

8-2010

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Recommended Citation

Raschke, Robyn L. and Ingraham, Laura R., "Business Process Maturity's Effect on Performance" (2010). *AMCIS 2010 Proceedings*. 402.

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Business Process Maturity's Effect on Performance

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ABSTRACT

Recent adoption of the Business Process Maturity Model (BPMM) by the Object Management Group (OMG) provides a means for managers to benchmark and monitor business processes as well as a roadmap for process improvement. The expectation is that as maturity increases, the result is a positive impact on performance; however, little empirical research has examined to what extent, if any process maturity has on performance. We conduct a survey of manufacturing firms to study the effects of process maturity on performance for two boundary spanning processes: purchasing and order fulfillment. Our results indicate that organizations with more mature purchasing processes appear to have higher relative levels of efficiency process outcomes than those with less mature purchasing processes. Similarly more mature order fulfillment processes do appear to have higher relative levels of quality process outcomes than those with less mature order fulfillment processes.

Keywords

Business Process Maturity, Process Outcomes, Purchasing, Order Fulfillment

INTRODUCTION

As IT and business continue to align, the business process is quickly becoming a common denominator for understanding performance. Information systems research recognizes that the business process is an important link in the relationship between IT and business value (Barua and Mukhopadhyay 2000; Barua, Konana, and Winston 2004; Dehning and Richardson 2002; Melville, Kraemer, and Gurbaxani 2004). From an accounting information systems perspective, it is important to understand that IT is a platform for information; however, it is the business process that effectively transforms that information into knowledge for decision making (Hofmann and Reiner 2006). A process perspective not only provides insights to value creation, but also relates to *how* value is provided (Elbashira, Collier, and Davern 2008).

Recently, the Object Management Group (OMG.org)¹ adopted a Business Process Maturity Model (BPMM) as a standard for assessing the maturity of business processes to provide a “roadmap for making the improvements needed to increase the success and benefits of enterprise applications” (Curtis and Alden 2007). Research focusing on Business Process Maturity Models (BPMM) has primarily been concerned with development of the BPMM and the relevance of dimensions used to capture the characteristics in which maturity is assessed (Rosemann, deBruin, and Hueffner 2004; Rosemann and deBruin 2005a, 2005b; Rosemann, deBruin, and Power 2006). Although the lens in which to view these dimensions may vary, a consensus of the maturity levels occurs with the basis for the model originating from the Capability Maturity Model (CMM) (Paulk, Curtis, Chrissis, and Weber 1993). The Capability Maturity Model was created to assess the maturity of the software development process with a belief that as the software development process matures the benefits of quality and cost efficiencies would increase. Likewise, the BPMM assumption is that improvements in maturity levels will contribute to process success (Rosemann and de Bruin 2005). The purpose of this paper is to empirically test that assumption for two core processes found in business: order fulfillment and purchasing.

LITERATURE REVIEW AND HYPOTHESES DEVELOPMENT

The business process maturity model (BPMM) is developed by the technology standards organization, Object Management Group (OMG), and used as a framework for process improvement. Process improvement is continuous and follows the dimensions along the business process lifecycle. The dimensions along the process lifecycle include process modeling and design, process implementation, process monitoring, and process evaluation. Process modeling and design is an approach of visually communicating the business operations by defining relationships among entities and activities along

¹ <http://www.omg.org/news/releases/pr2007/10-22-07.htm>

control flows (Curtis, Kellner, and Over 1992). Process implementation is the transference of a specific process (either manually via procedure handbooks or automated via workflow or BPM software) into the operational environment (zur Muehlin and Rosemann, 2005). Process monitoring is an important dimension of the Business Process Lifecycle providing the necessary performance metrics for auditing and control, as well as feedback to management used for evaluation purposes. Finally, process evaluation allows for the continuous improvement of a process initiating the cycle repeatedly over time as needed.

One such means to monitor and evaluate the process is maturity. A characteristic of maturity is the ability to continuously achieve capabilities despite incidence (Chrissis, Konrad, and Shrum 2003). The Business Process Maturity model (BPMM) is focused on guiding improvement in business processes. In addition to process improvement, the OMG perceives that the maturity model can assess process risk both prior to developing and implementing IT applications and to evaluating suppliers. Derived from the Capability Maturity Model (CMM), the Business Process Maturity Model is conceived as having a range of five states or levels of maturity. The five maturity levels are initial/adhoc, managed, standardized, predictable, and innovating. Figure 1 depicts the five different levels of process maturity that begin with an immature state (initial) which views the process as 'ad-hoc' and continues throughout to a mature state (optimizing) in which continuous improvement is enabled by feedback (Harmon 2004).

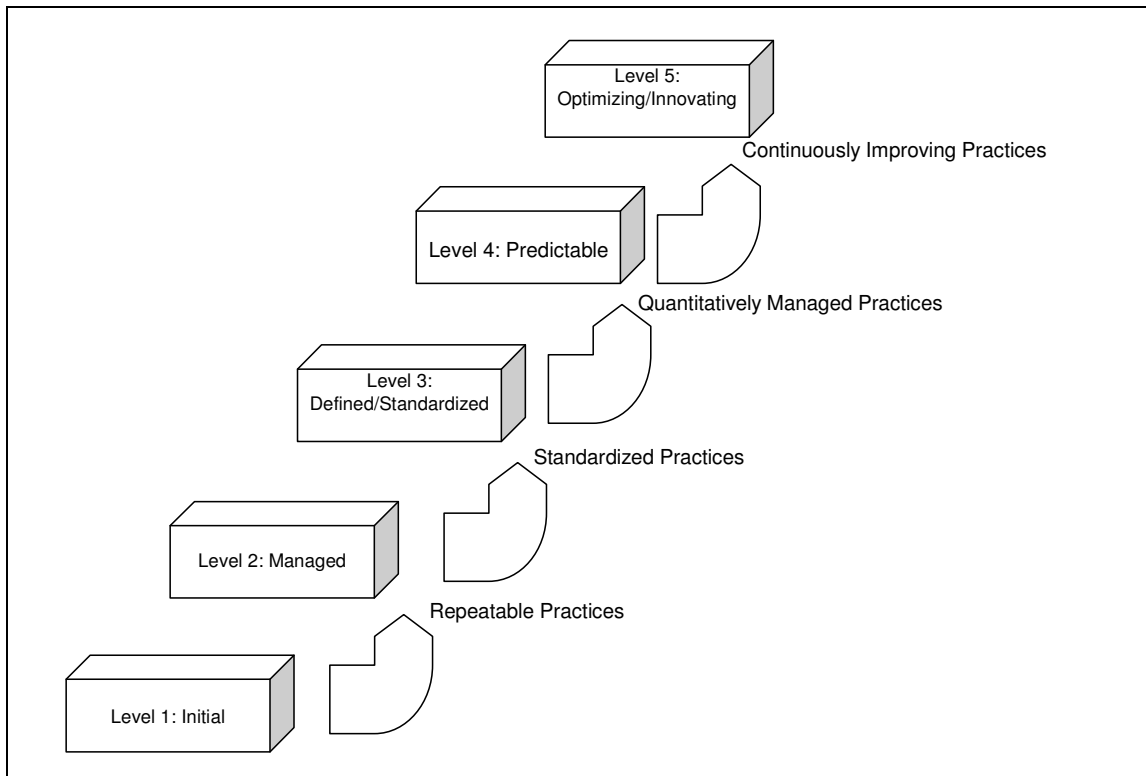


Figure 1: Business Process Maturity Model (Harmon 2004 and OMG.org)

Process Maturity and Performance

Recent empirical research suggests a correlation between process maturity and performance. Although this correlation has been previously shown, the measures of maturity were at a higher locus of value and not at the specific process level. Batenburg and Versendaal (2008) focused their efforts on maturity of the procurement process and performance and conducted a survey of 117 Dutch firms. They measured an overall procurement process maturity by focusing on six organizational dimensions: strategy, process, control, organization, information, and technology. Although, they did not measure process maturity based upon maturity levels of the process, their findings indicate that overall process maturity has a positive effect on procurement performance. Hoffman and Reiner (2006) examined the relationship between maturity and performance for supply chain processes for 68 supply chains. Descriptive evidence suggests that maturity and

performance measures are correlated. Their findings indicate that firms with mature supply chain processes have lower inventory levels, reduced days supply of inventory, reduced inventory carrying costs, and better cash to cash cycle time than firms with immature processes. Empirically, they showed process maturity affected cash to cash cycle time (significance level of .10).

From a process maturity perspective, the expectation is that as maturity increases, the result is a positive impact on performance (Rosemann and deBruin 2005a). Process efficiency and effectiveness are inherent indicators of process performance. Process outcomes are important to an organization because they are intermediate performance measures (Dehning and Richardson 2002; Melville et al. 2004), and they have been captured in the literature as quality and efficiency (Matolcsy, Booth, and Wieder, 2005; Melville et al. 2004; Rai, Patnayakuni, and Patnayakuni 1997; Ray, Muhanna, and Barney 2005; Saeed, Malhotra, and Grover 2005; Wieder, Booth, and Matolcsy 2006). Quality can be measured in terms of process results and is determined by “how effectively a process meets the customer’s needs” (Schneiderman 1996), ascertained by customer satisfaction. Such customer satisfaction indicators are often reflective of customer complaints, billing and shipping errors, and on-time delivery.

Efficiency is determined by “how the results are achieved” (Schneiderman 1996). The efficiency process outcomes are therefore reflected by reduced coordination costs, improved inventory management, and reliable lead times (Saeed et al. 2005). Process Outcomes from an efficiency perspective are focused on reduced transaction costs and reflective of reduced inventory and holding costs and in terms of efficiency from financial measures reflected in cost of goods sold and ultimately the gross margin (Matolcsy et al. 2005).

Purchasing and order fulfillment processes span internally within the firm to trading partners and are core processes within the value chain. Day (1994) describes these processes as spanning processes. Order fulfillment is the “heart of any business as they are the means through which an organization satisfies its customers” (Jin-Hai, Anderson, and Harrison 2003). Specifically, the success or failure of the order fulfillment process (i.e. on-time delivery) is directly linked to customer satisfaction (Kumar and Sharman 1992). Process failure of order fulfillment translates to reduced revenues and lost customers. Likewise, purchasing is equally as important as it relates to the ability of the firm to procure materials for manufacturing to meet customer demands. The performance of the procurement process has ramifications to the eventual satisfaction of the customer. Increased maturity at the process level for spanning processes such as purchasing and order fulfillment provides firms with the capability to better satisfy their customers through reduced complaints, better on-time delivery and reduction of shipping errors. Therefore, we hypothesize the following:

H1: Organizations with more mature order fulfillment processes will have higher relative levels of quality process outcomes than those with less mature order fulfillment processes.

H2: Organizations with more mature purchasing processes will have higher relative levels of efficiency process outcomes than those with less mature purchasing processes.

RESEARCH METHOD

A survey² was used to collect the data. A list was purchased of 880 randomly selected manufacturing firms with the process owner identified and surveyed to assess the maturity of purchasing and order fulfillment processes (Tables 1 and 2 provide the sample frame and response rates, respectively). Purchasing managers were asked to respond to the maturity of the purchasing process whereas operations managers were asked to respond to the maturity of the order fulfillment process.

Survey questions relating to the process maturity levels were taken from OMG defined levels and the process outcome questions are from Wiedner et al. (2006). A presurvey evaluation using 9 professionals with operations and purchasing experience were asked to categorize process outcome statements from the survey as either quality or efficiency outcomes. Summary results of the process outcomes categorization can be found on Table 3. Process outcomes are measured using a seven point Likert scale asking the respondents to rate their firms’ performance relative to other firms (1=Not at all Satisfactory to 7=Outstanding).

² The data for this research was collected from a comprehensive survey in which a series of studies were designed to examine various effects on process outcomes. This research specifically focuses on process maturity and has not been utilized in other studies as part of this series of research.

SIC Code	Description	% of Sample
23	Apparel and other textile products	1%
25	Furniture and Fixtures	3%
30	Rubber and Miscellaneous Plastics Products	5%
34	Fabricated Metal Products	7%
35	Industrial Machinery and Equipment	23%
36	Electronic and Electric Equipment	29%
37	Transportation Equipment	16%
38	Instruments and Related Products	15%
39	Miscellaneous Manufacturing Industries	2%
		100%

Table 1. Survey Sample Frame

	# of Responses	% of Response
Purchasing	195	22.2%
Order Fulfillment	161	18.3%

Table 2. Survey Response Rate

Process Outcome	Efficiency	Quality
Relative level of materials inventory holding costs	78%	22%
Relative level of obsolete inventory costs	100%	0%
Relative level of work in progress inventory costs	78%	22%
Relative level of finished goods inventory holding costs	89%	11%
Speed at filling orders	22%	78%
Ease at which we can change planned delivery dates	0%	100%
Extent to which we can change planned delivery dates	44%	56%
Percentage of deliveries made on time	0%	100%
Stockout probability	38%	62%
Backorder Level	25%	75%
Percentage of shipping errors	11%	89%
Percentage of customers who complain	0%	100%

Table 3: Summary results of process outcome categorization

Non-response bias testing compared the first 25% of responses to the last 25%. The first 25% of responses are deemed as early responders whereas the last 25% of the responses received are late responders. Comparisons of the means between the early and late responders for all survey questions indicate that there are no significant differences between the two groups (Armstrong and Overton 1977).

To test both hypotheses, a two separate (order fulfillment or purchasing) one-way analysis of variance (ANOVA) was conducted with the independent variable, Process Maturity. The dependent measure is the process outcome of Quality for the order fulfillment process (H1) and Efficiency for purchasing (H2). Because maturity level three is the stabilized state, maturity levels one and two are deemed as less mature whereas maturity levels four and five are deemed more mature. A planned contrast comparing the level of performance of the more mature organizations (maturity levels 4 and 5) to the less mature organizations (maturity levels 1 and 2) was used to test each hypothesis.

An analysis was conducted for the order fulfillment process using complete information from 152 respondents whereas the purchasing process had 183 useable responses. Survey validation of Process Outcomes indicates that reliability for the four item efficiency measure and the eight item quality measure yields Cronbach alphas of .84 and .86, respectively. The ANOVA model indicated a significant difference between the maturity levels for order fulfillment ($df=5, F = 4.21, p = .003$) as well as a significant difference between the maturity levels for purchasing ($df=5, F = 6.28, p = .000$). Means for order fulfillment and purchasing process maturity are found on Tables 4 and 5, respectively, and shown in Figure 2.

Maturity Level	N	Mean	Std. Error
1	10	3.70	.29
2	39	4.60	.20
3	47	4.62	.20
4	47	4.80	.14
5	9	5.83	.27

Table 4: Table of Means for Maturity of Order fulfillment process

Maturity Level	N	Mean	Std. Error
1	20	3.58	.28
2	51	3.75	.19
3	51	4.08	.18
4	44	4.58	.22
5	17	5.28	.26

Table 5: Table of Means for Maturity of Purchasing process

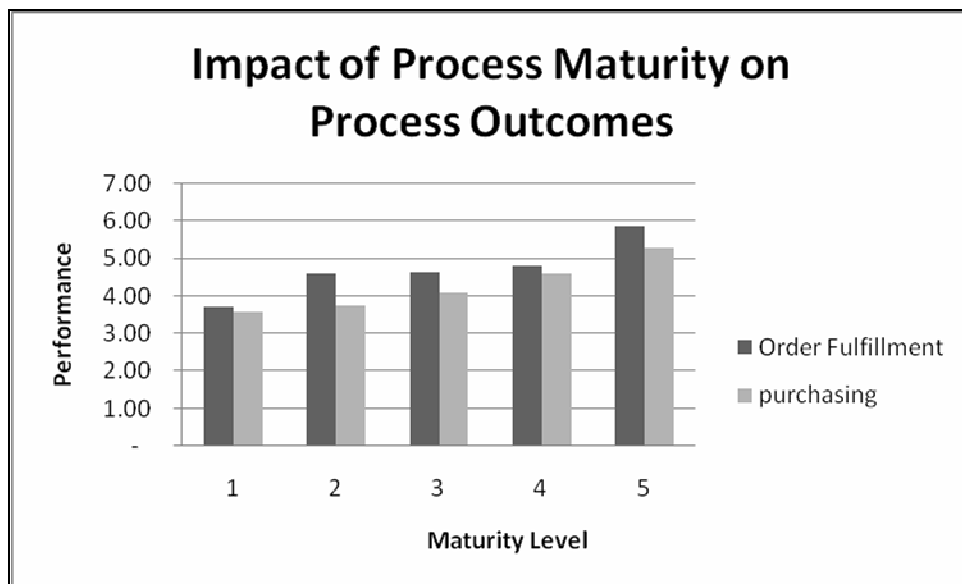


Figure 2: Maturity levels for Order fulfillment and Purchasing processes

Hypothesis 1 states that higher maturity organizations will have higher performance for the order fulfillment process than lower maturity organizations. To test this hypothesis, a planned contrast between means of the higher maturity organizations (maturity levels 4 and 5) compared to the means for the lower maturity organizations (maturity levels 1 and 2) was conducted. The results of the planned contrast was significant ($t = 3.957, p = .000$). Similarly, the test for hypothesis 2 which states that higher maturity organizations will have higher performance for the purchasing process than lower maturity organizations the planned contrast was significant ($t = 4.879, p = .000$).

DISCUSSION AND FUTURE RESEARCH

It appears, based upon the results of our analyses, that at the specific process level, business process maturity has an effect on process outcomes for the two core processes: purchasing and order fulfillment. Specifically, the results of our analyses provide support for hypothesis 1, i.e., organizations with more mature order fulfillment processes do appear to have higher relative levels of quality process outcomes than those with less mature order fulfillment processes. In addition, we found support for hypothesis 2, i.e., organizations with more mature purchasing processes appear to have higher relative levels of efficiency process outcomes than those with less mature purchasing processes. Thus, our results suggest that the business process maturity model provides a means to allow us to benchmark the progress of the organization's capabilities relating to a process rather than solely relating to IT. In addition, our results provide additional evidence that at the locus of value, the business process maturity matters. Further, as a means to monitor process maturity, the model allows managers to assess the risk in a process and to make improvements.

The Business Process Maturity Model assumes that level three is the basic level of maturity. However, additional research is necessary to determine whether organizations should, in fact, be satisfied with a level three maturity or whether they should be striving to achieve a higher level (i.e. five). Are there instances in which an organization might want to be a level three rather than a level four or level five? If so, is this dependent upon the process itself? In addition, research is necessary to discover the characteristics needed to move from one level to another and whether the related outcomes are linear or exponential. Further research is also needed to determine if process maturity is a linear progression. Meaning that moving from level 3 to level 4 maturity provides linear results at the process outcome level.

Another area of future research should focus on what potential antecedents enable or inhibit management from reaching their desired level of process maturity. Raschke and Ingraham (2010) have identified potential antecedents to CobiT process maturity. Additional research should focus on determining whether there are commonalities on these antecedents as they apply to the BPMM. Finally, more research is needed in understanding to what extent, if any, does process maturity affect auditing and decisions regarding process risk. According to the strategic systems lens top-down approach to risk assessment (Bell, Marrs, Solomon, and Thomas 1997), the overall understanding is that business activities present inherent business risks. Risk associated with a failed process increases audit risk (Tuttle and Vandervelde 2007). More research is needed to understand if business process maturity impacts those assessments of risk associated with the process.

CONCLUSIONS

Although our results suggest that business process maturity levels have an effect on process performance, the interpretations of our results have limitations. This research is limited to manufacturing firms and spanning processes, specifically purchasing and order fulfillment. The data collected is cross-sectional and collected at one point in time. Therefore, the conclusions contained in this study must be considered within the contexts in which they apply. Furthermore, we surveyed only two processes within manufacturing firms and, therefore, the generalizability of the results is limited. Additional research is needed to determine whether the results are robust across industries and processes.

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