and scan system, as well as through the exchange of messages and events between scans, servers and control clients.

d) Stakeholder Analysis for Process Monitoring

Normative stakeholder theory asserts that the primary stakeholders of an organization are customers, employees, suppliers and local communities (Smith 2002). In Information System Science (ISS), four different stakeholder groups can be identified: users, managers, developers and outsiders (Turunen and Talmon 1998). This general taxonomy is used widely in ISS, e.g. for the evaluation of IS effectiveness (Hamilton and Chervany 1981; Grover, Jeong et al. 1996). Other approaches attempt to divide stakeholders into more specific groups. For instance, RUOHONEN suggests that the key stakeholders groups in the strategic information systems planning process are top management, user management and IT/IS management (Ruohonen 1991). This illustrates that the composition of stakeholders may vary when different issues are analyzed. For this reason we need to identify the stakeholder in whose interest the evaluation of IS success is being performed (Seddon, Staples et al. 1998).

A welcome side-effect of stakeholder information analysis is the empowerment of IT specialists as agents of change. MARKUS and BENJAMIN (1996) have pointed out that IS specialists need to become better agents of organizational change. They reason that IT specialists who are effective change managers will have more influence than top management in leading IT implementation projects to success; change agentry will mostly likely become the largest and most important part of intra-organizational IS work in the future, and that IS specialists' becoming better change agents will improve their organizational credibility. Building useful process information systems will enable IT specialists to fill this role.

III. Stakeholders of BPMS

Generally, stakeholders of BPMS can be grouped into users, managers, developers and outsiders. The purpose of identifying stakeholders in this paper addresses the run-time phase of a BPMS, which differs from the build-time phase that is typically used for stakeholder segmentation. Firstly, since developers are usually not consumers of process monitoring systems from a business administration perspective, we choose to exclude them from our analysis.[1] We can then classify the three remaining stakeholder groups into Internal Stakeholders and External Stakeholders according to whether or not they work as employees of the organization employing a BPMS. Internal stakeholders are comprised of process participants, process managers, and enterprise management. External stakeholders are process participants outside the organization (for example, subcontractors), process customers, and other external observers, such as governmental and regulatory agencies. Figure 2 summarizes the different groups and their perspectives on a workflow application.

Internal Process Participants (also known as process performers (WfMC 1999)) are notified about pending activities through their work list, and can select and activate these activities. Upon completion of an activity, control is handed back to the BPMS. Depending on the nature of activities, process participants may be human resources, technical resources, or a combination of these. Their interest lies in individual process instances, and the reach of their activities extends to remedial actions that affect these instances. For example, a process participant may want to be reminded about a pending activity with high importance, in order to optimize his or her personal schedule.

Process Managers are typically not involved in the operational affairs of a process, but bear the responsibility for a process in whole or part. They can modify the resource capacities allocated for a particular process. For example, by changing staff assignments they may be able to alleviate temporary bottlenecks in a process. Process Managers are typically notified of exceptions that occur during

[1] Commercial process monitoring infrastructures often address developers by providing technical details that can be used to debug a BPMS, but provide limited support for business-level analysis.

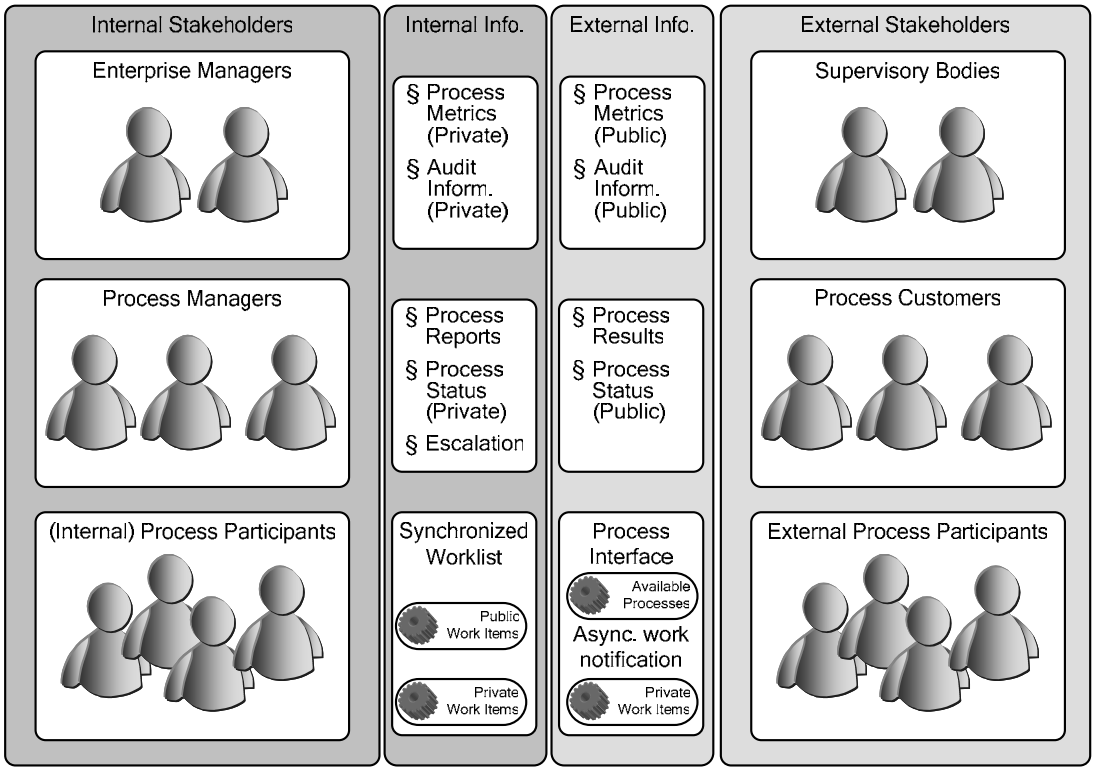

Figure 2: Process Stakeholders

process execution. The relationship between workflow processes and process managers can be static, i.e., responsibilities are defined for each process model, but the relationship can also be dynamic, and changes depending on the organizational position of the process initiator or the process participants, or through the business object that flows through the process (e.g. responsibility for specific customers or product types).

Enterprise Managers are neither involved in the operational execution, nor the operational management of workflow processes. Instead, they are concerned with the coordination of all enterprise processes to achieve the efficiency goals of the enterprise. In order to achieve this, they receive workflow-related monitoring and controlling information in aggregate form. Since the interest of this group is the overall performance of the enterprise, process-based metrics have to be related to other business-relevant information. For instance, a decrease in process cycle times becomes actionable information for enterprise managers, if the decrease can be related to customer retention across different customer groups.

External Process Participants are responsible for the execution of activities, but are not under the control of the organization operating the BPMS. Examples for this group of stakeholders are customers that participate in self-service processes. Information about the capacity and availability of these resources is not available to the BPMS service in most cases. The notification of these participants about pending activities is typically performed through an asynchronous medium, such as e-mail. Because of this, the revocation of activities is usually more difficult than in the case of internal workflow participants. Nevertheless, it can be assumed that external process participants have a similar information profile as internal process participants.

Process Customers directly or indirectly benefit from the results of a process. In many situations, they may be interested in intermediate results, before the process is completed. For this purpose, BPMS might provide process monitoring functions for trusted external parties.

Supervisory Bodies can be third parties who may have an interest in auditing certain processes, such as regulatory bodies or government organizations. While they do not take part in process instances or use their direct result, information about completed processes may be required by these parties (e.g. the proof of fulfillment for certain processes). In summary, the interaction of different stakeholders at runtime creates specific requirements for the design of process monitoring applications, such as the maintenance of monitoring profiles for different groups, or visibility constraints for process information.

IV. Identifying the Information requirements of BPMS Stakeholders

According to stakeholder theory, to categorize stakeholder groups their respective expectations and requirements need to be identified. RUOHONEN contends that requirements and preferences differ greatly according to the status of individual managers, such as his/her decision power and their expectation of IS services (Ruohonen 1991). That is, stakeholders bearing different job responsibilities look at business processes from different perspectives. An enterprise manager may be concerned with multiple processes whose operation impacts the overall organizational performance in an aggregate fashion. He/she is more sensitive to the events that have a strategic impact on the organization. A process manager may be interested in all instances of the process he or she

	Enterprise managers	Process managers	Process participants
Time	• Overall processing time trends • Key process instance overdue alert (New product development process; Transaction of a VIP customer)	• Alert for increasing waiting time across different process instances • Waiting time alert for the same task across different process instances • Increased throughput time alert for tasks (especially in an aggregated manner)	• Waiting time alert for current customer requests • Delays in expected activities (e.g. delayed deliveries)
Resource	• Ad hoc project needs resources that are engaged in different processes	• Key resources are unavailable • Large difference of time taken by resources to finish the same task • High resource utilization alert • Wrong resources assigned to task	• Partner unavailable • Machine unavailable
Inventory	• Rate change of inventory for different processes	• Low inventory warning • Change of average inventory levels (especially when there are either big or continuous changes)	• Inventory level can't meet order requirement
Capacity	• Large-scale change of demand	• Average process instances handled per unit time • Arrival rates alert for process instances per unit time (along with the average rate for comparison)	• Accurate forecast of daily capacity demand • Demand exceeds capacity (more staff is needed; staff reallocated; work overtime)
Schedule	• On-time percentage for key processes • Current key process overdue alert	• Potential overdue process instances notification • Customer changed orders – schedule revision needed	• Potential overdue task notification • Task priority change notification • Early notification of periodical tasks
Quality	• Serious quality problem warning (trend)	• Process contains intrinsic possibilities of conflicts, deadlock, etc	• Order/invoice mismatch
Customer	• VIP customer cancelled order (potential loss of customer)	• A large number of customer cancelled their orders together • An insurance claim whose circumstances were not in the policy • Requirements of VIP customer violate policies/regulations	• Order cancellation • Customer payment overdue • Number of customer waiting in the queue alert • Customer documents missing • Customer needs change (flight destination change)
Business Object	• Process goals contain conflicts or inconsistencies	• Service/product requests exceed capacity before registration deadline (conference paper submission)	• Delivery delayed • Invoice didn't go with the products • Process variable change (checking balance go below a limit)
Location	• Sudden order increase/decrease in location A	• Low inventory level warning in location A • Low capacity warning in location A • Long customer waiting time warning in location A	• Delivery misrouted

Table 1: Exemplary Process Monitoring Events

is responsible for. He has to make correct and timely decisions in order to deal with exceptions during business process execution. By contrast, a process participant may only have the horizon of his case or his task. Decisions made by process participants mostly deal with operational problems and do not have a long-term impact. Therefore, in order to identify stakeholder information requirements, we need to understand their general job responsibilities.

In order to illustrate the information requirements of these different groups of stakeholders, we illustrate some of the most common notifications in Table 1.

a) A Framework for Analyzing Stakeholder Information Requirements

The type of decision making accomplished at each planning and control levels has an important impact on the

information needed. LIN and SCHEINER discuss the general characteristic of information needs at the strategic planning, management control, and the operational control level (Lin and Scheiner 1982). Based on their work, we can summarize the different analysis dimensions of information requirements for process monitoring as follows:

Source

The source of information can be either external or internal to an organization. External information is typically required to assess market conditions and competitive developments at the strategic level. The formulation of organizational mission and business policies has to take into account the influences of the environment, such as suppliers and competitors. Internal information is more about the operation progress of the organization. In contrast, most operational management information is generated internally.

Measurability

Qualitative and quantitative information are two diverse forms of process monitoring data. Qualitative information provides a nominal measurement that carries no implication of importance, while quantitative information provides numerical measurement that can be used for comparison purposes.

Aggregation

Information can be processed at different level of abstraction. Since BPMS provide very detailed event logs, almost every single event can produce relevant information. Therefore, information needs to be processed and summarized to a higher level of abstraction, in order to obtain a holistic view across the enterprise. In other situations, detailed information on different aspect of an event or an object is necessary to guide management decisions.

Timeliness

Information can be provided with different urgencies. Information required for long term plans may be taken averaged over a longer period of time, while other information is required as soon as it is available.

Time horizon

Information, as materials, differs in its durability. More specifically, the period during which a piece of information has an effect is different. Information prepared for strategic plan might be used for years while information collected for operations may not be of any help after the specific task.

Accuracy

To serve decision making processes properly, information can be collected with different degrees of certainty. An example of accurate information that leads to an action would be the occurrence of a particular process event, while the forecasting of possible processing times carries a lower degree of certainty. Decision makers should take advantage of all information, even with low accuracy, in order to make the best decision.

Frequency of use

Some decisions have to be made periodically, while other decisions are only made infrequently. Periodical decisions require a continuous information supply, while infrequent decision making processes demand an active notification in case a decision is required.

Figure 3 illustrates the analysis dimensions and shows, how the information needs represented by these dimensions vary across three different stakeholder groups who make different management decisions.

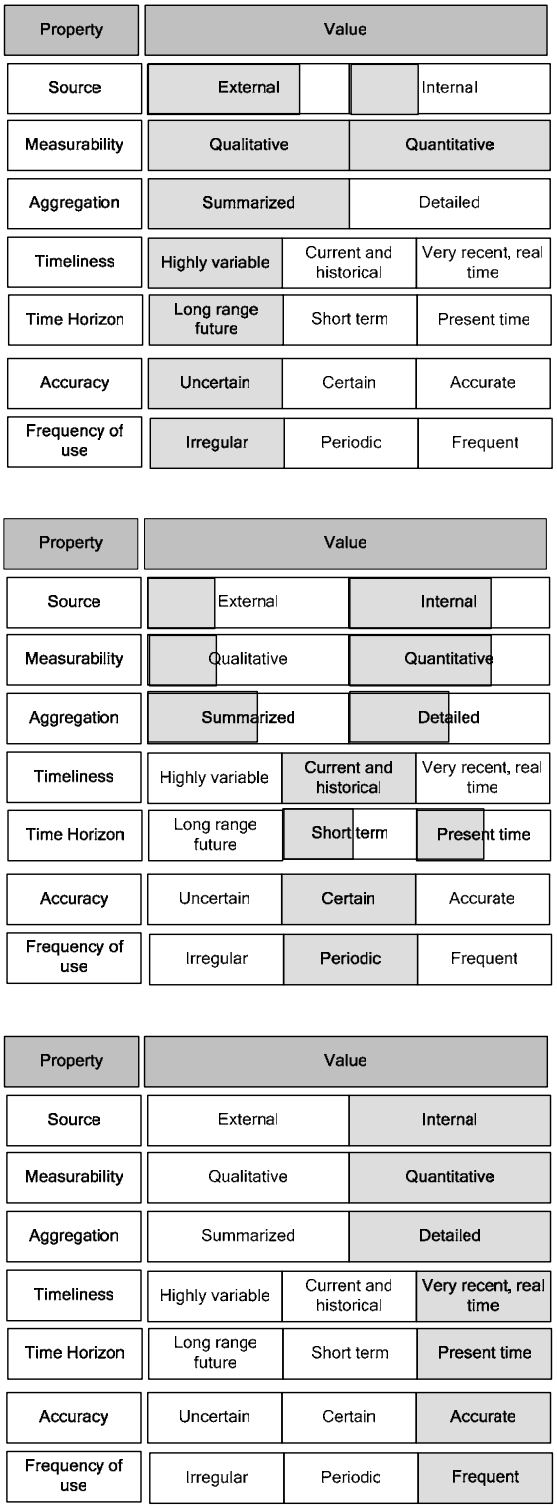

Figure 3: Information requirements for strategic, tactical, and operative decisions (top to bottom, compare Lin and Scheiner 1982)

b) Information Profile of a BPMS Audit Trail

The audit trail of a BPMS contains records of state changes in the activities and processes managed by the BPMS. These state changes have a fine level of granularity and are recorded as soon as the change occurs. Using the framework described in the previous section, we can characterize the information profile of a BPMS audit trail as shown in Figure 4:

Property	Value		
Source	External		Internal
Measurability	Qualitative		Quantitative
Aggregation	Summarized		Detailed
Timeliness	Highly variable	Current and historical	Very recent, real time
Time Horizon	Long range future	Short term	Present time
Accuracy	Uncertain	Certain	Accurate
Frequency of use	Irregular	Periodic	Frequent

Figure 4: Information profile of a typical BPMS Audit Trail

BPMS coordinate all business processes that are formally captured in the system, but have no information about activities that are performed outside the scope of the system. Thus, the information provided by a BPMS audit trail relates to the internal operations of an organization. The audit trail typically includes a large amount of quantitative information, such as the date, start and completion time of every task. In the course of process monitoring, once an exception has occurred information is required on a timely basis to address the exception before the corresponding process instance fails. Most BPMS contain active notification mechanisms that alert users once an exception is detected. Due to the mechanistic nature of BPMS, the information captured in the audit trail is an accurate reflection of events that have occurred, but contains no information about pending tasks or deadlines.

The information profile of a BPMS indicates that the information commonly provided by BPMS matches most closely the information needs of process participants, while it does not reflect the information need of process managers or enterprise managers. In the following section we discuss ways to improve this deficit.

V. Improving the Monitoring Information of BPMS

In order to alleviate some of the shortcomings of BPMS monitoring capabilities, several steps need to be taken:

- *Integration of outside data sources*. Since a BPMS only capture events that occur within its scope, external events are typically not represented in the monitoring data provided by a BPMS. Notifications from business partners and other application systems need to be captured and integrated with BPMS monitoring events, in order to provide a holistic perspective on company operations.
- *Integration of qualitative data.* Information about the time and kind of events that occur in a process is useful for process participants, but at an aggregate level they lose expressiveness. It is therefore necessary to relate this information to qualitative application data that is being processed in the respective tasks or processes. By linking process instances to their business objects, process managers can make informed decisions about the handling of process instances, since they can determine what the associated product or who the associated customer is.
- *Aggregation of process instance monitoring data.* Process and enterprise manager require cumulative information about process execution histories and performance trends. This information can be provided by aggregating individual process instance monitoring data across the same task/process/business object. Since process execution paths vary, the integration of this type of information is non-trivial.
- *Provision of active notification and passive auditing mechanisms*. BPMS need to provide configurable notification mechanisms that allow stakeholders to subscribe to events that affect their management decisions. At the same time, process warehousing facilities need to support the aggregation of process history information for detailed analyses on demand.

VI. Conclusion and Outlook

Current BPMS provide limited capabilities to deliver feedback on business process performance. These limitations cause latency in the organizational response to external or internal changes. One of the reasons for this latency is the weak link between process monitoring information and business relevant information.

In this paper, we looked at process monitoring from the perspective of stakeholder theory and identified three stakeholder groups for BPMS – enterprise managers, process managers and process participants. Based on the analysis of their job requirements, we then discuss their respective information requirements. The identified information requirements will require a relationship between technical audit trail and business-relevant information. This provides an opportunity to improve process monitoring functionalities of current BPMS. The stakeholder groups identified in this paper need to be validated in practice. We have assembled a group of enterprises for case studies which will explore the validity of our classification.

Based on the identified information requirements, we are currently exploring ways to provide business-relevant information to key stakeholders, and to add causal inference capabilities to process monitoring tools. Using causal inference, decision makers will not only receive alerts when a business relevant event occurs, they will also be able to identify potential causes for this event. Using a combination of simulation techniques and commercial workflow technology, we are building a process monitoring prototype to test our approach through a proof-of-concept implementation.

Building process monitoring and controlling systems that satisfy stakeholder information requirements is not a one-time endeavor. VOLBERDA (1996) has pointed out that firms in hyper-competitive environments continuously identify and develop new advantages, thereby creating a temporary disequilibrium. This dynamic process requires new organizational forms that are able to explore new opportunities effectively as well as exploit those opportunities efficiently. In a similar notion, SABHERWAL et al (2001) suggest that the alignment between business and IS is characterized by a long period of stability separated by short periods of considerable instability. During this period, the strategic IS management profile undergoes little change in evolutionary period while is completely transformed during the revolutionary period. Information requirements are thus not static, and need to be evaluated based on the contingencies of the firm-specific situation. This remains a challenging task for future work in this area.

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