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Business Process Management: A Research Overview and Analysis

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ABSTRACT

Business process management (BPM) as a research discipline has been around for quite a while. Extensive research effort has been devoted to advancing BPM methodologies, techniques, and tools. Despite its continuous development over the years, little attention has been given to understanding the evolutionary process of BPM research. In this paper, we attempt to analyze and rationalize the development of BPM research through a longitudinal literature analysis. We collect and review BPM articles from leading information systems (IS) journals. Each article is categorized based on its demographic background, year of publication, research method, and research area. We adopt a meta-analysis approach in analyzing the data produced from a categorization process. Our analysis provides an overview of BPM research from multiple perspectives. It also summarizes the publication behavior in the field. We hope our work will help BPM researchers identify research areas that are important yet under-researched. It may also be useful in guiding the future direction of BPM research.

Keywords

Business Process Management, Information Systems, Literature Review

INTRODUCTION

Business Process Management (BPM) applications have become more widespread in recent years in response to the demand for more efficient, flexible, and effective business processes. Our research objective in this paper is to describe the subject matter of BPM research as it has evolved in response to environmental and technical changes. We are particularly interested in the difference in topic concentration and research approaches chosen by BPM researchers across geographical regions.

Our work is based on and updates a previous Business Process Reengineering (BPR) study by Barothy, et al. (1995) entitled "Business Process Reengineering: Emergence of a New Research Field." Their study, in order to give first insights into the development and state of BPR as a new research field, analyzes BPR articles published in leading MIS journals and/or written by three proponents in the field in accordance to research approach and content for the period 1988 through 1994. We intend to replicate their experiment for a broader research domain (BPM) and for a time period extending to the present. Our work presents the latest overview of BPM research and compares it to the findings from the previous study to elucidate the evolution of BPM research over the years.

The remainder of the paper is organized as follows. In section 2 we provide the background of BPM as a research discipline and contrast it with its earlier incarnation as BPR. Business processes and the associated discipline, BPM, are carefully defined. Related work on analyzing research opportunities and forming research frameworks in BPM are also presented in this section. In section 3, we introduce the research methods and tools utilized in our work. In section 4, we discuss the key findings in detail. The results gained from analysis are compared with previous studies from multiple research perspectives. New findings are also depicted in this section. Finally, in section 5, we discuss the limitations of our study as well as the future work we will pursue in extending the current study. A summary of our work can be found in the concluding remarks.

BPM: TERMINOLOGY AND RESAERCH

The development of process-oriented thinking dates back to the development of Total Quality Management (TQM) at Toyota and other Japanese manufacturing companies in post world-war II Japan (Deming, 1982). More recently, TQM has evolved into "Six-Sigma". Similarly, "Lean Manufacturing" emerged from work at Toyota aimed at radically improving their manufacturing processes. These management philosophies were mainly devoted to manufacturing. More closely aligned to

businesses in a services economy, the business process paradigm emerged in the 1990's after publication of seminal papers by Davenport (1990) and Hammer (1990) in Sloan Management Review and Harvard Business Review, respectively. At that time, work in the business process area was focused on BPR, defined by Hammer and Champy (1993) as "the fundamental *rethinking* and *radical redesign* of business processes to achieve dramatic improvements in critical, contemporary measures of performance, such as cost, quality, service and speed."

Over time, business process management (BPM) has evolved from the more narrowly focused BPR. BPM and its derivatives have been continuously discussed and researched in both academia and industry. Although the term is often confused with other process-oriented improvement methodologies such as business process innovation, business process reengineering, business process redesign, and business process improvement, they can be generally viewed as a collection of process improvement efforts that differ in mission, scope and approach. BPM encompasses these methodologies and provides a general method for the study and improvement of business processes (Elzinga, et al, 1995).

In the BPM paradigm, an organization is viewed as a system of interlinked processes. To that extent, "a business process is a set of one or more linked procedures or activities which collectively realize a business objective or policy goals, normally within the context of an organizational structure defining functional roles and relationships" (WfMC, 1999). Similarly, according to Hickman [1993], "[a business process is] a logical series of dependent activities which use the resources of the organization to create, or result in, an observable outcome, such as product or service." BPM is regarded as "any systematic, structured approach to analyze, improve, and management processes with the aim of improving the quality of products and services" (Elzinga, et al, 1995). At the operational level, BPM supports business processes "[…] using methods, techniques, and software [tools] to design, enact, control, and analyze [processes] involving humans, organizations applications, documentations, and other source of information" (Weske, et al, 2004).

Depending on the perception of BPM, different management foci or "key practices" are proposed for the implementation of BPM. For instance, BPM, from the viewpoint of Benner and Tushman (2003), entails three major practices: process mapping, process improvement, and the adherence to systems of improved processes. van der Aalst and his fellow researchers (van der Aalst, et al, 2003) suggests four management areas that should be taken into account in BPM: diagnosis, process design, system configuration, and process enactment. Similar classification schemes can be found in (Harrington, 95), (Kettinger and Guha, 1997), (zur Muehlen, 2002), and (Papazoglou and van den Heuvel, 2007). We compare and contrast BPM key practices or management foci in Table 1.

Author(s)	**Benner, Tushman, 1993**	**Harrington, 1995**	**Kettinger, Guha, 1997**	**zur Muehlen, 2002**	**van der Aalst, et al, 2003**	**Papazoglou, van den Heuvel, 2007**
Field of Application	Process Management	Business Process Improvement	Business Process Reengineering	Business Process Management	Business Process Management	Business Process Development
Proposed Key Practices	Process mapping Process improvement Adherence to systems of improved processes	Organizing for quality Understanding the process Streamlining the process Implementation Measurement and controls Continuous improvement	Envision Initiate Diagnose Redesign Reconstruct Evaluate	Goal specification, environmental analysis Process design Process implementation Process enactment Process monitoring Process evaluation	Diagnosis Process design System configuration Process enactment	Planning Analysis & design Construction & testing Provisioning Deployment Execution & monitoring

Table 1. BPM Key Practices

The success of BPM implementation is positively associated with the performance of key practices. Information technologies (IT) are viewed as a major enabler of modern BPM practices (Davenport, 1993; Hammer and Champy, 1993). As Davenport (1993) points out, the value of IT in BPM results from its capability of automating, informating, sequencing, tracking, analyzing, integrating and disintermediating process resources and activities. IT is also used to break geographical and

intellectual boundaries that keep organizations from becoming process-oriented. Hence, various information systems are designed to facilitate the performance of BPM practices, collectively or independently. The information systems as such are referred to as "business process management systems" (Karagiannis, 1995), "process-driven management information systems" (zur Muehlen, 2001) or "Process-aware information systems (PAIS)" (Dumas, et al, 2005).

Dumas, et al (2005) define PAIS as "software systems that manage and execute operational processes involving people, applications, and/or information sources on the basis of process models." One of the most notable PAIS technologies is workflow management system (WfMS). zur Muehlen (2001) views a workflow as a "specific representation of a process, which is designed in such a way that the formal coordination mechanisms between activities, applications, and process participants can be controlled by an information system." Hollingsworth (1995) regards workflow as "the computerized facilitation or automation of a business process, in whole or in part." Hence, we view WfMS, which is a specific type of information system, as "a software package that provides support for the definition, management, and execution of workflows" (Dumas, et al, 2005). The implementation of workflow technology as such posits process knowledge as the base for automating process execution.

Despite the advancement of technologies, modern workflow management systems are still limited in their capability to support BPM "best practices." For instance, there are few WfMS that support simulation, verification, and validation of process designs. There are also very few systems that support the collection and interpretation of real-time data. Even more surprisingly, no tools to support any form of process diagnosis are offered by the traditional systems (Weske, et al, 2004). Thus, there is much room for further research in BPM. Such research should be based on a sound knowledge of the achievements, gaps and aspirations of existing BPM research. The following sections attempt to provide this understanding.

BPM Research in the Large

There has been an increasing amount of research on BPM. However, very few studies attempt to study the development of BPM or assess BPM as a research discipline in a systematic manner. In this section, we select four BPM research articles that provide overviews of BPM research from different angles. The research methods and research implications revealed by these four studies are discussed below.

In their work, Kettinger and Guha (1997) investigate methodologies, techniques, and tools available to the implementation of business process reengineering (BPR) project. 25 BPR methodologies are identified as a result of a literature review and a series of semi-structured interviews with BPR experts and vendors. A layered "Stage-Activity" framework for BPR is derived based on the description of the identified methodologies. Also, survey and interview results indicate that at least 72 techniques are utilized in accomplishing BPR activities. A total of 102 software tools are found available for facilitating or carrying out BPR activities at the time of their study. Both BPR techniques and tools are mapped to the key activities in the Stage-Activity framework. Such mapping is able to help BPR practitioners find their focus in BPR projects as well as the techniques or tools that may come in handy in performing BPR activities. Besides its implication in BPR practice, their study also sheds light on possible research directions for BPR such as the validation of the Stage-Activity framework and the empirical examination for each activity-technique/tool mapping.

O'Neal and Sohal (1999) review over 100 BPR research papers for the time period ranging from the 1980s to 1998. In reviewing the literature, they identified six major issues worthy of discussion: the definition of BPR, BPR tools and techniques, BPR and TQM co-existence, understanding organizational processes, the reengineering challenge, and organizational design using BPR. Their work differs from the BPR study by Kettinger and Guha (1997) in purpose and scope. The literature review conducted by O'Neal and Sohal does not target any BPR subject in particular. Instead, they identify research issues that may be most popular or most debatable during the given time period. In a way, their work shows BPR issues that have been heavily researched. It also implies that there may be research issues, especially those excluded in their discussion, that are critical to the subject matter but have received little attention. Interestingly, O'Neal and Sohal also recognize that empirical research in BPR has been lagging and that this presents the academic community with a considerable opportunity.

Stohr and Zhao (2001), in order to stimulate more workflow research, provide an overview of workflow automation from both industrial and academic perspectives. Their study covers the basic concepts of workflow systems, classes of workflow management systems and applications, and workflow architectures. Since the main contribution of their work resides in introducing workflow research to a wider, information system audience, they present a list of workflow issues under the three categories of technical, managerial, and market, economic, and social issues. According to their observation, research articles in the topic first appeared, and, for the most part, continue to appear, in the computer science literature. Most academic research on workflow has been conducted in Europe. They conclude that there is an urgent need for more research on the

impacts of workflow automation tools on humans, on the nature of work, on appropriate organizational structure, and on support for non-routine work.

Basu and Kumar (2002) study workflow management issues in e-Business. In order to provide a perspective on the field of workflow management and hence identify directions for future research, a framework for workflow systems research is introduced. In this layered framework, the first layer pertains to issues that arise in intra-organizational workflows. They include workflow specification, organizational metamodels, and workflow analysis and control. The second layer concerns other intra-organizational workflow issues such as distributed architectures, and heterogeneous workflow models. The outmost layer of the framework covers research issues in e-Business workflows. Supply chains, e-Hubs, e-Services, and standards. The workflow research framework acts as the main strand running through the entire paper. Among the issues covered in the framework, some are identified as promising areas for future research: specification of inter-organizational workflows, design of better organizational metamodels, support for exceptions, and development of standards to facilitate inter-organizational e-commerce. In Table 2, we compare the research framework proposed by our work with those adopted in the previous BPM studies. More details regarding the research framework can be found in the next section.

Author(s)	**Kettinger, Guha, 1997**	**O'Neill, Sohal, 1999**	**Stohr, Zhao, 2001**	**Basu, Kumar, 2002**	(The analysis framework adopted in this paper)
Research Area	Business Process Change	Business Process Reengineering	Workflow Automation	Intraorganizational Workflows (Core)	Business Process Management
Research Method	Literature Analysis, Interview, Survey	Literature Analysis	Literature Analysis	Literature Analysis	Literature Review
Research Framework Component	Methodology Technique Tool	BPR: Definition BPR: Tool & Techniques BPR and TQM Co-existence Understanding Organizational Processes Reengineering Challenge Organizational Design using BPR	Technical Issue Management & Organizational Issue Market, Economic & Social Issue	Workflow Management in e-Business Intraorganizational Workflows e-Business Workflows	BPM Life Cycle (Environmental Analysis, Design, Implement, Enactment, Monitoring, Evaluation) Research Issue (Technical, Organizational/Management, Social, Economic, & Ethical)

Table 2. Research Framework adopted in the selected BPM Studies

From our observation above, literature analysis is the most commonly used method for studying the development of BPM research. The four works discussed in this section, despite their intention to providing an overview in the research discipline, focus mostly on identifying research issues and suggesting research opportunities. In addition, the authors of these studies prefer to utilize a research framework for characterizing or analyzing various research efforts.

However, in order to understand and rationalize the evolution of BPM research in a broader sense, more research perspectives need to be adopted. For instance, Barthy and his colleague (1995), in their attempt to understand the emergence of BPR as a new research field, examine BPR articles in accordance with authorship, publication outlet, and research approach. Despite the small size of the study, their methodology expands the spectrum of similar research.

RESEARCH METHODOLOGY

The main objective of our work is to analyze and rationalize the development of BPM research in recent years. The development process as such may be captured by research efforts of various types. Notably, zur Muehlen (2004), in order to capture the evolvement of process automation technology, relates different workflow technologies and commercial workflow system packages in a chronological fashion. However, this paper intends to identify such development logic from BPM

literature. Besides its advantage in accessing and collecting required data, literature review also allows us to compare our findings with those from previous work, such as (Barthy, et al, 1995).

Our literature review covers the top 10 IS journals: MIS Quarterly, Information Systems Research, Communication of the ACM, Management Science, Journal of Management Information Systems, Artificial Intelligence, Decision Sciences, Harvard Business Review, IEEE Transactions, and AI Magazine. The ranking of IS journals is suggested by the Association of Information Systems (AIS) and is accessible on its official website (http://www.aisnet.org). The rankings for the top ten journals have been consistent with little variance over the past decade.

Our review examines BPM journal articles published from year 2000 to mid 2008. Three reviewers are involved in the validation of BPM articles: two with BPM background and one from the IS discipline. Journal articles are considered "BPM-relevant" if they are composed around the key elements of BPM. According to the definitions given for BPM in the previous section, journal articles written for, but not limited to, the following BPM research issues are included in our collection:

- Methodologies, techniques, and tools
- Improvement objectives and critical success/failure factors
- Key practices and management activities

All articles were obtained from library databases where the articles were made available electronically in full-text format. A total of 37 journal papers were found to be related to BPM. A complete list of the selected BPM articles can be found at the end of the paper.

Data Collection and Classification

The following information was extracted from each BPM article for further analysis: title, journal name, author name, publication year, school or institution where the author resides, geographical location of the school or institution, author's professions or specialties, research method adopted in the article and research area implied by the article. In order to identify the research methods described in the selected articles, the classification scheme by Palvia and Pinjani (2007) was adopted. The classification scheme was developed particularly for IS research and encompassed fourteen research methods that have been widely applied by IS researchers: speculation or commentary, frameworks and conceptual model, library research, literature analysis, case study, survey research, field study, field experiment, laboratory experiment, mathematical model, qualitative research, interview research, secondary data, and content analysis. Literature reviewers were able to distinguish research methods from one another in a concise manner by the detailed descriptions provided in (Palvia and Pinjani, 2007) for each research method, especially on its implementation and application.

A similar classification scheme was also needed for the identification of research area. As mentioned in the previous section, a variety of analysis frameworks have been proposed for BPM literature and research effort. In order to gain more insights into the development of BPM research, we identified research area from two perspectives: life cycle perspective and research issue perspective. For instance, the research paper titled "dynamic work distribution in workflow management systems: how to balance quality and performance" by Kumar, et al (2002) tackles the *technical issues* that occur the phase of *process implementation*.

A BPM life cycle is an implementation of BPM concepts. It embraces the concept of continuous improvement by relating key BPM practices in an iterative fashion. The BPM life cycle is used as not only a roadmap for the implementation of BPM projects but also a benchmark for evaluating the maturity of BPMS (van der Aalst, 2004). We adopted the BPM life cycle model proposed by zur Muehlen (2001). Six major BPM practices are included in his life cycle: goal specification and environmental analysis, process design, process implementation, process enactment, Process monitoring, and process evaluation. Each life cycle stage is associated with different BPM activities. More details can be found in (zur Muehlen, 2001).

While the first perspective helps indicate what BPM practices may have drawn the most attention from the researchers, the second perspective examines what research aspects have been taken in studying BPM practices. Stohr and Zhao (2001) divide research issues into three categories: technical research issues, management and organizational issues, and market, economic, and social issues. Technical issues include BPM research such as the implementation of PAIS and the automation of business process operation or management by integrating heterogeneous information systems. Management and organizational issues cover research such as the management of BPM projects or programs, organizational change caused by the implementation of BPM, and the evaluation of BPM effort. Finally, market, economic and social issues may concern research in BPM market directions, investment opportunity, and the impact of BPM on emerging markets and industry

structure. Example issues can be found in (Stohr and Zhao, 2001). Figure 1 illustrates the data structure implied by our research methodology.

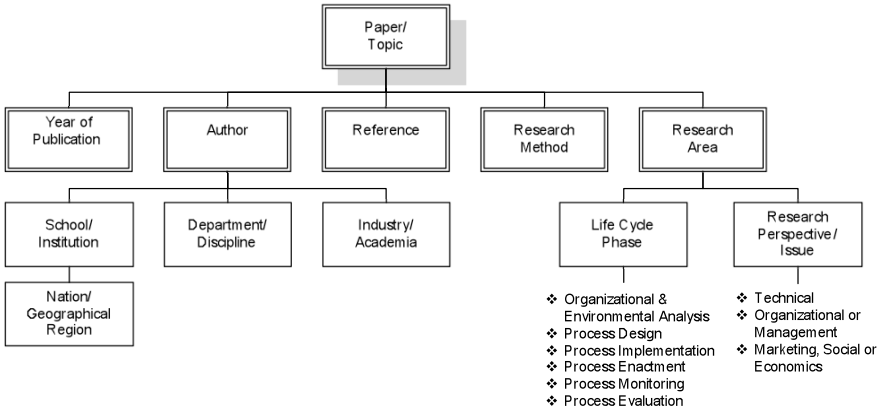

Figure 1. Data Structure for Literature Analysis

ANALYSIS

The exposure of BPM research varies from time to time in the top ten IS journals. Our study shows a severe decline in 2001 while a steep growth is followed in 2002. The publication achieves its peak in 2003 and shows a moderate decline after that. The publication rate has been consistent since 2005. It is to be noted that the drop occurred in 2008 may be due to the fact that our collection of BPM articles does not cover the entire year.

BPM articles focusing on technical issues tops other BPM research at all times except for articles published in 2001. The only one BPM article appeared in the top ten IS journals in that year was published in the Harvard Business Review by Michael Hammer, a widely renowned guru in the field of BPR. No research articles were found that discussed market, economic, or social issues during the proposed time period.

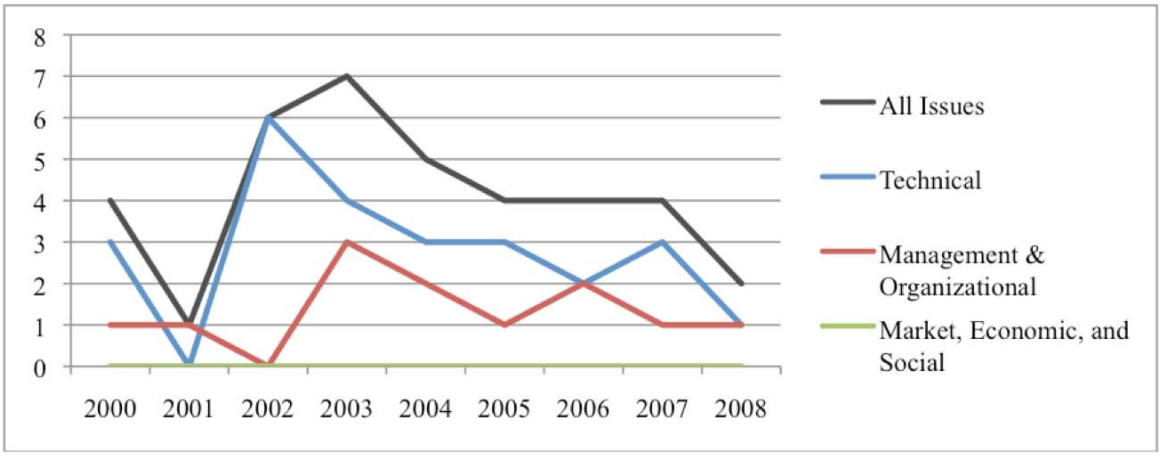

Figure 2. Time Distribution of BPM Publication

Research Collaboration across Geographical Regions

In order to observe collaborative activities in BPM research, BPM articles were sorted based on the country of origin of the authors. We adopted the geographical distribution framework suggested by AIS, where region 1 represents the Americas, region 2 represents Europe, the Middle East, and Africa, and region 3 represents the Asia-pacific countries. Our study shows that more than half of the selected articles result from either independent or collaborative work in region 1, followed by those in region 2 and region 3. It is also observed that only 16% of BPM research effort is produced from the collaborative work across geographical regions. Our study also shows such cross-region collaboration prefers technical issues of BPM research

to other research issues. Management and organizational issues are most valued in the Americas whereas technical issues are much more appreciated in other geographical regions.

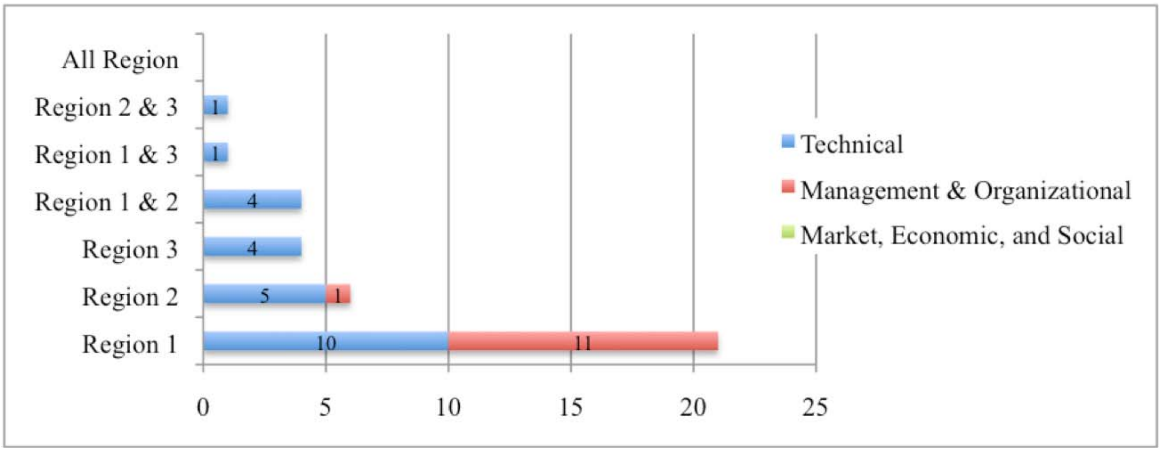

Figure 3. Geographical Regions vs. Research Issues

Research Methods

Out of the fourteen research methodologies proposed by Palvia and Pinjani (2007), only eight of them were found in the selected BPM articles. They are speculation or commentary, frameworks and conceptual model, case study, survey, field study, laboratory experiment, mathematical model and interview. Mathematical model is the most adopted approach in all types of research in BPM. Framework and conceptual model is also heavily used in BPM research. Together the two approaches dominate the technical research in BPM. Other research methods only contributed to one third of the research effort identified in our study.

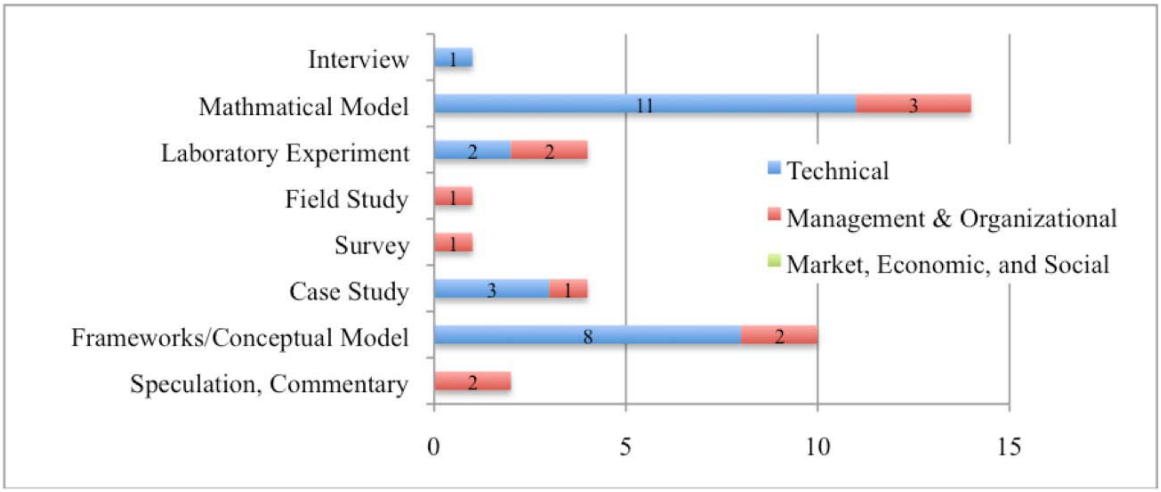

Figure 4. Research Method vs. Research Issues

A shift is observed in the selection of research methods for BPM research by contrasting our findings with the BPR study by Barthy, et al. (1995). In their literature review in which a different classification scheme for the identification of research method is utilized, illustrative method was the most common in the BPR literature from 1988 to 1994. By applying the same classification scheme, our study finds illustrative method the least used in the contemporary BPM research while concept orientation method becomes the most commonly adopted approach in the context of BPM. There is also an observable decline of empirical studies in the context of BPM. The shift in the adoption of research methods may imply the advance of research instruments as well as the evaluation of BPM discipline over time. In other words, the shift may reflect the rise and fall of certain types of BPM research. The classification scheme presented in figure 5 is well elaborated in (Barthy, et al., 1995).

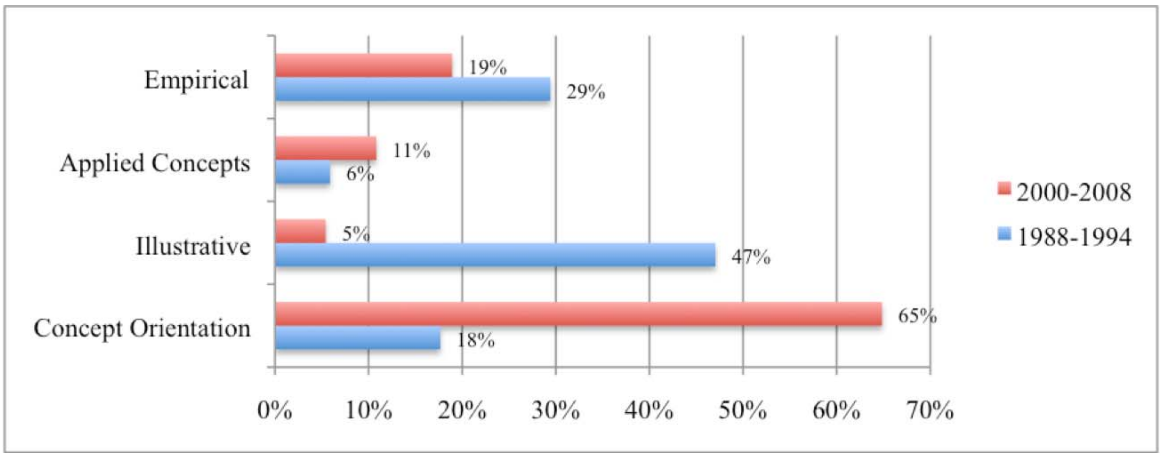

Figure 5. Life Cycle Phase vs. Research Issues – Comparison

Research Area: Life Cycle Phase vs. Research Issues

From the point of view of the BPM life cycle, process design appears to be the most researched BPM practice. Process design encompasses research topics such as process modeling, modeling standards and the derived applications, process rule conceptualization, and design patterns. Process evaluation also earns a great deal of attention from BPM researchers. Research foci that compose this specific BPM practice include the analysis of audit trails, the evaluation of process models, process simulation techniques, and the mining of workflow. Process enactment and process monitoring, nevertheless, are severely under-researched compared to other BPM practices. They are as well the only two BPM practices that are not researched from the management and organizational point of view. Technical research seems to dominate the research effort of BPM except that in goals specification and environmental analysis. Again it is noted that no research has appeared in the top 10 IS journals on market, economic, and social issues. Note that environmental analysis, process design, and process implementation are the most discussed BPM practices in the BPR study by Barty, et al. (1995). Management and organizational issues was the main stream of BPM research at the time.

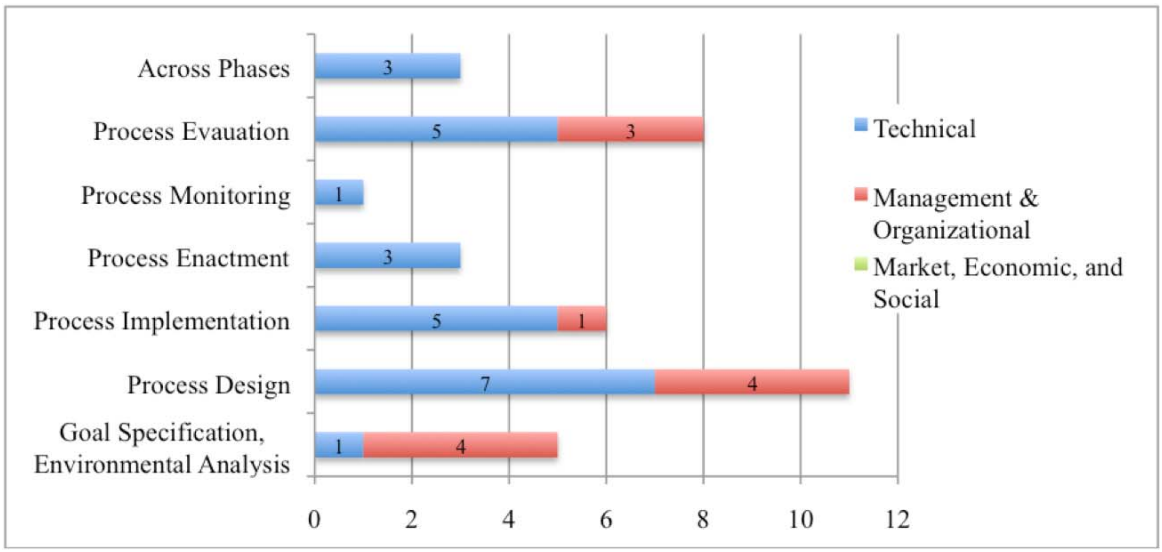

Figure 6. Life Cycle Phase vs. Research Issues

LIMITATIONS AND FUTURE WORK

The limitation of our study has to do primarily with the small sample size. On one hand, the time period covered in this study is relatively short. On the other hand, the literature review covers the top ten IS journals only excluding other publication outlets such as conference proceedings. The small sample size implies limited validity of our findings or conclusion drawn

from this study. For instance, we did not find any BPM article regarding market, economic, or social issues in the given article collection. The fact, however, is that subjects such as e-government and the relationship between productivity and BPM fall exactly into this research category and have been developed in the BPM community for years. Also, the top journals recommended by AIS contains more US-originated publication outlets that those from other countries, which may also create a bias in our study. In addition to the improvement opportunity in sample size and variety, our research may be brought to the next level where the relationship between research trends and collaborative activities, such as the citation patterns and the cross-discipline research effort, can be conceptualized in the discipline of BPM. A new way of predicting the trend of BPM research may thus emerge.

CONCLUDING REMARKS

In this paper, we attempt to analyze and rationalize the development of BPM research through a longitudinal literature analysis. We collect and review BPM articles that are published in the top ten IS journals from 2000 to mid 2008. The publication rate of BPM articles has held steady since its ups and downs in the early years. Within the time period studied, technical research has dominated the BPM discipline whereas research regarding market, economic, and social issues has been neglected. Management and organizational issues appear to be most common research focus in the American countries. Technical issues are common across all geographical regions. BPM effort tends to adopt research methods such as mathematical models and framework/conceptual models more then the others as both methods have been heavily used in researching technical issues of BPM. From the perspective of the BPM life cycle, process design and process evaluation are the most researched BPM practices overall. More research attention is required on process monitoring and process enactment. In addition, there is great opportunity for research on non-technical issues in most life cycle phases. Market, economic, and social issues have been neglected despite their potential importance. The result of the literature review also suggests a need for more empirical studies in the context of BPM.

REFERENCES

1. Barothy, T., Peterhans, M., Bauknecht, K. (1995) Business process reengineering: Emergence of a new research field, *SIGOIS Bulletin*, 16, 1, 3-10
2. Basu, A., Kumar, A. (2002) Research commentary: Workflow management issues in e-Business, *Information Systems Research*, 13, 1, 1-14
3. Becker, J., Dreiling, A., Holten, R. and Ribbert, M. (2003) Specifying information systems for business process integration – A management perspective, *Information Systems and e-Business Management*, 1, 231-263, Springer Verlag, Berlin
4. Benner, M.J. and Tushman, M.L. (2003) Exploitation, exploration, and process management: The productivity dilemma revisited, *Academy of Management Review*, 28, 238
5. Bhatt, G.D. (2000) An empirical examination of the effects of information systems integration on business process improvement, *International Journal of Operations & Product Management*, 20, 11, 1331
6. Davenport, T.H. (1993) Process innovation: Reengineering work through information technology, Harvard Business School Press, Boston, MA
7. Deming, W.E. (1982) Quality, Productivity, and Competitive Position, Massachusetts Institute of Technology, MA
8. Dumas, M., ver der Aalst, W.M.P. and ter Hofstede, H.M. (2005) Process-aware information systems: Bridging people and software through process technology, John Wiley & Sons, Inc., Hoboken, NJ
9. Enzinga, D.J., Horak, T., Chung-Yee, L. and Bruner, C. (1995) Business process management: Survey and methodology, *IEEE Transactions on Engineering Management*, 24, 2, 119-28
10. Grover, V., Geong, S.R., Kettinger, W.J. and Teng, J.T.C. (1995) The implementation of business process reengineering, *Journal of Management Information Systems*, 12, 1, 109-144
11. Harrington, H.J. (1991) Business process improvement: The breakthrough strategy for total quality, productivity, and competitiveness, McGraw-Hill, New York, NY
12. Hammer, C. and Champy, J. (1993) Reengineering the corporation: A manifesto for business revolution, HarperBusiness, New York, NY
13. Hickman, L.J. (1993) Technology and Business Process Re-engineering: Identifying opportunities for competitive advantage, *British computer Society CASE Seminar on Business Process Engineering*, 29, London

14. Hollingsworth, D. (1997) Workflow Management Coalition – The Workflow Reference Model, Document Number TC00-1003, Issue 1.1, Workflow Management Coalition, Brussels, Belgium
15. Karagiannis, D. (1995) BPMS: business process management systems, *SIGOIS Bulletin*, 16, 1, 10-13
16. Kettinger, W.J., Teng, J.T.C., Guha, S. (1997) Business process change: A study of methodologies, techniques, and tools
17. Kumar, A, et al. (2002) Dynamic Work Distribution in Workflow Management Systems: How to balance quality and performance, *Journal of Management Information Systems*, 18, 3, 157-193
18. O'Neal, P., Sohal, A.S. (1999) Business process reengineering: a review of recent literature, *Technovation*, 19, 571-581
19. Palvia, P., Pinjani, P., Sibley, E.H. (2007) A profile of information systems research published in Information & Management, *Information & Management*, 44, 1, 1-11
20. Papazoglou M.P. and van den Heuvel, W.-J. (2007) Business process development life cycle methodology, *Communications of the ACM*, 50, 10, 79-85
21. Stohr, E.A., Zhao, J.L. (2001) Workflow automation: Overview and research issues, *Information Frontier*, 3, 3, 281-296
22. van der Aalst, W.M.P., ter Hofstede, A.H.M., Weske, M. (2003) Business process management: A survey, *Lecture Notes in Computer Science*, BPM 2003, 2647, 1-12, Springer Verlag, Berlin
23. van der Aalst, W.M.P. (2004) Business process management demystified: A tutorial on models, systems and standards for workflow management, in Desel, J., Reisig, W., and Rozenberg, G. (Eds): *Proceedings of ACPN 2003*, Springer-Verlag, Berlin, 1-65
24. Weske, M., van der Aalst, W.M.P. and Verbeek, H.M.W. (2004) Advances in business process management, *Data & Knowledge Engineering*, 50, 1-8
25. WfMC (1999) Terminology & glossary. Document Number WFMC-TC-1011, 3.0
26. zur Muehlen, M. (2001) Process-driven information systems – Combining data warehouse and workflow technology, in Gavish, B. (Ed.): *Proceedings of the Fourth International Conference on Electronic Commerce Research (ICECR-4)*, Dallas, TX, Nov. 8-11, 550-566
27. zur Muehlen, M. (2002) Workflow-based process controlling, Logos Verlag, Berlin

2000	Basu/Blanning	ISR
	Hagen/Alonso	IEEE TRANS ON SOFTWARE ENGINEERING
	Chinn/Madey	IEEE TRANS ON ENGINEERING MANAGEMENT
	Casati et al.	IEEE TRANS ON SOFTWARE ENGINEERING
2001	Hammer	HBR
2002	Kumar et al.	JMIS
	Bieber et al.	JMIS
	Chiang et al.	MS
	Bettini et al.	AI
	Bajaj/Ram	IEEE TRANS ON KNOWLEDGE AND DATA ENGINEERING
	Y. K. Ng et al.	IEEE TRANS ON SYSTEMS, MAN, AND CYBERNETICS
2003	van der Aalst/Kumar	ISR
	Purao et al.	ISR
	Basu/Blanning	ISR
	Kang/Santhanam	JMIS
	Reijers et al.	JMIS
	Bulitko/Wilkins	AI
	T. C. Wong et al.	IEEE TRANS ON INFORMATION TECHNOLOGY IN BIOMEDICINE,
2004	Dalal et al.	CACM
	Raghu et al.	ISR
	Li et al.	IEEE TRANS ON SYSTEMS, MAN, AND CYBERNETICS
	van der Aalst	IEEE TRANS ON KNOWLEDGE AND DATA ENGINEERING,
	Bae et al.	IEEE TRANS ON KNOWLEDGE AND DATA ENGINEERING
2005	Thomas et al.	CACM
	Greco et al.	IEEE TRANS ON KNOWLEDGE AND DATA ENGINEERING
	Yan et al.	IEEE TRANS ON SYSTEMS, MAN, AND CYBERNETICS
	Thomas et al.	HBR
2006	Gan L.G. et al.	CACM
	Sun et al.	ISR
	Ernst et al.	MS
	Nichols et al.	IEEE TRANS ON SYSTEMS, MAN, AND CYBERNETICS
2007	Papazoglou/van den Heuvel	CACM
	Boh et al.	CACM
	Bala\Venkatesh	ISR
	Tanriverdi et al.	ISR
2008	Ren et al.	JMIS
	Hon Wai Chun	AI mag

Table 3. BPM Articles selected for Literature Review