Research in Business Process Management

Office Work and Automation

Every spring our campus library decommissions books that have not been requested in a number of years and that are either duplicates or have been rendered obsolete for other reasons. Anyone can browse through stacks of works such as “50 years of Soviet Aircraft Construction” or “Who’s Who in Science and Engineering – the 1973 edition” and take home a hardcover for $1 (paperbacks are 50 cents). Every now and then a gem emerges from the browsing tables. And so I came across a book by Howard S. Levin, entitled “Office Work and Automation”, published by John Wiley & Sons in 1956, and sold back then for $4.50. At 203 pages, Levin diligently outlines the value of information technology to “promote availability of information in a form that contributes to sound decisions” (p. 59) and the “elimination of manual intervention in data-processing activities” (p. 61).

He proclaims: “Technology will have considerable effect on the office. As information becomes more available, more timely, and more economical to obtain, we can expect changes in management concepts and business operations” (p. 167). Levin cites case studies from a number of companies, most of which are defunct by now (e.g., Sperry-Rand, Bendix Computer) but some of which are still thriving (AT&T and IBM among them). In essence, the book has all the ingredients of a current management bestseller – compelling cases, the call for new technology, and actionable advice for managers on how to deal with this new world. One of my colleagues half-jokingly suggested that we replace the cover, modernize the language and propose it to Harvard Business Press as the next big thing.

The reviews of the book back then were mixed. George Chernowitz wrote in Management Science that the book was “written from the standpoint of enthusiastic advocacy”, like many current bestsellers. He continues: “Office Work and Automation is written at a […] general level, principally useful to top management. [...] In a sense, the book is a primer of terms and concepts which management is thought to find useful in dealing with the systems engineer.” It is surprising that the contents in Levin’s book held up well over 50 years. More than that, the author foreshadows developments that current standards groups are still battling over: “What has been needed is a common language for office work. A common language enables machines to interact.” (p. 19) – BPMN, XPDL, BPEL and the likes fall into this category.

Research and Education in Business Process Management

It has often been said that Business Process Management is not new. Many notable scholars and industry representatives have discussed the context that motivates the structuring of organizations along processes, and the technology that supports such structures. Still, the question should be asked: What have we done in the past 50 years to answer Levin’s call for the use of technology that integrates machines, automates manual work, and promotes sound decision making? How many of these problems did we solve? And how are the issues from 1956 different from today’s issues surrounding BPM?
This quarterly column discusses research and educational activities in the context of Business Process Management. It strives to answer questions such as: Which aspects of BPM are currently being studied? What are the big open questions? Who is active in the BPM space? What educational programs exist, and who offers them? Let us begin with by taking a brief look at the history and current state of BPM research.

A Short History of BPM Research

Where to look?

As research topics go, BPM is a typical multi-disciplinary affair. It has roots in organizational theory, computer science, information systems, and management science. While individual papers on processes and process organizations date back more than a century, the process-oriented application of information technology was discussed in the 1960s. One of the earliest sources are the works of organizational theorists such as Fritz Nordsieck, who wrote:

“[A] modern data processing [system] represents a process that is connected with the business process, and accompanies – or even controls - this process across various segments.”

Since then, BPM-related topics have been investigated from many angles. Computer Science has focused on the components of BPMS and the formalisms of the underlying languages. A typical example is the view of a process as a long-running transaction, taken by researchers with a database background. From their perch, processes should share properties of transactional systems, and benefit from concepts such as the ability to compensate for failed processes, or the necessity to persist the results of a process. Other CS projects have studied the system support for exception handling, changes to process schemas at runtime, or the general architecture of BPMS. More recently, the use of BPM technology to provide Grid Computing services has attracted a number of projects in the Computer Science and Life Sciences space.

Organization theorists and Management Science research focuses on the structuring of organizations around processes and the effects of information technology on organizations. Some of the work related to BPM studied the effects of collaborative work technology on organizations and was centered on the deployment of systems such as Lotus Notes in the early 1990s. Management scholars have similarly addressed the design and redesign of processes, but generally speaking, BPM has not been high on the list of standard business school research topics. This may be due to the fact that BPM does not reside in a single management discipline, such as finance or marketing, and the fundamental implications of process technology on organizations are not easily separable from other influential forces such as competition, leadership style, or industry.

This interdisciplinary nature comes naturally to Information Systems researchers. Information Systems is uniquely situated at the intersection of Management and Computer Science, and Information System faculty is conducting many BPM research projects. Since many universities don’t have dedicated information systems departments, faculty interested in BPM may reside in Business Schools with MIS groups, Schools of Information Technology, or even IT & Electrical Engineering. IS research in BPM often deals with the modeling of processes, the application of BPM technology in practice, or ancillary technology such as Business Intelligence platforms that are fed by BPM data.

Office Automation: Officetalk and SCOOP

The works of Clarence Ellis and Gary Nutt on office automation prototypes at Xerox PARC during the late 1970s had a significant impact on the development of early office automation systems. Their systems, called Officetalk-Zero, Backtalk (a test environment for Officetalk-Zero), Officetalk-P, and Officetalk-D used forms as representations of activities. Processes were represented as Information Control Nets (ICN), a language derived from Petri Nets. Current developments in Business Activity Monitoring and Business Intelligence were already foreshadowed.
“[…] an [Office Information System] might support successively higher levels of management by offering […] the chief executive officer the ability to control and audit corporate resources.”

One of the first prototype systems that supported organizational processes was SCOOP (System for Computerization of Office Processes), developed by Michael Zisman at the Wharton School of Business, University of Pennsylvania. SCOOP, like Officetalk, used Petri Nets to represent business processes. His augmentation of Petri Nets supported the multiple triggering of activities, in case the number of activity instances necessary could only be determined at run time (a feature that was later found in IBM’s FlowMark product), and deadlines, in case time constraints for activities were violated.

Prototypes of BPM Systems

The first wave of office automation research peaked in the mid 1980s, and then slowly decreased. The first prototypes were completed, dissertations had been written, and research funding had run out. Research did not pick up again until the mid 1990s, when papers on a new wave of research prototypes were published. Figure 1 shows a timeline of the most well known office automation and BPM research prototypes between 1975 and 2005. The second wave peaked around 1999. A few systems have been developed in academia since then, and only a few have been around for more than 5 years (ADEPT is a good example). This is not surprising if you consider how research in Information Systems or Computer Science works.

A typical research project around BPM is supported through an external grant (to pay for time, travel and materials) and involves an academic advisor, 1-2 PhD students, and maybe a post-doc (if funding is available). Grants have a timeline of 1-3 years, and grant applications go through an average review process of up to 6 months before a funding decision is made. Add the time it takes to write a good grant application and the time from defining the problem statement to delivering the final report amounts to between 3 ½ and 4 years. This coincides with the time it takes to complete a PhD at many universities (somewhere between 3 ½ and 5 years).

A good PhD topic typically addresses a very narrow research question (i.e. one that can be answered given the time and page limitations), is inspired by a real world problem, and the insight from the project can be generalized to a larger area of application. Many of the research prototypes were built to serve as platforms for the answer to such questions. Three of these systems are MOBILE, WASA, and YAWL.
Three Sample Prototypes: MOBILE, WASA, YAWL

MOBILE was built at the University of Erlangen-Nuremberg to study how the architecture of a workflow system can be broken into several aspects that can be extended independently. The principal researchers, Stefan Jablonski and Christoph Bussler wrote a very good book on their findings (Workflow Management, ITC Press, 1996, long since out of print), and the MOBILE system was their proof-of-concept.

WASA at the University of Muenster was built to study dynamic changes to processes while instances of these processes were running. One of the principal investigators, Mathias Weske, is now the Business Process Technology chair at the Hasso-Plattner-Institute at the University of Potsdam and is still active in the BPM domain.

The YAWL project at Queensland University of Technology is an implementation of the YAWL workflow modeling language (Yet Another Workflow Language). Arthur ter Hofstede in Brisbane and Wil van der Aalst in Eindhoven have developed the fundamentals of the YAWL system, and they both remain very active researchers in the BPM space. The YAWL platform has recently moved to open source status and development is continuing.

Only one of the three prototypes, YAWL, is still being maintained. Many other prototypes never make it beyond the initial release stage. This, again, is not surprising if we consider the effort it takes to write a BPMS from scratch. Via email and through my online discussion forum I have received a number of inquiries by prospective students that want to write their own BPMS. This is almost always a bad idea. Consider the three years of research behind a typical dissertation topic. If the topic is the study of process interoperability, a researcher could easily spend the first two years to develop the basic process modeling and deployment functionality necessary for a bare-bones BPMS. This leaves him or her with just one year to study the specific functionality he or she is interested in, clearly not much time to make great progress. Consequently, it is not surprising that the practical impact of research prototypes has been very limited. I am aware of only one or two projects (ProMInanD being one of them) that were funded by the European Union and became somewhat successful commercial products.

The Answer? Bootstrapping!

So what should an aspiring BPM researcher do if he or she is interested in technical aspects of BPMS? Three possible strategies are: Use a commercial system, use an open-source system, or join forces with another research group.

If the functionality of interest is ancillary to the core BPMS functionality, a commercial system is often a good choice. Many vendors like to work with academic research groups, given that they do not have to provide technical support and NDAs about technical details of the underlying system are signed. Working with a commercial or open-source BPMS is also a good strategy to build an initial understanding of the maintenance complexity of BPMS. Once the first attempt at setting up the system has been completed (installing a new DBMS, application server, messaging infrastructure etc.), the initial desire to write your own system quickly subsides.

If the internal workings of a BPMS are of interest, open source systems are often a good choice, since they allow unrestricted access to the underlying source code. Many open source systems have reached considerable maturity (e.g. openWFE, jBPM or Enhydra Shark). Researchers should be careful to evaluate the state of the open source project of their choice, since many abandoned projects are still accessible in open source repositories (SourceForge).

Joining forces with an existing research group that has its own BPM prototype (such as YAWL or ADEPT) is a suitable strategy if the interests of the researcher are somewhat complementary to the overall area of the prototype in question.
Information Systems Research on BPM

BPM in the Information Systems area focus more on the use and effects of BPM technology than on the development of the technology itself. While these projects often do not involve the development of system, they often create new procedure methods, models, or languages. For example, the Process Handbook project at MIT intended to collect a representative number of high-level process models in a central repository\(^1\). As part of this project, a new language for the specification of processes was proposed (Process Interchange Format), which ultimately merged with the Process Specification Language of NIST.

Information Systems researchers increasingly study the practice of BPM in organizations, e.g. the maturity of process management activities. A prominent example is the BPM Maturity project at Queensland University of Technology of Rosemann and de Bruin\(^2\). The application of BPM in public administration is subject of the PICTURE project by Becker et al. at the University of Muenster\(^3\), and process modeling languages are evaluated by numerous researchers. The Event-driven Process Chain is prominently featured in the German-speaking IS community, e.g. in the works of Jan Mendling\(^4\), while Jan Recker in Brisbane is conducting a project on the application of BPMN in practice\(^5\). At Stevens Institute of Technology we work on the representation of risk in business processes\(^6\), task allocation strategies and the integration of business rules and business process modeling.

Is BPM Research Useful?

Research in BPM has produced a handful of software prototypes, numerous publications in academic journals and conferences, and two journals of its own kind, the International Journal of Business Process Integration and Management, and the Business Process Management Journal. A highly rated conference, the International Conference on Business Process Management, will be held for the fifth time in September 2007, this time in Brisbane, Australia. Other academic conferences with BPM content are the Conference on Cooperative Information Systems (CoopIS), the Conference on Advanced Information Systems Engineering (CAISE) and the European, American, Australasian, and International Conferences on Information Systems (ECIS, AMCIS, ACIS and ICIS). A number of well-qualified BPM experts have graduated with from BPM research groups as well. Academia has clearly produced a large BPM body of knowledge.

If BPM research is useful, who has benefited from it? Not many prototypes went on to influence the development of commercial systems, but many of those who built these prototypes went into industry with a deep understanding of the implications of BPM technology, and this includes graduate and undergraduate students that wrote many Bachelor's and Master's theses on these systems. So, in a sense, the main contribution of BPM research to industry may have been more in the education of the researchers than in the actual research results themselves.

Did BPM research answer all questions organizations or vendors might have? Certainly not. But it seems that the current hot topics are less in the technical capabilities of BPMS, and more in their application and impact. That is not to say that the design and development of BPMS is a worry-free affair, but it is not – and has never been – an answer to the issues that Levin has raised in his 1956 book. The answer to questions such as the use of process data for decision support, the search for a process design that is suitable for a given organization, or the capabilities an organization needs to successfully deploy a BPMS, requires insight into industrial practice.

What is Missing?

There is a lack of good BPM case studies. Many organizations are reluctant to let academics poke around to write about BPM projects, but in fact, developing BPM case studies can be beneficial for both sides. The researcher gains access to real world data, and often this data leads to insights beyond the initial project scope. The organization gains an independent watchdog that provides a neutral assessment of BPM activities. And often organizations improve
by simply looking at existing work practices, without the need for technology deployment. For instance, one of my students is studying the processes of an organization in the automotive domain, and the simple comparison of as-is and to-be processes unearthed improvement potential that could save the company more than a million USD annually, with no need for new technology. But in order to conduct BPM research that is meaningful for practice, researchers have to be able to separate a research mindset from a consulting mindset. Consultants are recognized for what they know. Researchers are recognized for what they find out. A good BPM researcher should not be afraid to develop a good set of consulting skills, because that will ultimately help him or her obtain the data required for good research.

But not just user organizations are a source of data for BPM research. For a recent project I tried to compile BPM case studies, only to find that most BPM case studies have been written by vendors, very few by users, and even fewer by academics. A possible role for research could thus be the authorship of case studies for vendors, which relieves a resource bottleneck for the affected vendors, and provides researchers with access to first hand accounts of BPM in practice.

Next Column: BPM Education Programs

Join me next time, when we will take a closer look at educational offerings in the BPM space. And if you think your organization’s IT spending is worrisome, consider Levin’s assessment of the relationship between real-world dynamics and IT spending:

“Should this cycle of better information and greater business complexity continue, it will be a contributing factor to greater outlays for information handling than are made under present procedures” (p. 61).

Doesn’t 2007 feel like 1956?

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2 This review is, by nature, brief and not exhaustive. If you are working on a BPM-related research project not mentioned here and would like to make yourself known please send me a brief description of your project. I will post a list of projects on the BPTrends website.
7 The list of systems in figure 1 is clearly not exhaustive. If you know of a system that is missing from the diagram I would appreciate if you could let me know at mzurmuehlen@stevens.edu - I will post an updated version of the diagram on the BPTrends site.