

2012

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### Recommended Citation

Ravesteyn, Pascal; Zoet, Martijn; Spekschoor, Joose; and Loggen, Roeland (2012) "Is there Dependence Between Process Maturity and Process Performance?," *Communications of the IIMA*: Vol. 12: Iss. 2, Article 5.

DOI: <https://doi.org/10.58729/1941-6687.1188>

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## **Is There Dependence Between Process Maturity and Process Performance?**

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### **ABSTRACT**

*During recent years the world has seen rapid changes such as globalization, the Internet, and the rise of new economies. To survive these changes organizations need to be in control of their processes, and be able to continuously improve the process performance. Therefore many organizations are increasingly adopting Business Process Management (BPM). However, it is not clear if the implementation of BPM(S) is really adding value to an organization. Consequently, in this paper, we try to answer the following research question: 'Does adoption of Business Process Management lead to a higher process performance?' Based on quantitative research we show that there is dependence between the performance of processes within an organization and the BPM maturity of that organization. As a result we conclude that improvement in process performance can be attained by increasing the BPM maturity of an organization.*

**Keywords:** Process, maturity, performance, correlation

### **INTRODUCTION**

During the past twenty years the world has seen rapid changes such as globalization, the adoption of the Internet, mobile communications, and the rise of China and India as important economies. These developments make it possible and in many cases necessary for organizations to change their business models. No longer is it possible to cater for the wishes of customers and consumers as stand-alone companies. Many organizations are outsourcing or off shoring part of

their processes, which enables them to focus on their core competences. By collaborating in ever growing and changing alliances -virtual organizations or extended enterprises- organizations are better adapted to cope with increasing competition. To realize such adaptability organizations need to increase control of their processes in order to be able to continuously improve them. Therefore many organizations are increasingly adopting Business Process Management (BPM).

Depending on the point of view on the BPM research domain it has either been around for a long time or it is quite young. One of the first persons to really analyze (manufacturing) workflows with the aim to improve them was Frederick Winslow Taylor in the early 1880s. Based on his experiences he wrote *The Principles of Scientific Management* (1911). However the term BPM as a label to a specific research area has not been around for more than about two or three decades, though the idea of process orientated design and analysis of organizations and supporting this with information systems has a long history starting with Ellis (1979) and Zisman (1977).

It was not until the mid- and late-nineties before BPM started to emerge as a separate field of research that aimed at integrating the best elements of both Total Quality Management (TQM) and Business Process Reengineering (BPR) (Lee & Dale 1997; Elzinga, Horak, Chung-Yee, & Bruner, 1995; Zairi 1997). Although Information System and Information Technology (IS/IT) was seen as an important enabler to process management it took until the beginning of this century before an integrated business and IS/IT approach to process management was envisioned (Fremantle, Weerawarana, & Khalaf, 2002; van der Aalst, ter Hofstede, & Weske, 2003).

Yet many organizations implementing BPM are hindered by their current IS/IT architecture. Most large organizations have invested heavily in enterprise systems such as Enterprise Resource Planning (ERP), Customer Relationship Management (CRM), and Supply Chain Management (SCM) and now find that these applications are not fully integrated and therefore do not provide an end-to-end view on their processes, let alone that they are able to control them. This is where vendors and resellers of Business Process Management Systems (BPMSs) come into play. They claim that the implementation of a BPMS will enable an organization to increase grip on its processes by creating transparency (via the modeling of processes), integration of supporting information systems, and continuous improvement opportunities via real time measurement of process performance. Whether the future will show if this claim is fully true is unlikely or at least complex as practice shows (Ernst & Young, 2009) that only one-third of IS/IT projects are classified as a complete success (success being defined as on time, within budget and delivering the predefined requirements). As International Data Corporation (IDC) predicts that the revenue for the BPM market will climb from \$1 billion in 2005 to US \$3.8 billion by 2012 (Liu, Li, & Zhao, 2008) the chances on failed BPMS implementation projects increase dramatically and therefore it is important to know whether the implementation of BPM(S) is really adding value to an organization. However there is little research on the topic of added value for organizations by BPM. The most important related research domain is that of process maturity as maturity models provide organizations the possibility to evaluate organizational processes and identify opportunities for optimization and thus adding value. Important research in this area is done by Rosemann, de Bruin, and Hueffner (2004) and Rosemann and de Bruin (2005) on BPM maturity models, Curtis and Alden (2006) on business process improvement guided by maturity models.

In this paper, we try to answer the following research question: Does adoption of Business Process Management lead to a higher process performance? To be able to do this we carried out a quantitative research in the Netherlands into the relation of process maturity and process performance. The next section describes the research approach and in section 3 the results are presented. Section 4 gives the conclusions based on this research and section 5 describes future research and discussion.

## RESEARCH APPROACH

The research presented in this paper is part of a broader research project on BPM in the Netherlands (Loggen et al., 2011). For that research, an online survey was developed with open and closed questions (in Dutch) that (next to general questions) were divided in the following six parts:

- (i) Questions on the definition of BPM and the amount of interest BPM receives within the organization
- (ii) Questions on the number of projects within the organization that are executed as being a BPM project
- (iii) Questions on the maturity of BPM within the organization
- (iv) Questions on the performance of the processes within the organization
- (v) Questions on future (project) plans in which BPM is involved
- (vi) Questions on the use of technology in BPM projects

In this paper we only describe in detail the research approach and the results for part 3 and 4 of the survey (part 5 and 6 are omitted).

The first part of the survey is used to determine how organizations perceive BPM. Based on the answers, the majority of respondents to this research (58%) defined BPM as *a management discipline that focuses on analyses and implementation of processes to improve the operational performance as well as the agility of processes*. Another (27%) of the respondents stated BPM is *a systematic approach to analyze, (re)engineer, improve and manage a specific process*. A small minority of respondents found BPM to be either a IT project, a cost cutting initiative, or a process modeling project.

Besides having a similar perspective on BPM, almost all organizations have started BPM projects within the last 3 years (88,6%). Furthermore 40% of the organizations that participated in this research executed BPM projects on a tactical level while in 39% of the organizations BPM is part of the portfolio of the board of directors.

To analyze the maturity of BPM within an organization we constructed 37 questions (items) that measure 7 dimensions of process maturity (see table 1). Each of the questions could be answered on a 1 to 5 Likert scale where 1 is 'totally disagree' and 5 is 'totally agree'. The maturity

dimensions are based on the Capability Maturity Model Integrated (CMMI) and research by Rosemann et al. (2004), Rosemann and de Bruin (2005) and Rosemann, de Bruin, and Power (2006).

<b>Dimension</b>	<b>Description</b>	<b>No. of Items</b>
Process awareness	Management realizes the importance of a process oriented organization and includes this in its strategy	4
Process description	Processes and related information within the organization are identified and captured in process descriptions	6
Measurement of processes	A system to measure and control processes is in place in order to be able to improve processes	5
Management of processes	Process owners are assigned within the organization whom are “horizontally” responsible for managing processes	5
Process improvement	The organization strives to continually improve processes and there is a system in place to enable this.	6
Process resources and knowledge	The organization has adequate resources (such as people with process knowledge) to create a “culture of process orientation”	4
Information Technology	The organization uses IT to design, simulate and execute processes, and to provide real-time measurement information (key performance indicators)	7

**Table 1: BPM Maturity Dimensions.**

Next to the process maturity we also measured the process performance of an organization. This was done on the basis of 12 statements that we developed (Table 2, the statements are translated from Dutch) to measure different process performance characteristics (based on Hüffner, 2007; Rudden 2007).

The survey was posted online from December 2010 to the end of January 2011 and to get respondents notifications were sent via news letters to members of the Dutch BPM-Forum, participants of the 2008 “BPM in the Netherlands” survey and via the database of the Research Centre for Technology and Innovation of the HU University of Applied Sciences (in total approximately 1500 persons were reached). The total number of respondents was 168 persons (about 11.2%).

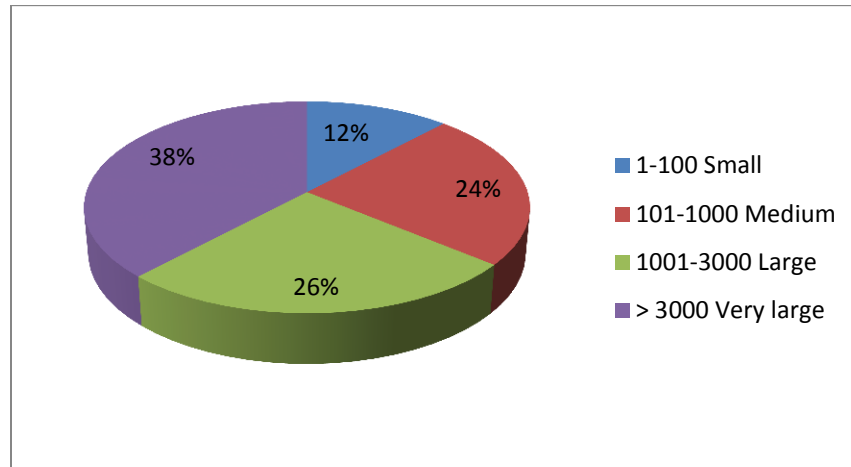
<b>Process Performance Characteristic</b>	<b>Statement</b>
Costs	The processes within the organization are executed against acceptable costs
Traceability	Processes within the organization are easily traceable (thus transparent)
Efficiency	Processes within the organization are efficient
Lead-time	The processes within the organization have an acceptable lead-time
Customer focus	Processes within the organization are customer centric
Continuous improvement	The processes within the organization are continuously being improved
Quality	The results delivered by processes within the organization are of good quality
Measurability	Processes within the organization are easily measurable
Employee satisfaction	Processes within the organization contribute to the employee satisfaction
Competitive advantage	The processes within the organization give our organization a competitive advantage
Flexibility	Processes within the organization can easily be changed
Comprehensibility	Processes within the organization can be understood by everybody

**Table 2: Statements about Process Performance.**

## **RESULTS**

As stated above the total number of respondents amounted to 168 persons. The respondents represented a cross section of Dutch organizations: 28% governmental organizations (ministries, provinces, municipalities etc.), 24% financial institutions, 12% business services, 8% manufacturing companies, 7% logistical service organizations, 5% healthcare, 5% retail, 4% education & science, and 7% were classified as 'others'. For ease of analysis we classified all organizations into three categories 1) private organizations (excluding finance) 2) public organizations (typically all government organizations) and 3) financial organizations. Since 24% of the survey respondents consisted of financial organizations we decided to keep this as a separate category. We also asked the respondents the sizes of their organization (Figure 1).

To get an indication of the experience level of our respondents we first asked if they had any knowledge about BPM and secondly if they had any practical experience with BPM projects or initiatives. A large majority of the respondents (77%) stated they had knowledge on BPM and of this group (42%) also stated that they had a lot of practical experience while the rest (35%) said to have a limited amount of hands-on experience. Furthermore 19% of the survey contributors said they did have some knowledge about BPM but no practical experience while 4% had little knowledge on BPM and no real life experience whatsoever.



**Figure 1: Company Size (Loggen et al., 2011).**

Furthermore we also asked our participants what role or function they had within their organization. The top five of roles that are mentioned most are:

- Management (27)
- Consultant (26)
- Process manager (25)
- Information manager (16)
- Business architect (15)

There is relevant variation between the respondents in terms of their sector of employment, size of the organization, and position within the organization.

Finally we also asked the participants if they would be answering the questions in our survey from the entire organization perspective (59%) or with a focus on their own business unit /division (41%). As it turned out there is a clear relationship between the size of the organization and the answer to this question, the larger the organization the more frequent the focus in the answers was on the business unit instead of the entire organization.

Based on the above we find that the respondents to our survey are knowledgeable on the topic of BPM and therefore their answers can be regarded as valid and of high quality.

### **Process Maturity**

As described above the process maturity of an organization was measured in seven different dimensions by asking 37 different questions. Since it was not mandatory to answer all questions in the survey the number of respondents that answered the questions on maturity was smaller (N = 138) than the total number of participants. However this sample is still large enough to present valid results.

On average across all dimensions and all organizations the BPM maturity was rated 3.02 on a scale from 1 to 5. This is slightly above the mean of 2.5 and therefore it can be concluded that overall the organizations participating in this survey are all actively involved in BPM. However there are some remarkable differences in the averages per organizational type. Financial organizations are considered to be the most mature with an average of 3.19; while other private organizations score 3.08 and government organizations only have an average of 2.85 in BPM maturity. An explanation for this could be that financial organizations were early adopters of business process management methods and techniques and have therefore had more time to achieve a higher maturity however we cannot conclude this based on the data from our survey. If we take a more in-depth view at the 37 items that determine the maturity in each of the dimensions (see Table 3) the findings become more interesting.

<b>Process Awareness (3.3)</b>	<b>Process Description (3.2)</b>	<b>Measurement of Processes (2.8)</b>	<b>Management of Processes (3.0)</b>	<b>Process Improvement (3.2)</b>	<b>Process Research &amp; Knowledge (3.1)</b>	<b>Information Technology (2.6)</b>
Work in a process oriented manner (3.6)	Process architecture (3.7)	Process deliverables defined (3.2)	Process owner assigned (3.7)	Responsibility for process improvement is assigned (3.5)	Process resources are defined & available (3.0)	Software for process modeling is used (3.9)
Top management support (3.5)	Process models (3.1)	Process KPI's defined (2.5)	Process planning implemented (2.5)	Employees are involved with improvements (3.1)	Training (3.4)	Simulation tools are used (2.1)
Strategy & goals (3.4)	Work instructions and guidelines (3.2)	Performance targets (related to strategy) are defined (2.7)	Process roles defined and implemented (3.0)	Stakeholders are involved with improvements (3.2)	Process goals are known and actively pursued (3.1)	Workflow- and case mgt. is implemented (2.6)
Adoption (2.9)	Roles, tasks and responsibilities (3.2)	Responsibility for measurements are clear (2.8)	A method for process management is implemented (2.9)	Improvement methods & techniques are available (3.1)	Process knowledge networks are implemented (3.1)	Straight through processing were possible (2.9)
	Stakeholders (3.2)	Process performance is evaluated (2.6)	Process compliance and control is implemented (3.1)	Continuous process improvement is planned (3.1)		Business Activity Monitoring (2.2)
	Contribution to strategy (2.8)			Management is actively involved (3.2)		Software is used to improve processes (1.7)
						IT department is involved with process improvement (2.6)

**Table 3: BPM Maturity in Seven Dimensions Based on 37 Items.**



The dimension 'process awareness' scores highest overall although the item 'adoption' scores comparatively low within that dimension. The corresponding question was: "Are process changes quickly accepted and adopted by the organization and its employees?" Based on the low score we can doubt if organizations are able to successfully continuously improve their processes if improvements are not always readily accepted and adopted. However since the 'process improvement' dimension also scores comparatively high it might be stated that organizations in the Netherlands are actively pursuing BPM to improve their processes in order to create a process oriented organization but that adoption of process changes by employees needs continuous attention and efforts by (process) managers.

The two dimensions that score comparatively low are 'measurement of process' and 'information technology'. In order to improve processes an organization needs information about how processes are performing. However based on our survey findings we can assume that many organizations don't have key performance indicators defined for their processes, there are no clear targets for process performance and processes are not evaluated on a regular basis. Thus while organizations are trying to realize process improvements the information needed to do so is not readily available nor is there any system in place that defines responsibilities and describes an evaluation procedure for process measurements. This lack of information that can be used by management might be related to the low score of the items 'process planning implemented' and 'a method for process management is implemented'. Based on the survey data it is however not clear which is the cause and which the effect.

The information technology dimension has the overall lowest score while the underlying items have both the highest score (software for process modeling is used) and the lowest score (software is used to improve processes) of all 37 items. The score of 3.9 for 'software for process modeling is used' clearly indicates that first and foremost software is being used to only model processes. Enactment or execution of processes via either straight through processing or the use of workflow and case management software scores low compared to many of the other items. Software to simulate processes or to realize real-time process performance measurement (with business activity monitoring) seems not to be very popular in the BPM initiatives of the respondents' organizations. Also process improvement is typically not supported by any IT. The low maturity scores in the IT dimension are something we didn't expect beforehand since a lot of the hype on BPM in recent years was created by software vendors and (IT-) consultants in the BPM domain. So either the developers and consultants are not selling as much software and services as we would have expected based on the amount of marketing effort or the software and services are being sold but do not have any clear effect on the BPM maturity of the end-user organizations.

Based on the findings described above we believe that in order for organizations to become really mature in business process management they should put more effort into measuring the performance of processes and relating this to their process improvement initiatives. Furthermore vendors and consultants of BPM technology and related services need to realize more added value in relation to the other six dimensions described in this section.

### **Process Performance Characteristics**

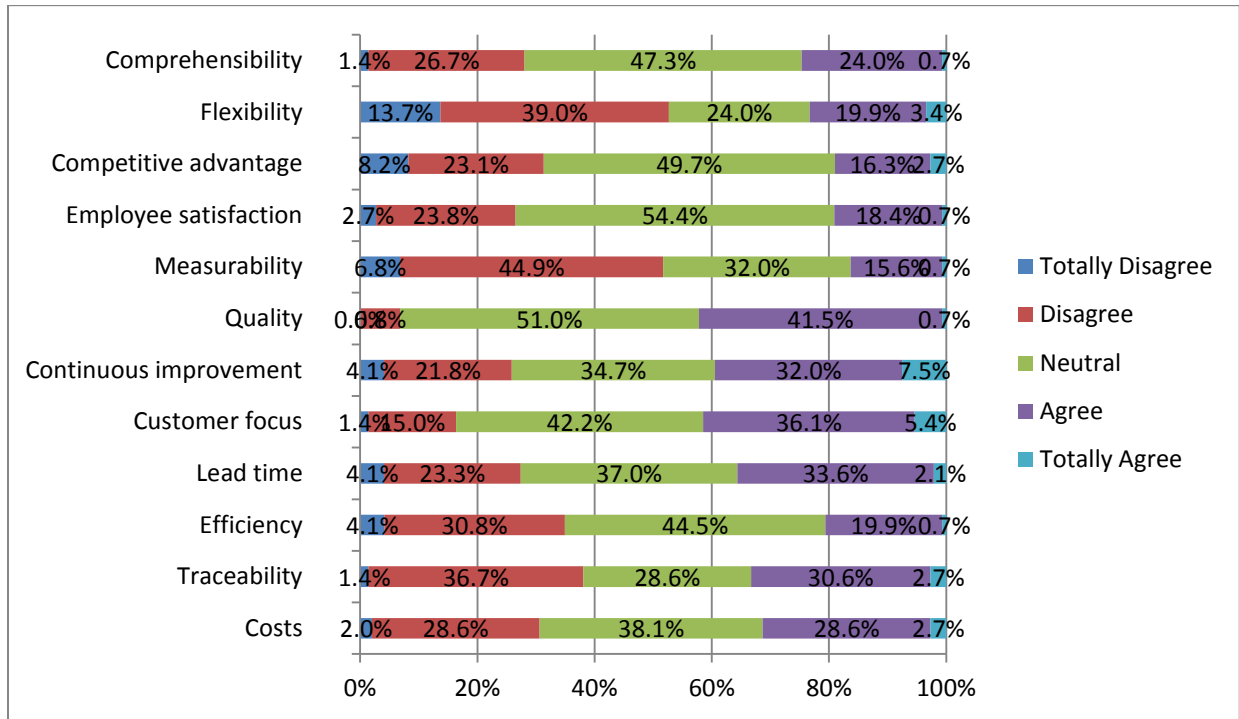
Also for the survey questions related to process performance part it was not mandatory to provide answers. Only the respondents that answered all questions in this part of the questionnaire were included in our analysis (N=142). In table 4 an overview is shown of the values given to the process performance characteristics by the respondents and in figure 2 a more detailed overview of the answers of the respondents is presented. For each characteristic the respondents were asked whether they agreed or disagreed that processes within their organization performed good. For example the 3.01 score for ‘costs’ is based on the following question: ‘Are processes in your organization executed against acceptable costs?’

<b>Performance Characteristic</b>	<b>Value</b>	<b>Performance Characteristic</b>	<b>Value</b>
Costs	3.01	Quality	3.36
Traceability	2.97	Measurability	2.59
Efficiency	2.82	Employee satisfaction	2.90
Lead-time	3.06	Competitive advantage	2.82
Customer focus	3.29	Flexibility	2.60
Continuous improvement	3.17	Comprehensibility	2.96

**Table 4: Process Performance Characteristics Rated by Respondents.**

As can be seen in table 4 ‘quality’ and ‘customer focus’ are the highest scoring process performance characteristics. This means that according to the respondents the processes in their organization deliver results of good quality and are customer focused. Likewise the lowest scoring characteristics are ‘measurability’ and ‘flexibility’ so according to the respondents the processes in their organization cannot be easily measured (i.e. how is a process performing) and cannot be easily changed. These findings correspond with the low maturity scores for ‘adoption’ in the process awareness dimension and the overall low score for the dimension ‘measurement of processes’.

Based on the overall scores we can state that the process performance of the organizations that participated in this survey is just above average (mean of 2.96 across all characteristics) and therefore there is much room for improvement.



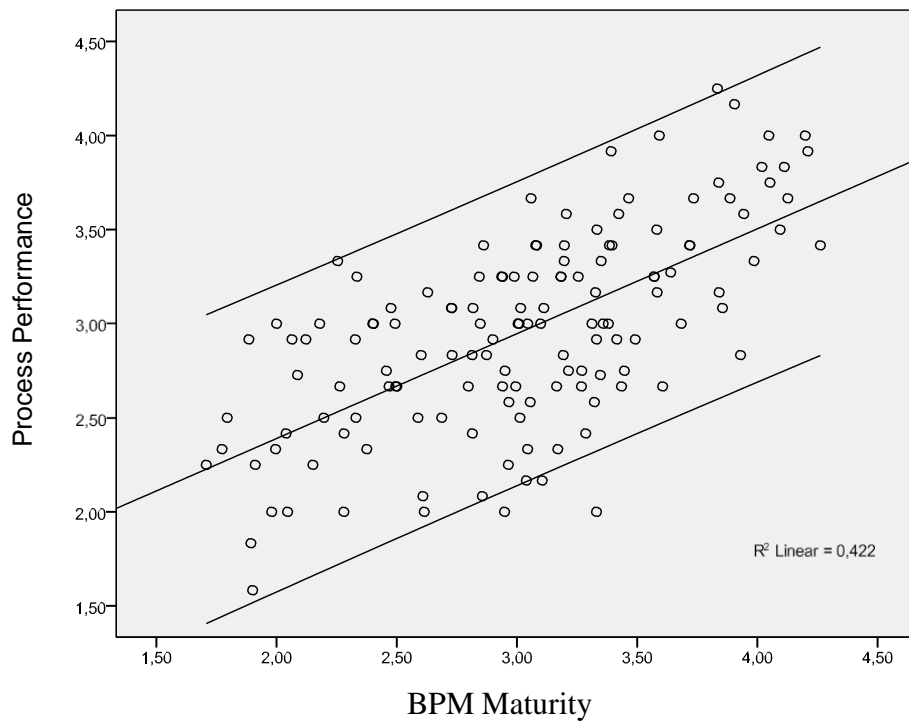
**Figure 2: Response Related to Process Performance Characteristics (Loggen et al., 2011).**

**Process Maturity and Performance**

To answer our research question (*Does adoption of Business Process Management lead to a higher process performance?*) we needed to determine if there is dependence between the process maturity of an organization and its process performance. For this we did a correlation analysis (with only those respondents which answered both the maturity and the process performance questions, N=138) which is shown in figure 3. Each dot represents one organization and is plotted according to its overall BPM Maturity score across the 7 dimensions and its overall Process Performance score over the 12 process performance characteristics. Based on this analysis we can safely assume that there is linear relation between the performance of processes within an organization and the BPM maturity of that organization.

In addition we also did an analysis for subsets of our data such as organizational size and type of organization. This however did not provide any significant differences.

Furthermore we also analysed if there is a relation between any of the 7 dimensions and one or more process performance characteristics, here we didn't find any significant results. Therefore we conclude that improvement in process performance can only be reached by heightening the overall BPM maturity of the organization across all dimensions.



**Figure 3: Relation between BPM Maturity and Process Performance (Loggen et al., 2011)**

Finally we analyzed whether there were any differences between the top 10 organizations with the highest overall process performance score and the 10 organizations that scored lowest. The reason for this analysis is that we found a remarkable pattern in our regression analysis: there were organizations that had a different BPM maturity rate and all scored low on performance. Our assumption was that BPM can be implemented in a way that does not add value (increase in process performance). Furthermore we did find organizations that had high scores for both maturity and performance but no organizations that had high scores for performance with low scores for BPM maturity. From this we conclude that BPM is a required factor for best in class process performance. To understand the lower score on performance with varying score on maturity, we analyzed the top and bottom 10 organizations.

We found that highest scoring organizations had a significant higher BPM maturity on the following six items:

- 'Management is actively involved' and 'Continuous process improvement is planned' from the dimension 'process improvement'.
- 'Work instructions and guidelines' and 'Contribution to strategy' from the dimension 'process description'.
- 'Process roles defined and implemented' from the dimension 'management of processes'.

- ‘Business Activity Monitoring’ from the dimension ‘information technology’.

From these items ‘management is actively involved’ is being mentioned most often by the respondents that worked for the top 10 performing organizations. Derived from these results we conclude that business process management should be implemented in organizations with strong support of top management in order to be successful and cannot be delegated to a staff or IT department.

## CONCLUSIONS

In this research we tried to answer the question: *Does adoption of Business Process Management lead to a higher process performance?*

For this a survey was developed that was put online and to which 168 persons responded. Of this group a large majority (77%) stated that they had knowledge on BPM and also had more or less practical experience.

Not all respondents answered the questions on BPM maturity and process performance so the sample size that was analyzed in order to answer the research question was 138 participants.

We found that (on average) across all dimensions and all organizations the BPM maturity was rated 3.02 on a scale from 1 to 5, from this we assume that the Dutch organizations are actively involved in business process management to improve their processes and create a more process oriented organization. However the level of maturity differs depending on the type of organization, we found that financial organizations are typically more mature than other private organizations and that government organizations are the least mature.

Although organizations are getting more mature in their BPM efforts we also found that adoption of changes by employees needs continuous attention and efforts by management. In addition many organizations that are trying to improve their processes lack the information needed to do this and don’t have any system in place that defines responsibilities and describes an evaluation procedure for process measurements. Therefore a plan-do-check-act cycle cannot be fed with current information and will be less effective.

As it turned out the Information Technology dimension of BPM maturity had the lowest score, something we didn’t expect beforehand. This might mean that the BPM software and services which are being sold do not have a measurable effect on the maturity of the organizations that acquire such software or services.

For organizations to become really mature in business process management we conclude that more effort needs to be put into measuring the performance of processes and relating this to ongoing process improvement initiatives. Furthermore we conclude that business process

management should be implemented in organizations with strong support of top management in order to be successful and cannot be delegated to a staff or IT department.

To determine the process performance of the organizations participants were asked how they perceived that their organization was performing on a set of 12 process performance characteristics. This showed that organizations scored just above average (mean of 2.96 across all characteristics) which leaves much room for improvement.

Finally we analysed the relation between BPM maturity and process performance. The study we did shows that there is linear relation ( $R^2 = 0.422$ ) between the performance of processes within an organization and the BPM maturity of that organization. Therefore we conclude that improvement in process performance can be attained by increasing the BPM maturity of an organization.

## **DISCUSSION AND FUTURE RESEARCH**

As stated we asked respondents whether they answered the questions from a business unit / division point of view or from an organizational perspective. Some of the respondents that stated that they answered the survey from a business unit point of view commented that they didn't have an organization wide view on BPM initiatives and maturity. This means that although on a business unit level the relation between maturity and performance is clear there is no assurance that this will help these organizations. It seems that in these cases there is no overall management and control on BPM. Furthermore our respondents group might be biased in their answers. Typically respondents to a BPM survey tend to be interested in the topic already. This notion is confirmed by the high rate of experienced and knowledgeable participants. However we find that this usually adds to the quality of the answers and thus the validity.

To measure the process performance of organizations the respondents were asked to agree or disagree with twelve statements. However their answers are based on the respondent's perception of process performance. Since there were no case studies performed we cannot be entirely sure that the answers are completely correct.

Furthermore, even though we found a significant relation between BPM maturity and process performance it is possible that this is caused by a third variable which was not considered in this research. However since BPM maturity was measured with 37 items and process performance is based on 12 statements we don't expect that this is the case.

To further support the findings of this research we want to do several case studies at different organizations in which quite a few people are interviewed in order to determine the BPM maturity and process performance levels of that organization and see whether we can still find the correlation between these two variables.

Additionally we also want to repeat this study in other countries to see if we will find the same results.

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### **ACKNOWLEDGEMENTS**

We would like to thank Capgemini Netherlands for their sponsorship and contribution to this research project.



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