# ON THE IMPORTANCE OF ORGANISATIONAL CULTURE AND STRUCTURE IN BUSINESS PROCESS MATURITY.

Completed Research Paper

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## Abstract

This article is dedicated to advance knowledge of the organisational role that culture and structure may have in business process maturity. The latter is a measure for the expected business process performance. Particularly, a two-fold approach was followed to explore whether the sequence of realising both organisational concepts matters. First, data mining was applied to find an existence dependency between a process-oriented organisational culture and structure among existing maturity types. Secondly, a literature study was conducted to find management theories that explain the interrelationship between business processes and a process-oriented organisational culture and structure. It turned out that a process-oriented organisational culture and structure are important to business process maturity, but to a different degree. As the organisational culture should precede the organisational structure, no business process maturity type affects structure, without affecting culture. This finding may help organisations reorganise properly, and underpins a holistic business process management discipline.

**Keywords:** Business process management; business process improvement; organisational maturity; capabilities; organisational culture; organisational adoption.

## Introduction

Business process management (BPM) is believed to result in higher business performance (e.g. higher customer satisfaction and doing business or launching new products and services at lower cost) and higher compliancy of a system by finding an optimal balance between standardised business processes and customisation (Hall and Johnson 2009). Therefore, it appeals practitioners who seek to respond to market pressures and compliance requirements or make use of IT and outsourcing opportunities (vom Brocke and Rosemann 2010; Weske 2010).

In order to realise these BPM outcomes, the current business process literature starts to recognise the role of a process-oriented organisational culture and structure (vom Brocke and Sinnl 2011) in addition to the traditional process lifecycle (Weske 2010). In the 1990s, BPM research mainly examined technical ITrelated methods throughout the process lifecycle, for instance, for modelling and deploying workflows (Jablonski and Bussler 1996), software process improvements (Kellner et al. 1999), or business process reengineering (Hammer, 1990). As from the 2000s, various authors advocate a more holistic (de Bruin and Rosemann 2007; Willaert et al. 2007) or comprehensive (Kohlbacher 2010) BPM approach, also known as business process orientation (BPO) (McCormack and Johnson 2001). It means that organisations should also fundamentally change their organisation management by adopting an organisational culture and structure that support (not impede) process improvements.

Although the importance of organisational culture and structure to BPM is recognised nowadays, their interdependency (or existence dependency) remains unclear. To our knowledge, the complexity of this organisational role by means of different ways to realise BPM in an organisation requires further research. In other words: how do the organisational culture, structure and business processes relate to each other? Is the presence of a process-oriented organisational culture and/or structure sufficient for BPM success? Or is the sequence in which these organisational characteristics are introduced also crucial? For instance, in the literature, it is still unknown whether BPM can be realised when business processes are supported by a process-oriented culture, but when a process-oriented structure lags behind, or vice versa? Consequently, this article elaborates on the role of organisational culture and structure in BPM by exploring indications that the sequence of realising both concepts matters in future research.

To measure BPM realisations, we rely on the concept of business process maturity as an indication of the expected business process performance. Business process maturity expresses the degree to which an organisation has explicitly and consistently performed its business processes, and can be increased by simultaneously improving the capability areas (i.e. skills or competences) needed to perform (Van Looy et al. 2011). To support the high BPM demand, business process maturity models (BPMMs) have been developed to assist organisations in a gradual BPM adoption and use. Hence, BPMMs offer best practices that deal with the business challenges and opportunities of BPM over its entire lifecycle from consideration and adoption to implementation and continuous improvements. CMMI is the most common model (Ahern et al. 2004), but many other BPMMs exist (de Bruin and Rosemann 2007; Hammer 2007; Harrington 2006; McCormack and Johnson 2001). In line with the above, Van Looy et al. (2012) show that many BPMMs also address the organisational culture and/or structure to increase business process maturity. Given their practical relevance, BPMMs are used to evaluate and compare business process improvements worldwide (Maier et al. 2009). Moreover, some scholars predict that the overall use of maturity models is likely to increase (Scott 2007). We must, however, note that organisations can use a BPMM without naming the model as such. Particularly, organisations tend to follow and quantify the overall condition of their business processes to progress or for (internal or external) benchmarking, but without explicitly referring to business process maturity. Nevertheless, a recent BPTrends survey reported a major increase in business process maturity by organisations (Wolf and Harmon 2012).

Consequently, this article intends to address the following research question:

#### RQ. What is the role of organisational culture and structure in business process maturity?

Our objective is to help underpin a holistic approach in the business process literature, measured by business process maturity. By exploring and refining the organisational impact on business processes, we would like to direct future research and contribute to BPM as an academic discipline. Insights into the

role of organisational culture and structure may also help managers and executive decision-makers reorganise their organisation properly.

We proceed as follows. Section 2 presents our theoretical background. Next, we describe the methodology employed for this study. As it concerns a two-fold approach, the results are covered in section 4 and section 5. We then conclude with the main findings and avenues for future research.

# **Prior Work**

To understand the theoretical background of our research, we discuss the capability areas related to business process maturity and, in particular, the organisational culture and structure.

### **Business Process Maturity**

Along with the many BPMMs, arise substantial differences in what BPMMs actually measure and improve. These differences are expressed as business process maturity types, and give insight into the direction of a BPMM. Maturity types are typically defined according to the number of processes addressed by a BPMM (de Bruin and Rosemann 2007): (1) the maturity of specific business processes and (2) the maturity of all business processes in the organisation. A refinement is added in Van Looy et al. (2012) by also considering the capability areas addressed:

- Business Process Management (BPM) maturity for BPMMs limited to the so-called basic areas in the traditional business process lifecycle, namely business process modelling, deployment, optimisation and management (Weske 2010);
- intermediate Business Process Orientation (BPO) maturity for BPMMs combining the basic areas with a process-oriented organisational culture;
- BPO maturity for BPMMs addressing the basic areas plus a process-oriented organisational culture and structure.

The names of these three types of business process maturity suggest a funnel arrangement of business process capability areas, with BPM being included in intermediate BPO, which in turn is included in BPO (i.e. BPM < intermediate BPO < BPO).

While de Bruin and Rosemann (2007) and Van Looy et al. (2012) focus on the identification of business process capability areas and maturity types, we intend to explain the differences among these maturity types to advance knowledge of BPM and BPMMs. Hence, the present study complements previous studies by justifying the differences in which an organisational culture and structure are present in these business process maturity types. For instance, why is a maturity type that combines basic areas with a process-oriented organisational structure (but not a process-oriented organisational culture) missing? And is the proposed distinction between business process maturity types meaningful for practitioners' use?

#### **Business Process Capability Areas**

The critical success factors for business process performance have been frequently examined with empirical data, like case studies. BPMMs refer to these factors as business process capability areas, and aggregate them into business process maturity (Ahern et al. 2004; de Bruin and Rosemann 2007; Hammer 2007; Harrington 2006; McCormack and Johnson 2001). We hereby elaborate on the capability areas of de Bruin and Rosemann (2007), which are globally recognised, and the recent capability areas of Van Looy et al. (2012), which are underpinned by theories and independent of any BPMM.

de Bruin and Rosemann (2007) propose six business process capability areas, which are also used as outline of a recent BPM handbook (vom Brocke and Rosemann 2010): (1) strategic alignment, (2) governance, (3) methods, (4) information technology, (5) people, and (6) culture. Each area has five sub areas. The capability areas of de Bruin and Rosemann (2007) were elicited from existing studies on critical success factors for BPM and empirical research (i.e. Delphi and case studies) to build a maturity model, albeit without relying on underlying theories.

This gap is addressed by Van Looy et al. (2012), who identified a similar set of capability areas linked to theories, i.e. 'theories for explaining and/or predicting' and 'theories for design and action' (Gregor 2006). Particularly, it concerns process lifecycle theories (Weske 2010) and organisation management theories of performance and change management (Burke and Litwin 1992; Waterman et al. 1980), human resource management (Boswell et al. 2006), and strategic management (e.g. underlying the balanced scorecard of Kaplan and Norton (2001)). Particularly, Van Looy et al. (2012) theoretically identified six capability areas and 17 sub areas, and empirically validated them with a mapping to a sample of existing BPMMs (instead of a single BPMM). Their six capability areas are business process (1) modelling, (2) deployment, (3) optimisation, (4) management, and a process-oriented (5) culture, and (6) structure. For instance, Table 1 shows that all aspects of the 7-S framework (Waterman et al. 1980) and the Burke-Litwin model (Burke and Litwin 1992) affect the capability areas of Van Looy et al. (2012).

organisation management theories.					
Capability areas for organisational performance and change:		Capability areas for business process maturity (i.e. expected performance):			
7-S framework	Burke-Litwin model	Main areas	Sub areas		
(Waterman et al. 1980)	(Burke and Litwin 1992)				
Systems	Systems (policies and	Modelling	1/ Business process design		
	procedures) (1)		2/ Business process analysis		
		Deployment	3/ Business process implementation and enactment		
			4/ Business process measurement and control		
		Optimisation	5/ Business process evaluation		
			6/ Business process improvement		
Strategy	Mission and strategy	Management	7/ Strategy and key performance indicators		
	External environment		8/ External relationships and service level agreements		
Skills	Task and individual skills		9/ Roles and responsibilities 10/ Skills, expertise, and training		
	Management practices	•	11/ Daily management		
Superordinate goals	Organisational culture	Culture	12/ Values		
Staff (soft aspects)	Motivation		13/ Attitudes and behaviours		
	Work unit climate				
	Individual needs and values				
Staff (hard aspects)	Systems (2)		14/ Appraisals and rewards		
Style	Leadership	1	15/ Top management commitment		
Structure	Structure	Structure	16/ Organisation chart		
			17/ Governance bodies		

Table 1. An illustrative mapping of the bu organisat	siness process capability areas of Van Looy et al. (2012) to ion management theories.
apability areas for organisational	Capability areas for business process maturity (i.e.

Although the capability areas of Van Looy et al. (2012) differ in naming from those of de Bruin and Rosemann (2007), the sub areas are mostly comparable. Afterwards, Van Looy et al. (2012) applied statistical classification techniques to identify different maturity types being measured by actual BPMMs, as mentioned above. Since the BPMM of de Bruin and Rosemann (2007) covers almost all sub areas of Van Looy et al. (2012), it was classified as BPO maturity, and this for all business processes in the organisation.

Finally, the clustering in Van Looy et al. (2012) was intended to empirically prove a meaningful distinction between the theoretical concepts of BPM and BPO. Moreover, it added an extra dimension by proposing a hierarchy between the organisational culture and structure, resulting in intermediate BPO maturity. Notwithstanding the theoretical motivation for the capability areas of Van Looy et al. (2012), the classification in statistical clusters (as maturity types) remains an empirical finding based on sampled BPMMs. Therefore, the present study investigates which insights can be derived from the proposed classification to justify a hierarchy between the organisational culture and structure. As the suggested maturity types seem to differ in characteristics that impact the whole process portfolio of an organisation (instead of characteristics per business process), we subsequently explain the organisational culture and structure.

#### **Process-oriented Organisational Culture**

The organisational culture is not included in the typical process lifecycle (Weske 2010), but scholars are increasingly recognising that an inapproprate culture may impede the realisation of process improvements and excellence (vom Brocke and Sinnl, 2011). We must, however, note that the article's focus is limited to the process-oriented aspects of an organisational culture, i.e. which influence the realisation of business process maturity, and not on the larger body of knowledge that deals with the concept (Leidner and Kayworth 2006). The aspects discussed can be traced back to the cultural sub areas of Table 1 (i.e. sub areas 12 to 15).

Schmiedel et al. (2012) elicited four values that support BPM, namely customer orientation, excellence, responsibility and teamwork. These process-oriented values can be visualised by charters, symbols, rituals, and stories about important events or heroes. Although the organisational culture is generally defined as shared values among organisation members, it comprises more aspects. Particularly, values are primarily transmitted and maintained by the human resources department and top managers, as well as by attitudes and behaviours of employees to socialise (new) members (Kerr and Slocum 1987; Wiener 1988).

Possible work attitudes and behaviours refer to employees who are aware of the business processes within their organisation, who are motivated to do their job, who do not resist change, and who share facilities and lessons learned among business processes. Furthermore, appraisals and rewards must depend on the performance of business processes (instead of departments) in order to control these values, attitudes, and behaviours for all employees (instead of only for the process owners) (Hammer and Stanton 1999; Harrington 2006; Kohlbacher 2010; Lee and Dale 1998). Finally, Scheer and Brabänder (2010) conclude that *'without a BPM Sponsor at the executive level who is committed to internally marketing all BPM initiatives, BPM awareness and status will not be strong enough*' (p.260).

#### **Process-oriented Organisational Structure**

Also the organisational structure is a characteristic that transcends the boundaries of business processes. More specifically, process orientation can be translated into the organisation chart and into additional permanent bodies that coordinate all business processes and, thus, govern BPM. It concerns the structural aspects in Table 1 (i.e. sub areas 16 to 17).

Regarding the organisation chart, Silvestro and Westley (2002) give an overview of a vertical organisation (i.e. structured around departments), a horizontal organisation (i.e. structured around core processes), and a matrix organisation (i.e. structured around departments and core processes). Their research suggests that a vertical structure fits more with a cost leadership strategy, whereas a horizontal structure seems more valuable for a differentiation strategy. A matrix structure allows combining both advantages.

The structural reconfiguration also introduces a program management office and a centre of excellence,

besides process offices (i.e. each with a process owner and an improvement team per business process) (Hammer and Stanton 1999; Kohlbacher 2010). The program management office is responsible to coordinate all process-related activities and projects within the organisation. It is headed by a program manager or BPM head, and possibly attended by the process sponsor, all process owners, regional BPM heads, and experts. In a large organisation or business network, an additional local BPM head and associated office can be present for each local entity (Scheer and Brabänder 2010). The program manager leads a centre of excellence (or competence centre), comprising process experts or internal consultants regarding process management methodologies and tools, as well as project management skills (Scheer and Brabänder 2010). Rosemann (2010) explains that organisations establish a centralised centre of excellence as their maturity increases in order to offer standardised services in a more consistent and cost-effective way. He proposes a list of fifteen centralised services that may support the basic areas with best practices and methodology: (1) maturity assessment, (2) strategic alignment, (3) modelling, (4) library (artefact) management, (5) improvement, (6) process-aware information systems, (7) automation, (8) change management, (9) project management, (10) process governance, e.g. roles and responsibilities, daily management, (11) compliance, (12) performance measurement, (13) forensics, i.e. uncovering the causes of process failures, (14) education and training, and (15) portfolio management, i.e. prioritising business processes for service initiatives. Nevertheless, the concrete interpretation of centralised services varies across authors (Scheer and Brabänder 2010).

# Methodology

In line with Gregor (2006), the terminology for business process maturity types and capability areas of de Bruin and Rosemann (2007) and Van Looy et al. (2012) constitute a 'theory for analysing and describing' the similarities and differences between BPMMs. As both studies try to understand the capability areas that contribute to business process maturity as critical success factors, they partly contribute to a 'theory for explaining'. However, in order to obtain a 'theory for explaining and predicting', future research is required to elaborate on causal relationships and to formulate hypotheses that predict business (process) performance. The present article takes a first step, by exploring interrelationships between business processes, the organisational culture and structure based on inductive reasoning. Particularly, we provide systematic generalisations of business process maturity types based on observations from data mining and a literature review in order to direct future research avenues.

## Data Mining

We started from an existing study of maturity types, which showed that some (but not all) business process maturity models (BPMMs) include the organisational culture and structure as capability areas (Van Looy et al. 2012). The existing study aimed at providing a terminology for maturity types by clustering BPMMs. As cluster analysis remains descriptive, the resulting terminology does not explain the interrelationship between business processes and the organisational culture and structure. To supplement this previous research, we reused the publicly available BPMM database from the previous study to verify an existence dependency by applying data mining techniques. Data mining typically investigates a sequence of attributes (or business process capability sub areas) to find the best differentiators (i.e. among the different maturity types). Therefore, a rule set is to be derived from the clustered BPMMs to generate general rules that assign any BPMM to a maturity type. For the purpose of this paper, the resulting rules can be used to gain insight into the existence dependency of the capability sub areas, rather than assigning concrete BPMMs to a maturity type. As such, a rule set may help interpret the major differences between existing maturity types. We therefore elaborate on the sub areas of organisational culture and structure, since the basic sub areas are present across the maturity types and are, thus, no differentiators.

Particularly, in order to analyse, describe and understand the differences between the business process maturity types, a data mining-based approach was applied to the publicly available BPMM dataset (Van Looy et al. 2012). Although mining is typically done on massive datasets, data mining techniques also allow distilling new patterns (i.e. knowledge) from smaller data. In data mining terms:

• the BPMM dataset consists of 69 instances (i.e. BPMMs),

- each of them having 17 attributes (i.e. sub areas of Table 1)
- and which have been clustered in one of three maturity types (i.e. BPM, intermediate BPO and BPO maturity).

Since the research focuses on the importance of and differences between the organisational culture and structure, the attributes not belonging to cultural or structural capability areas were removed from the attribute space. The resulting dataset then consists of the 69 instances (i.e. BPMMs), each having the six attributes of culture and structure. By defining these attributes as independent variables and business process maturity (i.e. clustered BPMMs) as a dependent variable, it is possible to apply classification techniques to the model.

By applying a rule learner and a decision tree builder, a comprehensible set of rules or tree can be learned' which explains how the clusters (or maturity types) differ. One of the most commonly used tree induction techniques is the C4.5 algorithm. C4.5 induces decision trees based on information theoretic concepts (such as entropy). Regarding existence dependency, C4.5 selects that attribute (i.e. sub area) from the attribute space that most effectively splits the instances (i.e. BPMMs). This means that the attribute with the highest predictable value will be used first. The results then give an indication of the importance between organisational culture and structure among clustered BPMMs (i.e. maturity types). Other tree induction techniques exist, such as Ripper, CN2, 1R, and Cart. Ripper is a rule induction technique that generates a list of ordered rules. Some of the best performing classification algorithms (like SVM) generate a black box model to describe the dataset. One of the main criteria for selecting the data mining algorithms for this research was comprehensibility. It is generally accepted that rule-learners and tree-learners generate the most comprehensible models, particularly C4.5 and Ripper (Verbeke et al. 2009). Both learners are implemented in the well-known Weka data mining tool (version 3) (Hall et al. 2009). The C4.5 decision tree algorithm is implemented as J48 and the Ripper rule-learner is implemented in Weka as the JRip algorithm. For both algorithms, the default settings were used.

#### Literature Review

While data mining verified a possible existence dependency between the organisational culture and structure among business process maturity types, a literature review was conducted to also explore causal relationships between the organisational concepts within the most complete maturity type. Particularly, BPO maturity is characterised by the presence of both a process-oriented organisational culture and structure. But does it matter whether this organisational culture is realised before structure, or vice versa?

Our research goal requires a review of organisation management theories relevant to the interrelationship between business process capability areas. To identify papers which adequately represent the research topic, we initially searched for articles within the online academic databases of the Web of Science (i.e. SCI-Expanded, SSCI, A&HCI, CPCI-S, CPCI-SSH) by using the combined keywords of *"theory"*, *"organis(z)ational culture"*, *"organis(z)ational structure"* and *"processes"* in the text. The keyword *"processes"* was also replaced by synonyms like *"procedures"*, *"operations"* or *"tasks"*. The publication period for relevant literature was based on the availability of resources in the online academic databases (i.e. as from 1955 for SCI-EXPANDED, 1956 for SSCI, 1975 for A&HCI, 1990 for CPCI-S, and 1990 for CPCI-SSH) until April 2013. A preliminary search (i.e. without perusal of abstracts and full texts) yielded 542 articles, some of which were duplicates (Table 2).

Subsequently, perusal of abstracts and full texts resulted in the elimination of articles which do not directly pertain to the organisational impact on business process management. It thus concerns articles which do not literally address the interrelationship between business processes and the organisational culture and structure. In this phase, many articles were excluded because they primarily focus on knowledge management, the learning organisation, leadership, individual behaviour and perceptions, politics, quality or project management, IT innovations, etc. Table 2 shows that six articles remained, considering the duplicates for combinations of search queries. Then, we traced the references in identified articles for other relevant sources. In total, nine studies were selected that present a research model or framework regarding the interrelationship between business processes and the organisational culture and structure. Following this, we carefully examined each study and categorised it according to its perspective. The present article gives an introduction to the different perspectives taken by the selected studies.

Table 2. An overview of the search for relevant theories.					
Search query	British		American		
(between brackets: full text articles about the research topic)	Engli	English		English	
Perusal:	No	Yes	No	Yes	
"theory" + "organis(z)ational culture" + ""organis(z)ational structure" + "processes"	0	(0)	13	(0)	
"theory" + "organis(z)ational culture" + ""organis(z)ational structure" + "procedures"	1	(1)	0	(0)	
"theory" + "organis(z)ational culture" + ""organis(z)ational structure" + "operations"	0	(0)	3	(0)	
"theory" + "organis(z)ational culture" + "organis(z)ational structure" + "tasks"	0	(0)	2	(1)	
"theory" + "organis(z)ational culture" + "processes"	23	(0)	156	(1)	
"theory" + "organis(z)ational culture" + "procedures"	3	(1)	17	(0)	
"theory" + "organis(z)ational culture" + "operations"	5	(1)	14	(0)	
"theory" + "organis(z)ational culture" + "tasks"	7	(1)	29	(1)	
"theory" + "organis(z)ational structure" + "processes"	20	(0)	171	(1)	
"theory" + "organis(z)ational structure" + "procedures"	4	(1)	6	(0)	
"theory" + "organis(z)ational structure" + "operations"	5	(0)	33	(0)	
"theory" + "organis(z)ational structure" + "tasks"	4	(0)	26	(1)	
Total = 542 articles (10)	72	(5)	470	(5)	
Summary					
• Step A: results without perusal of abstracts and full texts	542				
• Step B: results with perusal of abstracts and full texts, minus duplicates	6 (10 – 4 duplicates)				
• Step C: results of step B and references	9 (step B + 3 references)				

# Data Mining

The classification problem at hand is called a multi-class classification problem, as there are more than two classes (i.e. BPM, intermediate BPO, and BPO maturity) to be 'learned'. A typical approach to tackle this kind of problem is a one-versus-all strategy. Using this approach, the multiclass problem is transformed to multiple binary classification problems. The learner will first try to distinguish one class from all other classes. This approach perfectly matches our research, as we only want to discover differences pertaining to the cultural and structural aspects. Hence, data mining was conducted in two steps: (1) BPM maturity (without organisational areas) compared to (intermediate) BPO maturity (with organisational areas), and (2) intermediate BPO maturity (with organisational culture, but no structure) compared to BPO maturity (with organisational culture and structure).

## BPM maturity versus (intermediate) BPO maturity

The first step investigates the differences between BPM maturity and the other maturity types (intermediate BPO and BPO). Figure 1 represents the rule set that was generated by the Ripper algorithm (with default values). The resulting decision tree by applying the C4.5 algorithm (with default settings) is presented in Figure 2. The numeric labels between brackets (e.g. 20.0/1.0) refer to the actual number of

instances reaching that rule or leaf of the tree (e.g. 20 BPMMs) and the number of instances that were misclassified compared to previous cluster analysis (e.g. 1 BPMM).

- If (Appraisals = Absent) and (Top = Absent) => Maturity\_Type = BPM cluster (20.0/1.0)
- (Attitudes = Absent) and (Top = Present) and (Values = Absent) => Maturity\_Type = BPM cluster (3.0/0.0)
  - $\Rightarrow$  Maturity\_Type = Other (46.0/1.0)

Figure 1. The Ripper rules to distinct BPM maturity from (intermediate) BPO maturity (3 rules).



Figure 2. The pruned decision tree to distinct BPM maturity from (intermediate) BPO maturity (4 leaves).

Accuracy results are specified in Table 3. Both algorithms performed almost the same, with an accuracy of almost 87% in the 68-fold cross-validation setup. The Cohen's Kappa value remained far above 0.4 (p<0.001), indicating an almost excellent agreement between the data mining classification and the previous cluster analysis. 60 out of the 69 BPMMs were classified correctly based on the trained models, which means a misclassification of only 9 BPMMs.

In order to find a possible explanation for this small misclassification, we take a closer look at the differentiators resulting from the Ripper and C4.5 algorithms. The decision tree in Figure 2 shows all cultural sub areas, except for the process-oriented values. On the other hand, values are present in the Ripper rules (Figure 1), and this in combination with other cultural sub areas. In a few cases, the classification models classified a BPMM as addressing BPM maturity, while the cluster analysis previously attributed this BPMM to another cluster. Such a misclassification may, for instance, occur when only abstract values are present, without any concrete cultural realisation. Questions may, however, arise about the actual value of such (rare) BPMMs for increasing business (process) performance, as discussed in the next section. On the other hand, a slightly more frequent mistake was that a BPMM was classified as not belonging to BPM maturity, while it did in previous cluster analysis. This difference in classification may possibly be inherent to the applied algorithms. For instance, a decision tree typically assumes a hierarchy among its tree elements (which makes it easier to read and understand). Hence, a decision tree is inherently univariate at each split, whereas a cluster analysis is always multivariate.

The most interesting result from these two classification models is that only cultural sub areas seem to define the difference between BPM maturity and the other maturity types. Particularly, the Ripper algorithm included all cultural sub areas, whereas C4.5 considered three out of four cultural sub areas as differentiators (i.e. without process-oriented values). Hence, the organisational structure is of no importance in the difference between BPM maturity and (intermediate) BPO maturity. This empirical finding confirms that cultural sub areas are also substantially covered by BPMMs that were assigned to

Table 3. The first mining step compared to previous cluster analysis.							
Step 1: BPM <> Other		Predicted group membership for the Ripper algorithm		Predicted group membership for the C4.5 algorithm		Total	
			BPM	Other	BPM	Other	
Original	Count	BPM	22	1	21	2	23
		Other	1	45	2	44	46
	Result	esult <b>97.10%</b> (i original gro correctly cla (kappa= <b>0.9</b> p< <b>0.001</b> )		67/69) of oed instances fied. 3>0.75;	<b>94.20%</b> (i.e. 65/69) of original grouped instances correctly classified. (kappa= <b>0.870</b> >0.75; p<0.001)		
Cross-	Count	BPM	18	5	16	7	23
vandated <sup>a</sup>		Other	4	42	2	44	46
	Result		86.96% (i.e. cross-validated instances classified. (kappa=0.40	60/69) of l grouped correctly 0.700<0.75;	86.96% (i.e. cross-validated instances classified. (kappa=0.40< p<0.001)	60/69) of l grouped correctly 0.700<0.75;	
<sup>a</sup> With cross-validation, each instance (i.e. BPMM) is classified by the rule sets derived from all instances other than that instance (cfr. leave-one-out validation).							

BPO maturity, which gives an initial proof of the funnel arrangement among the three maturity types (BPM < intermediate BPO < BPO).

## Intermediate BPO maturity versus BPO maturity

In the second step, the binary classification between intermediate BPO and BPO maturity is investigated. Therefore, the instances belonging to the BPM cluster were removed (i.e. 23 instances), and the remaining dataset of 46 instances was used as input for the classification algorithms. The resulting rule set and decision tree are shown in Figure 3 and Figure 4.

 $\Rightarrow$  Maturity\_Type = Intermediate BPO cluster (29.0/5.0)

Figure 3. The Ripper rules to distinct BPM maturity from (intermediate) BPO maturity (2 rules).



Table 4 shows a good agreement between the data mining classification and the previous cluster analysis (0.40<kappa<0.75; p<0.001). The accuracy of Ripper and C4.5 was respectively 82.61% and 84.78% in the 68-fold cross-validation setup. This means that Ripper misclassified eight BPMMs, while C4.5 misclassified seven BPMMs.

The most common mistake made by the classification models was that they classified a BPMM as addressing intermediate BPO maturity, while the cluster analysis previously attributed this BPMM to BPO maturity. Such BPMMs are likely to address the organisation chart, but not the governance bodies. The former is indeed the only structural capability sub area not detected by Ripper or C4.5 as an important differentiator. As it only concerns about five BPMMs, we may expect that restructuring an organogram is perceived as less necessary for business (process) excellence than establishing process-oriented governance bodies, such as a centre of excellence. Another possible explanation is given in Visscher and Fisscher (2012), who argue that an organogram or organisational design is an abstract solution to a problem situation, which must be implemented by concrete governance bodies.

Table 4. The second mining step compared to previous cluster analysis.							
Step 2: intermediate BPO <> BPO		Predicted group membership for the Ripper algorithm		Predicted group membership for the C4.5 algorithm		Total	
			Interm. BPO	BPO	Interm. BPO	BPO	
Original	Count	Interm. BPO	24	2	24	2	26
		BPO	5	15	5	15	20
	Result		<b>84.78%</b> (i.e. 39/46) of original grouped instances correctly classified. (kappa=0.40< <b>0.685</b> <0.75; p<0.001)		<b>84.78%</b> (i.e. 39/46) of original grouped instances correctly classified. (kappa=0.40< <b>0.685</b> <0.75; p<0.001)		
Cross- validated <sup>a</sup>	Count	Interm. BPO	24	2	24	2	26
		BPO	6	14	5	15	20
o 147'11	Result		82.61% (i.e. cross-validated instances classified. (kappa=0.40< p<0.001)	38/46) of grouped correctly 0.638<0.75;	<b>84.78%</b> (i.e. original group correctly classi (kappa=0.40< p<0.001)	39/46) of ed instances fied. <b>0.685</b> <0.75;	
<sup>a</sup> With cross-validation, each instance (i.e. BPMM) is classified by the rule sets derived from all instances							

<sup>a</sup> With cross-validation, each instance (i.e. BPMM) is classified by the rule sets derived from all instance other than that instance (cfr. leave-one-out validation).

Most interestingly, the main difference between intermediate BPO maturity and BPO maturity can be attributed to the existence or absence of a process-oriented organisational structure in a BPMM (represented by the 'bodies' capability sub area). Together with step 1, we now have empirical evidence of the proposed funnel arrangement among maturity types (BPM < intermediate BPO < BPO), as BPM maturity mainly differs from the other maturity types on cultural sub areas (step 1), while intermediate BPO maturity mainly differs from BPO maturity on a structural sub area (step 2). Hence, by investigating the sequence in which cultural and structural sub areas differentiate the existing business process maturity types, data mining revealed that the organisational structure seems to depend on the organisational culture.

# **Literature Review**

The role of organisational culture and structure in business process maturity is further explored in a literature study. Similar to the previous section, we first examine the differences between BPM maturity and (intermediate) BPO maturity, before examining the differences between intermediate BPO maturity

and BPO maturity.

## BPM maturity versus (intermediate) BPO maturity

The first maturity type is limited to process characteristics, without considering any organisational impact. This cluster conforms to the perspective of BPM studies in the 1990s, as explained in the introduction section, which focused on technical IT-related aspects of business processes, like business process reengineering or modelling workflows. As from the 2000s, the business process literature started to include the organisational context by referring to a holistic or process-oriented organisation (vom Brocke and Sinnl 2011). Both perspectives in the literature justify a meaningful difference between the notions of business process management (BPM) and business process orientation (BPO), and thus between the first maturity type and the other two maturity types.

## Intermediate BPO maturity versus BPO maturity

In order to justify a meaningful difference between the second and third maturity type, we rely on organisation management theories. Prominent studies widely agree that an organisation is affected by its organisational culture, structure, and business processes (Allaire and Firsirotu 1984; Burke and Litwin 1992; Fink et al. 2012; Hatch 1993; Lachman et al. 1994; Marcoulides and Heck 1993; Schein 1985; Waterman et al. 1980; Weiner 2009). The organisational culture is also referred to as the informal structure of an organisation, while the formal structure is represented by (1) the organogram (e.g. with governance bodies and linkages to tell employees to whom they should listen and with whom they should cooperate) and (2) by the business processes (e.g. in diagrams, work procedures and job descriptions to tell employees what they should do) (Visscher and Fisscher 2012). Accordingly, section 2 showed that these key aspects are important capability areas in BPMMs, and distinguish different business process maturity types (Van Looy et al. 2012).

Table 5. An overview of theories on organisational culture and structure.					
Author	Model	Interrelationship			
Waterman et al. (1980)	7-S framework of organisational change	Organisational culture + Structure + Processes			
Weiner (2009)	Theory of organisational readiness for change				
Marcoulides	Model for organisational	Organisational values + Structure + Processes			
and Heck (1993)	performance	$\rightarrow$ Appraisals and rewards + Top management commitment + Attitudes and behaviour			
Allaire and	Conceptual framework of	Organisational culture			
Firsirotu (1984)	organisational culture	$\rightarrow$ Structure + Processes			
Schein (1985)	Levels of organisational culture				
Hatch (1993)	Dynamics of organisational culture				
Lachman et al. (1994)	Theoretical framework for cross- cultural analysis				
Burke and	Causal model of organisational	Organisational culture			
Litwin (1992)	performance and change	$\rightarrow$ Structure + Processes			
		$\rightarrow$ Workgroup culture			
Fink et al.	Configuration model of	Organisational culture			
(2012)	organisational culture	$\rightarrow$ Structure			
		$\rightarrow$ Processes			

Table 5 shows five perspectives on the interrelationship between the organisational culture, structure, and business processes in the organisation management literature. As mentioned in the methodology section, it is based on studies which simultaneously address business processes, the organisational culture and structure, though not necessarily detailing all sub areas of Table 1. Hence, this literature review intends to get acquainted with the possible impact of organisational culture and structure (as main capability areas) on business processes to direct future research.

The first perspective is represented by Waterman et al. (1980) and emphasises interaction between the organisational culture, structure and business processes, without proposing any direction of influence, or *"effective organizational change is really the relationship between structure, strategy, systems, style, skills, staff, and something that we call superordinate goals"* (Waterman et al. 1980, p. 17). Weiner (2009) agrees by asserting that the organisational culture, structure and business processes are contextual factors that (together with past experience and resources) may affect the organisational readiness for change, i.e. by affecting change commitment and perceived change efficacy. The other perspectives supplement this view with some form of causality.

In the second perspective, a distinction is made between the cultural sub areas. Particularly, Marcoulides and Heck (1993) state that the organisational structure and business processes co-exist with organisational values, and together affect appraisals and rewards, and top management commitment (as task organisation). In turn, all aforementioned areas affect attitudes and behaviours (as organisational climate). Attitudes of individual employees are influenced by all cultural sub areas.

The third perspective distinguishes the organisational culture on the one hand from the organisational structure and business processes on the other hand. For instance, Allaire and Firsirotu (1984) argue that the cultural system (i.e. values, myths and ideology) should legitimate the socio-structural system (i.e. with formal policies and strategies, but also structure and business processes), with the socio-structural system supporting and reinforcing the former. Individual employees are affected by both systems. When environmental changes require changes in the socio-structural system, the cultural system will only gradually adapt, resulting in a period of stress. Also Schein (1985) differentiates a cultural layer from a layer with structure and business processes. In his view, culture refers to shared basic assumptions, which are manifested by espoused values (e.g. norms and rules) and realised by visible artefacts (e.g. structure and business processes, among others). Hatch (1993) refines Schein's model by specifying that symbols interpret the basic assumptions, instead of considering them as artefacts. Cultural legitimation is also advocated by Lachman et al. (1994), since embedded cultural values permeate an organisation by its structure and processes. The latter must also adapt to other contextual factors (like scarcity of economic resources) to be effective, but within the legitimised ranges.

The fourth perspective recognises that the notion of 'culture' has different dimensions, and that the cultural environment or context of a particular organisation may consist of different cultures, like an organisational culture, different work group cultures, and national cultures (Leidner and Kayworth 2006; vom Brocke and Sinnl 2011). For instance, the causal model of Burke and Litwin (1992) suggests that the external environment (with national cultures, among others) affects the organisational mission and strategy, leadership (or style) and organisational culture. In turn, they affect the organisational structure, systems (with business processes), management practices, and so the work unit climate (or workgroup culture), individual tasks and skills, and individual values. A combination of these factors will result in motivation, and performance.

The fifth perspective explicitly differentiates the organisational structure from business processes by adding a causal relationship between them. Particularly, Fink et al. (2012) proclaim that the organisational culture affects the organisational strategy, which provides guidance for the organisational structure. The latter is operationalized into organisational behaviour or operations (i.e. business processes). In turn, structures and operations are directly affected by the external environment (e.g. influence from the market, lobby groups or public opinion), while strategies are indirectly affected.

In sum, while Waterman et al. (1980) and Weiner (2009) suggest that the organisational culture, structure and business processes co-exist, various authors claim some causal relationships (Allaire and Firsirotu 1984; Burke and Litwin 1992; Fink et al. 2012; Hatch 1993; Lachman et al. 1994; Marcoulides and Heck 1993; Schein 1985). Particularly, the majority agree that the structure and business processes of an organisation should follow the organisational culture. This finding theoretically explains why Van Looy

et al. (2012) statistically identified a maturity type for culture without structure (i.e. intermediate BPO maturity) and for culture with structure (i.e. BPO maturity), but not for structure without culture among sampled BPMMs. Consequently, the sequence in which both organisational concepts are realised seems to influence the success of process initiatives to some degree (i.e. the expected business process performance or business process maturity). Given these indications, we encourage future research to elaborate on the interrelationships between the capability sub areas of Table 1 in order to build and test a theoretical model.

# Conclusion

This article gave more evidence of the role that a process-oriented organisational culture and structure may have in business process maturity. Besides recognising the importance of both organisational concepts, the study suggested that the sequence in which they are realised matters. Therefore, two approaches were combined that explore the impact of the organisational culture and structure on business processes (i.e. data mining and a literature review). We hereby elaborated on existing business process maturity types: (1) BPM maturity (i.e. with basic capability areas in the process lifecycle), (2) intermediate Business Process Orientation (BPO) maturity (i.e. with basic areas plus culture), and (3) BPO maturity (i.e. with basic areas plus culture).

It turned out that existing BPMMs implicitly suggest an existence dependency among the organisational culture and structure, as data mining confirmed a funnel arrangement among the different maturity types that are measured by these BPMMs (BPM < intermediate BPO < BPO). Particularly, BPM maturity mainly differs from the other maturity types on cultural sub areas, while intermediate BPO maturity mainly differs from BPO maturity on structural sub areas. In other words, cultural sub areas are also substantially covered by BPMMs that were assigned to BPO maturity.

The following literature review continued to focus on the interrelationship between business processes, the organisational culture and structure. According to prominent organisation management theories, changes in the organisational culture should precede changes in the organisational structure and in business processes. This theoretical explanation underpins the related business process maturity types, as none of these existing maturity types combines basic areas in the process lifecycle with merely structural reconfigurations. Particularly, intermediate BPO maturity is limited to cultural changes and BPO maturity combines culture with structure.

Our findings contribute to practice as well as research. Regarding the managerial implications, the findings may help organisations reorganise properly. For instance, organisations that invest in a process-oriented structure, but not in a process-oriented culture, are likely to experience more difficulties in realising their business process initiatives than organisations that do not invest in a process-oriented culture. Similarly, organisations that do not invest in a process-oriented culture or structure are likely to experience more difficulties in realising their business process initiatives than organisations that do not invest in a process-oriented culture, but not in a process-oriented structure. Similarly, organisations that do not invest in a process-oriented culture or structure are likely to experience more difficulties in realising their business process initiatives than organisations that would invest in both concepts. In both cases, the former organisations might get high levels of BPM maturity (if a workgroup culture is process-oriented), but still with low levels of (intermediate) BPO maturity.

For the contribution to academia, this study helped refine a holistic approach in the business process literature by differentiating the impact of the organisational culture and structure on business process maturity. It justified the differences between existing business process maturity types by means of (1) a rule set that can be applied to any BPMM, and (2) organisation management theories which showed that the proposed distinction is legitimate. The paper suggested that the organisational culture should precede the organisational structure, which makes further research worthwhile on different ways to realise process initiatives. A critical view on the paper's research limitations leads to other, interesting research avenues to elaborate on the complexity of this organisational role.

First, we considered organisational theories that explicitly focus on the interrelationship between business processes, the organisational culture and structure. Future research is required to verify whether the proposed sequence of culture preceding structure applies to all cultural and structural sub areas, or whether refinements are needed. As such, insights need to be gained into the degree to which the organisational sub areas are relevant to business process maturity.

Secondly, this paper primarily focused on the organisational culture, while one of the collected theories

also highlighted the importance of workgroup cultures. By recognising different cultures in the organisation, future research could verify whether different problems are encountered between business process initiatives that are realised top-down or bottom-up. For instance, we may expect that the organisational culture is particularly relevant to (intermediate) BPO maturity (which are more related to top-down initiatives), whereas work group cultures are relevant to all the maturity types.

Thirdly, we examined the role of organisational culture and structure in business process maturity, which is an indicator for the expected business process performance. As all business process maturity types (i.e. BPM and (intermediate) BPO maturity) consider the traditional business process lifecycle, the general concept of business process maturity seemed an appropriate and accepted measure for business process initiatives, BPM realisations or BPM success. Previous studies also showed a link between business process maturity and the actual business (process) performance (McCormack and Johnson 2001). Nonetheless, when examining different ways to realise BPM in concrete organisations, future research could also collect actual performance data to complete the research scope. By looking at concrete realisations in organisations, statements may emerge about which maturity type is best suited for which situation. In order to clarify the organisational impact on the business process lifecycle in more detail, future research might also consider the individual sub areas of business process modelling, deployment, optimisation and management.

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