

## PROCESS ARCHITECTURE AS A BPM CRITICAL SUCCESS FACTOR: A Bibliographic Review

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### ABSTRACT

*Process Architecture (PA) has gained importance as a central subject of Business Process Management (BPM) and as one of its critical success factors (CSFs) as organizations develop large collections of business process. The number of publications on the topic of PA in recent years demonstrates its maturity; one example is its appearance as a relevant topic at the BPM Congress in 2013. However, given the great diversity of definitions and considerations in the literature regarding the importance and applications of PA, many of them divergent, a consolidation of the subject is necessary. The objective of this work was to identify in the literature the relevant aspects of PA that contribute to BPM success. The methodology adopted by the authors was a bibliographic review with a search of the terms “Process Architecture” AND “BPM” in the Scopus, ISI Web of Knowledge and Emerald databases, as well as in the Springerlink publishing site. Five relevant PA aspects were found: process hierarchic vision; processes alignment - end-to-end vision; alignment between processes and strategy; alignment between organizational processes and resources; and measuring and change mechanisms. The result of this work could be useful as a guide for BPM professionals in the elaboration and governance of process architectures and collection to verify that they contribute to the success of BPM promotion initiatives. The work participates in the evolution of the subject of BPM because it consolidates the knowledge regarding one of its CSFs: Process Architecture.*

**Keywords:** *Process Architecture, Process Collection, Process Management, BPM Critical Success Factors*

### 1 INTRODUCTION

BPM is a management approach that has matured over time in both theory and practice. Since the appearance of management trends, such as Toyota Production System (TPS), Total Quality Management (TQM), Six Sigma and Business Process Reengineering (BPR), among others, organizations have pursued Process Orientation, creating collections of hundreds or even thousands of business processes that represent the complex system of entities that form an organization (Eid-Sabbagh, Dijkman, & Weske, 2012).

Despite the maturation of the subject of BPM, its rapid expansion into diversified areas and initiatives to consolidate theoretical and practical knowledge, such as the Handbook on Business Process Management (Rosemann & Brocke, 2010a) and the Common Body of Knowledge of BPM (CBOK) (Benedict et al., 2013), there is still short empirical research (PalMBERG, 2010; Smart, Maddern, & Maull, 2009), and there is a lack of analysis and categorization of the efforts of BPM researchers and practitioners (Trkman, 2010). This lack highlights the challenges in developing theoretical concepts of BPM that can be applied practically (Melao & Pidd, 2000).

More than a set of concepts, BPM can be characterized as a continuous life cycle of gradual and interactive integrated activities that include: Business Process Management, Modeling, Analysis, Design, Performance Management, Process Change, BPM Technology (Benedict et al., 2013). BPM promotion initiatives that aim for success must pay attention not only to the activities of each phase of the BPM life cycle but also to the Critical Success Factors (CSFs), or core elements, of BPM (Rosemann & Brocke, 2010b; Smart et al., 2009; Trkman, 2010), (Rosemann & Brocke, 2010b) and (Trkman, 2010).

Process Architecture (PA) is a CSF of BPM (Biazzo & Bernardi, 2003; Burlton, 2001; Hajiheydari & Dabaghkashani, 2011; Rosemann & Brocke, 2010b; Rub & Issa, 2012; Smart et al., 2009), and it is the first step

for an organization that intends to become process oriented (Burlton, 2001; Harrison-broninski, 2010). One of the main definitions of Process Architecture (PA) is “a hierarchical model that shows what the organization does according to a process point of view” (Armistead, Pritchard, & Machin, 1999). Other definitions include the following: a macro-vision of the organization’s process (Bititci et al., 2011), a model that collaborates to align processes and strategy (Harmon, 2010), and a process’s life cycle model (Leu & Huang, 2011), among others. With the intention of collaborate with BPM knowledge consolidation and to help organizations engaged in the practice BPM to be successful, this work aimed to answer the following question: Which are the relevant aspects of PA that contribute to the success of BPM?

The goal of this work was to identify the relevant aspects of PA that contribute to BPM success. The authors performed a bibliographic review (Biolchini, Mian, Natali, & Travassos, 2005) through a systematic search to map the state-of-the-art on the subject, in other words, the set of results from a search on PA in the BPM context that has been communicated to the international scientific community and that is indexed and available in widely recognized scientific databases.

The execution of the work consisted of the following stages:

- Article prospection in journal databases (Scopus, ISI Web of Knowledge and Emerald) and in publishing houses that organize books and conferences with impact in the area (Springerlink) with searching the combination of the terms “Process Architecture” AND “BPM” (122 articles)
- Adoption of exclusion criteria (C): C1 – lack of access to the article (9 articles); C2 – repetition in different databases (9 articles) ; and C3 – does not address the subjects of Process Architecture (17 articles) ; in other words, although it contains the term “Process Architecture” in the text, it appears only in the references or in parts such as “(...) process, architecture (...)”.

## 2 RESULTS AND DISCUSSION

After the search, filtering and application of the exclusion criteria, 87 works were selected. These works were analyzed, looking for the term “Process Architecture,” and 44 works were finally considered for discussion because they addressed PA in the context of BPM and followed the assumption that PA “[...] shows what the organization does according to the processes point of view” (Armistead et al., 1999).

The aspects referring to PA, from its conception to its application, and to its importance were grouped by subject as they appeared in the texts. Five Relevant Aspects (RA) of PA were defined from these groups, which showed convergent and/or complementary points, as shown in Table 1.

The following sections demonstrate the RAs and discuss the findings of the articles analyzed in this study.

### 2.1 RA1 – Processes hierarchical vision

As shown previously, PA demonstrates what the organization does from the perspective of processes (Armistead et al., 1999). This demonstration is a high-level vision and is represented by the management, operational and support macroprocesses (Bititci et al., 2011; Rummler & Ramias, 2010), as demonstrated in Figure 1. Although Dumas et al. (2013b) affirmed that understanding of the first level of the processes is the most important PA definition, it is necessary to be cautious when PA is considered only a high-level vision of the organization’s processes because Ould (1997) already affirmed in 1997 that the designing of a list of an organization’s macroprocesses corresponding to the functional units must be avoided. The author also warned against imagining that such a list would, in some way, represent PA.

Methods for BPM promotion initiatives, such as those presented by Rummler and Ramias (2010) and by Barros (2011), have among their initial phases the elaboration of a PA that shows the organization’s significant macroprocesses, as well as further phases with mechanisms concerned with issues such as hierarchic unfolding and process alignment. This vision coincides with the most common (and broadest) PA definition, that is, a hierarchical model of the organization’s processes (Davies & Reeves, 2010; Pritchard & Armistead, 1999; Scheer & Brabänder, 2010; Smart et al., 2009).

The process’s hierarchical concept can be defined as a macroprocesses, processes, sub-processes, activities and task management models (Smart et al., 2009) or as a process hierarchy with levels starting from Level 0, which represents the organization’s value chain, going to Level 1, where each element of the value chain is divided into a set of processes, which in turn can be divided in other sub-processes, to Level 2, etc., where the vision of macroprocesses, processes and sub-processes will depend on the observer’s point of view (Harmon, 2010).

Antonucci et al. (2009) presented a hierarchical model that, just like PA, showed the unfolding of the processes from the “What” the organization does level to the “How” the organization does level. Similarly, according to Scheer and Brabänder (2010), in addition to describing processes at different detail levels, the hierarchical PA covers other visions directly related to the organization’s processes, starting with a map of the high-level processes, which represent the business’s conceptual vision, to the processes’ detailed flow, which describes specific tasks and their relationships with roles, organizations, data and Information Technology (IT) systems. The authors also affirmed that PA and its related models help to structure the BPM scenario in an organization.

The hierarchical vision also facilitates the incremental creation of PA because PA is not created all at once but rather as investment is justified (Veasey, 2001). It is also not expected that PA will be precisely ready before it is used; in fact, it will never be exact, given the business’s dynamics (Veasey, 2001). Scheer and Brabänder (2010) argued that as a company becomes more process oriented and more mature in the PA of BPM, process hierarchy, guides, standards and conventions must be established. Davies and Reeves (2010) moreover described a case in which the creation of a PA in a hierarchic model, in which the core processes related vertically and horizontally, saved time and resources by avoiding the modeling of all of the variations of the existing processes.

The PA picture must be created from the lowest to the highest level of detail, holistically and across the entire organization (Antonucci & Goeke, 2011). This process is another characteristic of PA: it shows the entire organization from one end to the other (in other words, an “end-to-end” vision). PA takes the form of a collection of processes and the links among them, which provides both a high-level vision and the relationships among the organization’s processes (Dumas, La Rosa, Mendling, & Reijers, 2013a).

## 2.2 RA2 – Alignment between the processes – End-to-end vision

A high-level vision and the hierarchical representation of the processes alone are not sufficient to elaborate a PA and to demonstrate how the organization works (Ould, 1997). Additionally, the PA must represent the business processes and their interrelationships (Castellanos & Correal, 2013; Dumas et al., 2013a, 2013b; Eid-Sabbagh, Dijkman, et al., 2012; Eid-Sabbagh, Kunze, Meyer, & Weske, 2012; Eid-Sabbagh, 2012).

BPM requires a holistic vision of planning, conduction and “end-to-end” process management (Antonucci & Goeke, 2011). Many organizations focus on discreet processes and fail to see the whole picture by creating high-level models with many processes without identifying the physical and information flows of which they consist (Smart et al., 2009). This phenomenon results from a function-oriented approach, in which the managers focus on improving their areas while they worsen the whole, ignoring their peers’ needs and closing their eyes to the proposition of value to the customer (Burlton, 2010). Smart, Maddern and Maull identified the introduction of a language and of key process concepts, such as “end-to-end” thinking and focus on the customer, as the most significant contributions of PA, according to the BPM practitioners in companies. This vision encourages the resources to align their daily activities with the customer’s requirements — an “outside in” vision of the organization.

The company is not merely the sum of its business processes but is also a system of dynamic relationships among the processes that creates value for customers (Beretta, 2002). However, the relationships among processes, many times an ignored aspect, should be addressed by PA (Olbrich, 2010). As companies start to work with PA, they require the means to focus on specific processes and to examine all of the relationships between a given high-level process and all of the other processes associated with it (Harmon, 2010).

Regarding the relationships among processes in the hierarchic model, a usual problem in BPM initiatives is the creation of process models that mix different abstraction levels (Aitken, Stephenson, & Brinkworth, 2010). For this reason, PA must guarantee the consistency of aggregation/disaggregation and generalization/specialization among the process’s hierarchic levels (Heinrich, Henneberger, Leist, & Zellner, 2007), in addition to paying attention to the information flow and triggering relationship dynamics (Eid-Sabbagh, Dijkman, et al., 2012).

It is important to emphasize that PA must also come together with directives and guidelines to manage the complexity of the interactions among the processes (Dumas et al., 2013b; Eid-Sabbagh, Dijkman, et al., 2012; Eid-Sabbagh, 2012) and to guarantee that their collections are consistent and integrated, therefore enabling navigation and the obtaining of process information (Eid-Sabbagh, 2012).

Burlton (2010) complemented this concept by affirming that PA associated with the “end-to-end” vision of the processes helps to unfold strategy from processes at the strategic level, with low degrees of detail and granularity, down to the activity level, with greater detail and granularity.

### 2.3 RA3 - Alignment between processes and strategy

PA is a key element of BPM that collaborates in BPM's strategic alignment (Rosemann & Brocke, 2010b), in other words, PA collaborates directly with the implementation of the organizational strategy because it helps to translate the strategic goals and the stakeholders' intentions (defined at the strategic level) into the criteria to be met by each process (Harmon, 2010).

This translation is a result of PA being linked to the organization's strategic level, a vision initially presented by Armistead, Pritchard and Machin (1999) in their BPM Organizational Framework (Figure 2), which consists of a strategic level (where PA is located), a task level and an integrator.

Similarly, Harmon (2010) reinforced the vision that PA occurs at the organization's strategic level in his BPTrends Associates Pyramid, which is divided into three levels: Enterprise Level, Processes Level and Implementation Level. The PA is one of the elements of its level which addresses general strategic alignment and processes assets management with governance, prioritization and resource allocation for process transformation.

More than helping to align processes with strategy, PA must guarantee that the different organization's capabilities are aligned with each other and together deliver the process's performance according to the strategic goals. In other words, the organization's scarce resources must be allocated as in an orchestra, with value to the customer increased and the stakeholders' requirements met (Burlton, 2010).

### 2.4 RA4 – Alignment between the organization's processes and resources

Another purpose of PA is to show the alignment between processes and the technical and non-technical resources that are responsible for the transformation of inputs into outputs, such as technologies, installations, human resources (HR), policies and business rules (Harmon, 2010; Smart et al., 2009).

Burlton (2010) presented a model in which alignment between PA and resources (HR, IT, Information and others) must occur to keep the strategy's integrity and to conduct the processes in an optimal way (Figure 3).

Although, as previously seen, Rummler and Ramias (2010) showed PA to be a high-level process model, the authors also agreed with the importance of aligning processes and resources, and for that purpose, they presented the Business Process Architecture Detail Chart, a tool that shows which of the organization's functions and systems support the PA processes.

Barros and Julio (2011) affirmed that the most important factor in a PA is the design of the relationships among processes and of the processes with other elements of the organization, in such a manner that they work as a system. For this reason, they presented a PA model that provided alignment among Value Chain, Internal Shared Services, Organization's Capabilities, Business Strategy, Support Processes and External Shared Services.

Among all of the resources to be aligned by PA, two were emphasized in the analyzed literature: the alignment between processes and IT resources in Enterprise Architecture (EA) (Castellanos & Correal, 2013; Gullledge, 2010; Harmon, 2010; Heinrich et al., 2007; Marques, Borges, Sousa, & Pinho, 2011) and Service Oriented Architecture (SOA) (Alt & Puschmann, 2005; Cummins, 2010; Heinrich et al., 2007; Sneed, 2011) and the alignment between processes and human resources (Antonucci & Goeke, 2011; Burlton, 2010; Davies & Reeves, 2010; Harmon, 2010; Kirchmer, 2010; Stephenson & Bandara, 2007; Veasey, 2001; Willaert, Bergh, Willems, & Deschoolmeester, 2007)

### 2.5 RA5 - Measurement and change mechanism

PA can facilitate the improvement and change cycle through hierarchic vision and alignment of the processes, demonstrating the information flows within the business by each process (Biazzo & Bernardi, 2003; Smart et al., 2009). It must also be aligned with performance measurements, alerts, reports, process improvement actions and monitoring, as shown in Figure 4 (Heß, 2006).

Burlton (2010) affirmed that indicators could be defined for each PA process as measuring mechanisms. These indicators must be focused not only on meeting strategic and stakeholders' criteria but also on the value delivered to the customer. For high-level PA processes, one should seek to understand how these processes support the organization's strategic directions and deliver value to the stakeholders, and for these defined KPIs (Key Performance Indicators) (Burlton, 2010; Hee, Schonenberg, Serebrenik, & Sidorova, 2008), the second PA level implements the process's tactical objectives, while the third level shows the process's steps and operational indicators (Hee et al., 2008). It is possible to create metrics from the micro-organizational to the macro-organizational levels using a hierarchical PA (Recker, Rosemann, Hjalmarsson, & Lind, 2012).

An important practical contribution of PA as a change mechanism is that it shows the impact that a change in one process can cause on another and on the organization as a whole (Dumas et al., 2013b). This contribution is a basic mechanism for analyzing process collection and for identifying which processes to prioritize for improvement and automation initiatives, based on their impacts on the organization, the value they add or their critical nature (Burlton, 2010; Dumas et al., 2013b; Harmon, 2010; Rosemann, 2010; Veasey, 2001), in addition reducing complexity in organizational change projects (Baumo, 2010).

Also, the AP can potentiate the implementation of Balanced Scorecard (BSC) (Burlton, 2010) together with BPM considering the relationship between BSC metrics attributed to the functional structure and metrics attributed to business processes (Dumas, La Rosa, Mendling, & Reijers, 2013c), for don't lead to functional bias.

It is important to emphasize that a process and metrics structure alone is not sufficient to promote changes in processes because change occurs in people. For this reason, a shared vision of process orientation, an open discussion culture, tolerance to failure in the creative search of processes improvements, openness to change and knowledge sharing are prerequisites for a PA that delivers value to the organization (Komus, 2011).

### 3 CONCLUSION

This bibliographic review on the subject of PA and the categorization of the results allow the conclusion that the PA concept goes beyond the vision of what an organization does according to the process perspective. It is also a hierarchic process model that contributes to the success of BPM because it guarantees alignment of end-to-end processes with the organization's strategy and of the processes with the resources that support them. Additionally, PA is an important basis for a measurement and change mechanism that can verify how each process meets the strategies, delivers value to customers and attend stakeholders' objectives. It also can help to analyze the impact of improvement projects on processes and on the organization.

This work aimed to contribute to the advancement of the literature through the consolidation of dispersed concepts and applications, therefore arriving close to the state-of-the-art for the subject of PA. Additionally, the results could be a guide for BPM professionals in the elaboration of their Process Architectures, verifying whether they contribute to the success of BPM promotion initiatives.

A limitation of this study was that it only considered works published in scientific databases. It is known that this subject is well disseminated in other sources, such as Web sites and professional communities, so these sources might also contribute to its improvement, considering the large interface between BPM theory and practice. To fill this gap, future research could be undertaken to validate the PA aspects identified by BPM professionals. Additionally, this work identified only a limited number of studies that showed how to create a PA, which suggests the need for more research in this area.

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**TABLES/IMAGES**

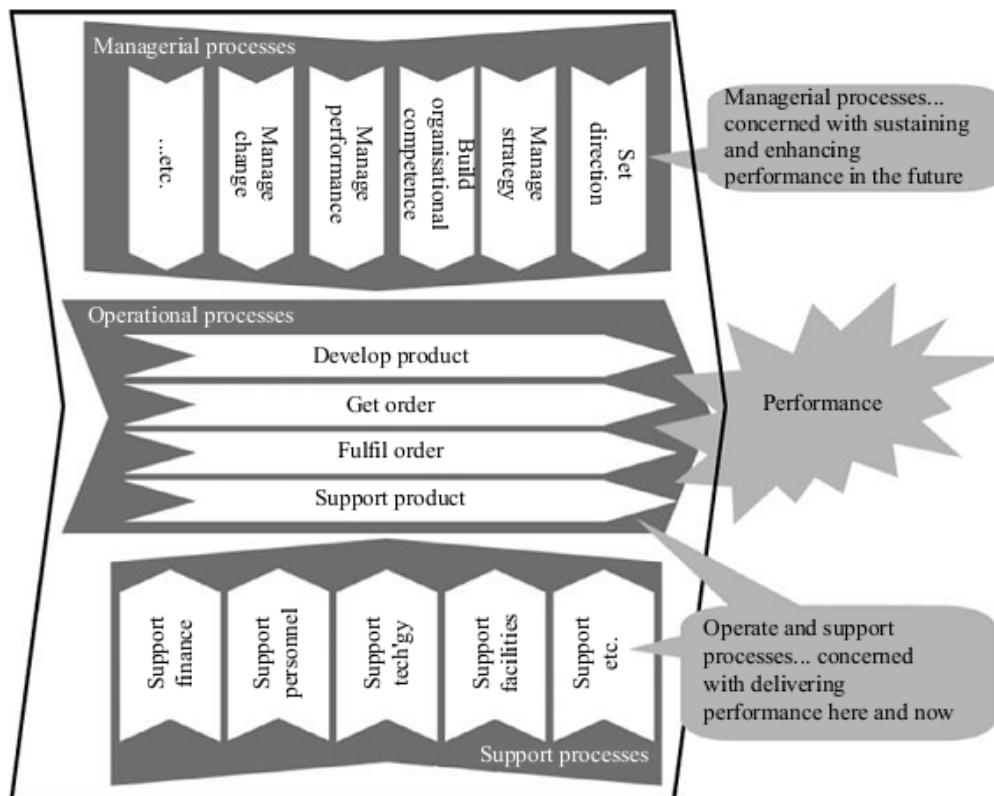
**Table 1.** Relevant Aspects of Process Architecture

PA Relevant Aspects	Characteristics	Authors
RA1 - PA provides a hierarchical vision of the organization’s processes	PA presents a process hierarchical model that starts from the top, showing “what” the organization does and its value chain, to the bottom, showing “how” the organization executes it and its operational and support processes.	(Antonucci & Goeke, 2011), (Hee et al., 2008), (Davies & Reeves, 2010), (Scheer & Brabänder, 2010), (Harmon, 2010), (Smart et al., 2009), (Bititci et al., 2011), (Rummler & Ramias, 2010), (Dumas et al., 2013b)
RA2 - PA demonstrates the relationships between processes	PA shows the “end-to-end” processes relationships between the different hierarchic levels and functional areas with a focus on the customer’s standpoint.	(Ould, 1997), (Antonucci & Goeke, 2011), (Beretta, 2002), (Veasey, 2001), (Sanz et al., 2012),



		(Eid-Sabbagh, Kunze, et al., 2012), (Eid-Sabbagh, 2012), (Rummler & Ramias, 2010), (Eid-Sabbagh, Dijkman, et al., 2012), (Burlton, 2010), (Dumas et al., 2013a), (Dumas et al., 2013b), (Dumas et al., 2013c), (Heinrich et al., 2007), (Harmon, 2010), (Olbrich, 2010), (Smart et al., 2009)
RA3 - PA collaborates in aligning the organization's processes and strategy	PA shows how strategic and valuable objectives for customers and stakeholders are folded into day-to-day actions in all of the processes.	(Pritchard & Armistead, 1999), (Antonucci & Goeke, 2011), (Dumas et al., 2013c), (Harmon, 2010), (Armistead et al., 1999), (Rosemann & Brocke, 2010b)
RA4 - PA shows the organization's process and resource alignment	PA shows which of an organization's resources support the business's processes.	(Smart et al., 2009), (Harmon, 2010), (Burlton, 2010), (Rummler & Ramias, 2010), (Barros & Julio, 2011)
	Alignment between processes and IT: PA is the center of EA because it helps to align business processes, information, applications and IT infrastructure. It also facilitates SOA because it collaborates in identifying customer-oriented shared services.	(Alt & Puschmann, 2005), (Barros & Julio, 2011), (Antonucci & Goeke, 2011), (Bucher, Gericke, & Sigg, 2009), (Beretta, 2002), (Barros et al., 2011), (Ould, 2003), (Sanz, Fellow, & Zhao, 2011), (Marques et al., 2011), (Cummins, 2010), (Burlton, 2010), (Sneed, 2011), (Gulledge, 2010), (Harmon, 2010), (Joosten, 2000), (Smart et al., 2009)
	Alignment between processes and HR: PA defines a governance structure with process owners and other aspects, such as positions, salaries, required competencies	(Barros & Julio, 2011), (Antonucci & Goeke, 2011), (Veasey, 2001),

	and the training associated with each process	(Doebeli, Fisher, Gapp, & Sanzogni, 2011), (Burlton, 2010), (Kirchmer, 2010), (Willaert et al., 2007), (Harmon, 2010), (Smart et al., 2009)
RA5 - PA collaborates in creating a process-oriented measurement and change mechanism	PA defines the indicators for each process, and through the vision of the relationships between processes, it allows for the measuring of the impact of one process on the others and on the organization. This ability helps to analyze which processes should be the targets of change projects.	(Biazzo & Bernardi, 2003), (Stephenson & Bandara, 2007), (Hee et al., 2008), (Baumo, 2010), (Burlton, 2010), (Komus, 2011), (Recker et al., 2012), (Heß, 2006), (Dumas et al., 2013b), (Dumas et al., 2013c), (Rosemann, 2010), (Smart et al., 2009)



**Fig. 1.** Performance and Process Architecture (Source: (Bititci et al., 2011))

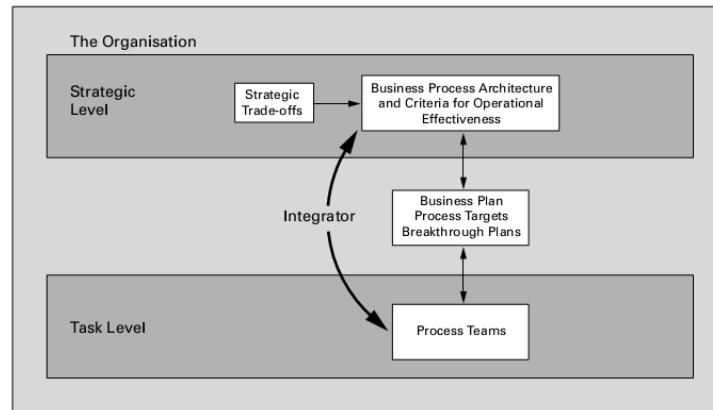


Fig. 2. BPM organizational framework (Source: (Armistead et al., 1999))

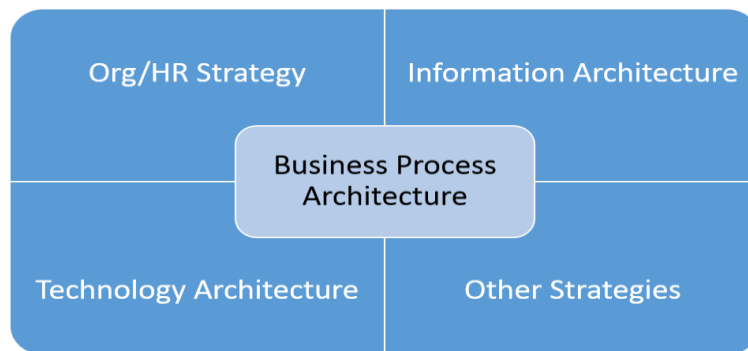


Fig. 3. Strategy integrity model (Source: Adapted from Burlton (2010))

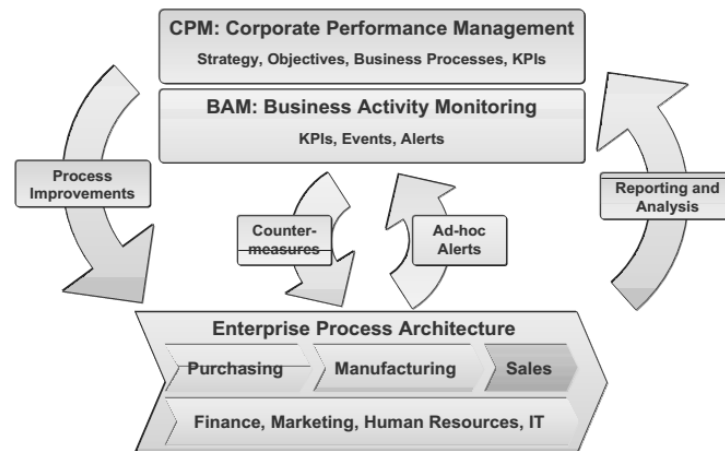


Fig. 4. Short- and medium-term improvement cycle (Source: : (Heß, 2006))