An Empirical Investigation of Operational Business Intelligence Perspectives to Support an Analysis and Control of Business Processes

Tom Hänel
TU Bergakademie Freiberg
tom.haenel@bwl.tu-freiberg.de

Carsten Felden
TU Bergakademie Freiberg
carsten.felden@bwl.tu-freiberg.de

Abstract
Operational Business Intelligence (OpBI) supports an analysis and control of business processes by an integration of information systems (IS) from a technical and business perspective. However, determinants of IS integration for OpBI are not systemized by a theoretical basis, yet. This leads to problems in identifying generic benefits and obstacles of OpBI according to company strategies and market environments. Therefore, the paper proposes a multi-theoretical framework using dynamic capabilities, organizational information processing, process virtualization, and work system theory. A survey with a sample of 109 companies provides empirical evidence. The findings include implications for theory and practice with an interest in an OpBI-reliant analysis and control of business processes.

1. Introduction

The analysis and control of business processes is determining the competitiveness of organizations. This facilitates a consideration of and a reaction to changing influencing factors on the organizational business processes. Approaches to integrate IS and, due to this, a technical and a business perspective are seen as beneficial to analyze and control business processes [1]. OpBI is a recent example for an IS-driven integration as it concerns a decision-making to improve business processes by analyzing daily updated data [2]. Thereby, a reinforced IS integration of business process information leads to a higher efficiency in terms of business process improvement [1], [3]. It is already stated that the efficiency of IS concepts is conditional and depends on strategic considerations in line with surrounding market conditions [4]. The explanation of influencing factors on IS-driven integration gains insights to justify a choice or a rejection of a concept like OpBI based on a particular organizational strategy. This demands the need to examine and discuss different perspectives on an IS-driven integration of technical and business aspects to analyze and control business processes. This paper’s goal is therefore to explain the integration requirements of OpBI for an analysis and control of business processes.

The literature about OpBI encompasses predominantly case studies [5]–[11] and occasional theoretical considerations [7], [12]. However, the literature neither discusses nor clarifies OpBI for the purpose of analyzing and controlling the performance of business processes. This makes it rather impossible to gain general knowledge out of research findings of previous OpBI applications. However, such a discussion is important to validate benefits or obstacles of IS integration aspects for OpBI. The validation of such aspects is interesting to build in particular strategies for business process improvements. We address this research gap by introducing a theoretical model to examine the dependent variable of IS integration for OpBI to be able to analyze and control business processes. We contribute to research with an empirical investigation of 109 process oriented organizations. This provides a theoretical fundament for the field of operational decision making by a novel combination of dynamic capabilities, organizational information processing, process virtualization, and work system theory. This basis can be used to study the analysis and control of business processes by OpBI in general and to distinguish OpBI from other process oriented decision support concepts, like business process intelligence [13].

The paper discusses at first the need of IS integration for OpBI to analyze and control business processes. Then, we present a research model to explain this phenomenon by the use of stated theories. Next, the paper describes the results of a cross-sectional survey including a partial least squares (PLS) analysis of the research model. The findings are discussed and summarized in the concluding sections.

2. Status quo

The context of our study addresses three research areas (cf. Figure 1). These areas cause a following discussion and a choice of findings from previous studies. An integration of IS to combine technical and business perspectives in organizations as well as a
business process coordination and improvement was mainly discussed in the 1990s. A consideration of OpBI requires a new investigation.

Figure 1. Research areas

2.1. The need of IS integration for OpBI to analyze and control business processes

The coordination and improvement of business processes mentioned in Figure 1 has a reference to the value chain discussion [14]. A value chain is understood as an interrelated system of different core and supporting activities [15]. The management of business process information and operational performance is a beneficial strategy to organize the activities of the value chain efficiently [14]. This can be guided by steps to analyze and control process information [16]. The relevance of such a closed loop of analysis and control manifests itself in methods to improve business processes like six sigma [17]. A critical success factor for such a process improvement is an effective use of information technology (IT) [16]. Already [15] discussed that value activities always have an information processing component. This role of IT is still emphasized in recent concepts like e³-value [18]. The efficiency of IT to manage business processes gains thereby evident benefits from a comprehensive IS integration [3]. Consequently, methods for process improvements require an integrative IT-based approach for a closed loop analysis and control of business processes [14].

OpBI is related to the coordination and improvement of business processes (cf. Figure 1). The reason for this relation is the concern of OpBI to analyze the efficiency of daily business processes and to control actions of process improvement. OpBI integrates analytical information and business processes through an application of common BI functionalities. [2] The inherent IS integration of these BI functionalities [19] is used for an analysis and control of business processes. These integration efforts are beneficial on an operational level in order to improve business processes [20].

2.2. Related studies

A structured literature review reveals that the mentioned integration capability of OpBI is often investigated by case studies. There are cases in manufacturing [5], [10] and in service provision [6], [11]. From another point of view, the success of process improvements depends on a systemic and holistic understanding of organizations. Such systematizations are achievable with theories [21]. However, theoretical investigations regarding to OpBI are rare. Previous studies do not intend to explain determinants of IS integration for OpBI to analyze and control business processes. The framework of [7] discusses a theoretical integration of BI and business process management (BPM) to support knowledge-intensive processes. This framework has been used for empirical case studies in service organizations [8], [9]. Another study of [12] considers strategic and operational BI capabilities combined in a theoretical model to explain an incremental BI-driven service innovation and its performance impacts.

Related topics to OpBI are business process intelligence (BPI) [22] and process centric BI (PCBI) [23]. PCBI concerns a process execution and considers analytical information in order to support the fulfillment of process related tasks. The study of [23] clearly distinguishes PCBI from using BI to analyze and control business processes. BPI supports strategic and tactical management decisions about a process design or redesign [22]. According to [22] the use of BPI can be investigated by multiple theories. The proposed approach is however not verified. Moreover, the verification approach refers to a mix of empirical and qualitative research actions. The findings of [22] are therefore not easily transferable in the hitherto discussed OpBI context.

3. Research model and hypotheses

We propose a multi-perspective consideration to explain OpBI in terms of analyzing and controlling business processes. This is reasonable due to the suitability of multiple theoretical frameworks to explain complex relationships [24]. Such a complexity is evident for relationships between IS integration and management control [25], which is in particular the field of an OpBI's decision-making. An inherent complexity is also regarded with BPM [26], which is addressed by OpBI [9].

3.1. Preliminary considerations

We are going to combine four theories to explain an IS integration in context to OpBI, i.e. dynamic capabilities, organizational information processing, process virtualization, and work system theory. These theories seem to be vaguely related at a first glance. However, the relation can be drawn due to the
organizational application context of OpBI. Object of OpBI’s interest is the performance of business processes. Performance indicators are measured by analytical models and systems. The analysis results are input for operational decisions to configure actions for a coordination and improvement of business processes.

Hence, OpBI addresses the change of organizational processes, which is a core issue of dynamic capabilities [27]. OpBI provides analytical capabilities to process and communicate information about processes. These are key issues of organizational information processing, which argues that certain organizational design strategies can improve company performance [28]. The analysis and control of business processes with OpBI is an IT-driven approach to collect, transform and communicate information. Such IT capabilities are understood as a main driver and enabler for process virtualization [29]. Thus, a business process needs to be at least partially amenable to virtualization so that a concept like OpBI is generally able to achieve a support in this context. Due to the mentioned information processing capabilities, OpBI can be understood as an IT-reliant work system [30]. Therefore, the dynamic view of how a work system evolves over time is transferrable to OpBI.

The following specifies the preliminary considerations for each theory and derives hypotheses on this basis. This serves as a foundation to confirm or falsify the presented arguments.

3.2. OpBI and dynamic capabilities

The theory of dynamic capabilities argues that the achievement of competitive advantages does not depend solely on valuable and rare resources. The resource-based view is extended by a consideration of changing environments. Dynamic capabilities concern the management of competencies in order to buffer change effects on the resources of an organization. Such capabilities require management skills and knowledge to enable the coordination of organizational activities and the usage of firm-specific assets. Dynamic capabilities are referred to organizational routines such as quality assurance or system integration.[27]

Research studies discuss dynamic capabilities within the concurrence of IT capabilities, business process orientation and organizational performance [31], [32]. For example, [32] clarifies the link between operational and dynamic capabilities by examining the impact of organizational knowledge on operational capabilities.

The characteristics of dynamic capabilities are attributable to IS, if they influence the development, integration and release of an organization’s key resources [33]. As an analysis and control of business processes impacts such key resources [17], dynamic capabilities affect the OpBI’s IS integration efforts. Therefore, we examine this relationship by the following hypothesis:

H1: Dynamic capabilities are positively associated with IS integration for OpBI to control and analyze business processes.

3.3. OpBI and organizational information processing theory

The organizational information processing theory discusses aspects of organization design to ensure effective and efficient operations. The theory assumes that an increased uncertainty of task execution is associated with an increased amount of information to be processed during a task oriented decision making. In order to handle such uncertainties, organizations can reduce the need for information processing or they can increase the information processing capacity.[28]

From the beginning of the discussion about BI, the ability of information processing is inherent for BI systems [34]. Information processing networks provide decision making individuals with information to deal with decision situations [35]. The analysis and control of business processes is an example for the decision making needs to be fulfilled by BI capabilities. BI facilitates information processing capacities, but this requires a high quality communication of the corresponding system components [36]. Information processing capacities and needs are thereby discussed in context of BI success [37]. An enhancement of information processing capabilities and a reduction of information processing needs become evident in this discussion. Thus, we hypothesize the following relationships between the OpBI’s IS integration and the design strategies of organizational information processing theory:

H2a: “Information processing needs” is negatively associated with IS integration for OpBI to control and analyze business processes.

H2b: “Information processing capacities” is positively associated with IS integration for OpBI to control and analyze business processes.

3.4. OpBI and process virtualization theory

Process virtualization theory argues that physical interaction between people and objects of business processes are replaced through virtual means. The
transition from physical to virtual is regarded as process virtualization. However, not every business process is equally suited to a virtual process environment. The theory proposes main constructs of process virtualization. These are requirements with a counteractive impact on process virtualization, so that a high requirement specification leads to a low possibility of process virtualization. This effect of the main constructs is influenced by moderating constructs of process virtualization. These moderators refer to IT characteristics, which positively affect the relation between the main constructs and the process virtualization. [29]

Process virtualization theory is discussed by application scenarios in electronic commerce [39] or in the public sector [40]. However, there is evidence for an explanation potential of business process analysis and control. [13] discuss aspects of virtualization in BPM systems and BI to enable a management of processes by analysis, prediction, monitoring, control, and optimization. The creation of a virtual value chain allows a consideration of efficiency and effectiveness indicators for physical operations, but this is associated with information integration over the whole value chain [41]. According to this, virtualization entails integration efforts and is relevant for an analysis and control of business processes by OpBI. These efforts are likely to increase in context of diminishing possibilities for process virtualization. Therefore, we hypothesize in context of process virtualization and IS integration for OpBI:

**H3a:** Process virtualization requirements are positively associated with IS integration for OpBI to control and analyze business processes.

**H3b:** The process virtualization moderators counteract the effect of process virtualization requirements on IS integration for OpBI to control and analyze business processes.

### 3.5. OpBI and work system theory

A work system consists of participants (human, machines), information, technology, and business processes, in order to perform work. The aim of this system is the provision of products and services for internal or external customers. Value chains and information systems are considered as special forms of work systems. The existence of a work system is time-dependent. A work system life cycle allows a dynamic view on changes of work systems over time. This model is iterative and considers planned and unplanned changes. The initial point for change decisions is the operation and maintenance of work systems. This phase includes the monitoring of work system performance, the identification and correction of flaws as well as improvement activities. [30]

The analysis and design of work systems requires the awareness of methods for process and data analysis to monitor and improve operational business processes [42]. Decision making capabilities, like the analysis and control of business processes by OpBI, need to be incorporated into organizational work systems in order to implicate certain benefits [43]. Hence, changes on work systems are likely to affect corresponding decision-making infrastructure. These are the characteristics of IS integration for OpBI in context of the analysis and control of business processes. Thus, we hypothesize:

**H4:** Work system change is positively associated with IS integration for OpBI to control and analyze business processes.

Figure 2 joins the used theories and shows the research model considering the developed hypotheses and their effect on IS integration for OpBI to analyze and control business processes.

![Figure 2. Research model](image)

### 4. Research Method

We conducted an empirical study to test our hypotheses. A survey for process-oriented companies was set up to explore the requirements for an analysis and control of business processes. The preparation of the survey instrument referred to literature about the stated theories as well as to empirical studies about BI, BPM and performance management. The initial version of the survey has been pretested by academics and practitioners with expertise in BI and BPM. Based on the answers of 65 respondents, we were able to redefine the survey instrument. Redundancies were condensed and incomprehensibilities were rephrased. We could also improve the survey structure and format-specific issues.
4.1. Data collection

Data were collected online in the second half of 2013. A survey invitation was emailed to more than 600 companies out of different industries. Contacts were identified by browsing panels and discussion groups regarding BI and BPM in databases of economic development councils, trade directories and social networks like LinkedIn or Facebook.

256 participants joined the survey and we received 109 completed surveys, which is a completion rate of 42.48%. Table 1 summarizes the general facts of the respondents and illustrates an industry classification.

4.2. Operationalization of constructs

The survey combines reflective and formative constructs. The constructs were operationalized by items based on the literature about the underpinning theories and IS integration. The survey instrument encompasses 24 items. The measurement of the items refers to a six-point Likert scale ranging from (1) strongly agree to (6) strongly disagree [44]. In the following, we discuss the development of the items.

4.2.1. IS integration for OpBI to analyze and control business processes. This construct encompasses five reflective items. The data integration, functional unit integration, and process integration are used to capture areas of IS integration [1], [3], [45]. Furthermore, the direction of information flows is considered by a horizontal and a vertical information structure of firms in order to coordinate operational decisions [46], [47].

4.2.2. Dynamic capabilities. Dynamic capabilities are reflected by three items, which consider the integration, building, and reconfiguration of internal and external competencies. Integration addresses the coordination of specific organizational routines and emphasizes external factors characterized by strategic alliances, networks or technology collaborations. Learning means a combination of individual and organizational skills to generate knowledge to advance organizational routines and to allow an inter-organizational learning. A reconfiguration and transformation of organizational assets is associated with a surveillance of markets and technologies as well as an adoption of best practice. [27]

4.2.3. Process virtualization requirements. The process virtualization requirements are measured reflectively by sensory relationship, synchronism as well as identification and control requirements. Sensory requirements depend on the need to taste, see, hear, smell, or touch objects or participants during a process including the overall sensation felt in the engagement of processes. Relationship requirements illustrate the need for social or professional interaction of process participants. Synchronism refers to delays between process activities. A need for minimal delays leads to high synchronism requirements. Identification and control requirements consider the ability to identify process participants and to control their behavior. [29]

4.2.4. Process virtualization moderators. The measures of the process virtualization moderators refer to IT characteristics of representation, reach and monitoring capability. Representation refers to relevant information about characteristics of processes and about interactions between process participants and objects. Reach facilitates a participation in processes independent of time and space. Monitoring capabilities allow the authentication of process participants and the tracing of process activities. [29]

4.2.5. Information processing needs. Information processing needs is a formative construct. Slack resources encompass the increase of financial budgets and the consideration buffers for completion times or inventories. The creation of self-contained tasks changes business units to output-based entities with its own authority structure and decentralized information systems. [28]

4.2.6. Information processing capacities. Information processing capacities is a reflective construct. Vertical information systems provide capabilities for a
situational planning based on current requirements and a frequent decision-making. Lateral relations concern an establishment of communication channels to align the level of decision-making to information requirements of managerial tasks. [28]

4.2.7. Work system change. Work system change is a formative construct. The work system lifecycle model forces decisions about the existence and enhancement of a work system during operation. This can be a redesign according to a standardized procedure, a continuous improvement or a termination, if the work system and its components do not lead to valuable benefits anymore. [30]

4.3. Data analysis

We use Partial Least Squares (PLS) to test our research model. This structural modeling approach is adequate for small sample sizes and it allows a consideration of formative constructs [48]. The model evaluation is done with the SmartPLS software package including a PLS algorithm as well as methods for bootstrapping and blindfolding [49].

The evaluation of the measurements follows the rules of thumb and remarks to PLS according to Hair et al. [50]. Therefore, we determined the internal consistency reliability (ICR), indicator loadings, the average variance extracted (AVE) and the discriminant validity for the reflective measures (cf. Table 3).

Table 3: Evaluation of reflective measures

<table>
<thead>
<tr>
<th>Item</th>
<th>DC</th>
<th>ISI</th>
<th>IPC</th>
<th>PVR</th>
</tr>
</thead>
<tbody>
<tr>
<td>AVE</td>
<td>0.54</td>
<td>0.57</td>
<td>0.70</td>
<td>0.52</td>
</tr>
<tr>
<td>ICR</td>
<td>0.78</td>
<td>0.87</td>
<td>0.82</td>
<td>0.75</td>
</tr>
<tr>
<td>CROSS LOADINGS</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Integration</td>
<td>0.722</td>
<td>0.316</td>
<td>0.213</td>
<td>0.278</td>
</tr>
<tr>
<td>Building</td>
<td>0.685</td>
<td>0.320</td>
<td>0.190</td>
<td>0.362</td>
</tr>
<tr>
<td>Reconfiguration</td>
<td>0.793</td>
<td>0.310</td>
<td>0.194</td>
<td>0.176</td>
</tr>
<tr>
<td>Data integration</td>
<td>0.280</td>
<td>0.763</td>
<td>0.300</td>
<td>0.489</td>
</tr>
<tr>
<td>Function integration</td>
<td>0.384</td>
<td>0.815</td>
<td>0.407</td>
<td>0.495</td>
</tr>
<tr>
<td>Process integration</td>
<td>0.378</td>
<td>0.782</td>
<td>0.421</td>
<td>0.398</td>
</tr>
<tr>
<td>Horizontal integration</td>
<td>0.237</td>
<td>0.776</td>
<td>0.410</td>
<td>0.423</td>
</tr>
<tr>
<td>Vertical integration</td>
<td>0.337</td>
<td>0.622</td>
<td>0.373</td>
<td>0.391</td>
</tr>
<tr>
<td>Lateral relations</td>
<td>0.207</td>
<td>0.515</td>
<td>0.921</td>
<td>0.372</td>
</tr>
<tr>
<td>Vertical IS</td>
<td>0.276</td>
<td>0.300</td>
<td>0.745</td>
<td>0.316</td>
</tr>
<tr>
<td>Sensors</td>
<td>0.163</td>
<td>0.316</td>
<td>0.284</td>
<td>0.694</td>
</tr>
<tr>
<td>Synchronization</td>
<td>0.379</td>
<td>0.583</td>
<td>0.348</td>
<td>0.885</td>
</tr>
<tr>
<td>Identification and control</td>
<td>0.202</td>
<td>0.274</td>
<td>0.249</td>
<td>0.532</td>
</tr>
<tr>
<td>CORRELATION MATRIX</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DC</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ISI</td>
<td>0.431</td>
<td>-</td>
<td></td>
<td></td>
</tr>
<tr>
<td>IPC</td>
<td>0.272</td>
<td>0.509</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>PVR</td>
<td>0.372</td>
<td>0.585</td>
<td>0.410</td>
<td>-</td>
</tr>
</tbody>
</table>

Table 3 summarizes the evaluation of the reflective measures, which comply to the PLS conditions. The ICR values are higher than 0.7 and the AVE of each construct is higher than 0.5. The requirements for discriminant validity are also fulfilled. The highest squared correlation with any other latent construct (0.342) is less than the calculated AVE of the constructs, and the indicator loadings are higher than their cross loadings. The indicator loadings should be higher than 0.7, which is achieved for 9 indicators. We could also consider loadings above 0.5, because the ICR values exceed the suggested threshold values [50].

The evaluation of formative measures includes an examination of the indicator weights. We used the method for bootstrapping with 5000 samples to assess the significance of the indicators. The critical t-value was 1.65 to achieve a significance level of 10 percent. We calculated the variance inflation factor (VIF), which has to be less than 5 for each indicator to avoid multi-collinearity. Table 4 indicates that these conditions are met for our formative constructs.

Table 4: Evaluation of the formative measures

<table>
<thead>
<tr>
<th>Item</th>
<th>Weight</th>
<th>t-value</th>
<th>VIF</th>
</tr>
</thead>
<tbody>
<tr>
<td>WSC</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Termination</td>
<td>0.413</td>
<td>1.871*</td>
<td>1.20</td>
</tr>
<tr>
<td>Continuous improvement</td>
<td>0.475</td>
<td>1.889*</td>
<td>1.25</td>
</tr>
<tr>
<td>Redesign</td>
<td>0.499</td>
<td>2.118**</td>
<td>1.05</td>
</tr>
<tr>
<td>IPN</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Slack resources</td>
<td>0.925</td>
<td>4.059***</td>
<td>1.04</td>
</tr>
<tr>
<td>Self-contained tasks</td>
<td>-0.641</td>
<td>2.076**</td>
<td>1.04</td>
</tr>
</tbody>
</table>

The evaluation criteria for the research model are the R² value, the Q² value and the significance of our path coefficients. Figure 3 illustrates the results of the model evaluation.

Our R² value indicates that the model explains 49 percent of the dependent construct variance. This leads to a reasonable certainty, because R² values of 0.67, 0.33, and 0.19 can be considered as substantial, moderate, and weak [48]. The Q² value is larger than zero. This indicates the predictive relevance of the
exogenous constructs on information systems integration for OpBI to analyze and control business processes. The effect of dynamic capabilities is positive on a significance level of five percent. This supports H1. The path for reduction of information processing needs is insignificant and indicates a marginal effect on the information systems integration for OpBI. This confutes H2a, while H2b is supported. The structural model shows a positive effect for the information processing capacities, which is significant at a level of one percent. The process virtualization requirements contribute strongest to information systems integration, supporting H3a. This factor has a path coefficient of 0.372 on a one-percent significance level. The hypothesis on work system change is also not supported. The effect is weak with a value of 0.99, and the path coefficient with a t-value of 1.466 only achieves a significance level of less than 20 percent.

In order to test hypothesis H3b, we used the parametric approach for multi-group analysis [51]. We calculated the mean of the process virtualization moderators and used the median of these values (2.33) to split the original data in two groups. Response sets with a mean below 2.33 were grouped with high pronounced moderators and sets with a mean above 2.33 with low pronounced moderators. Response sets with a mean of 2.33 were equally distributed to both groups. The bootstrapping method was applied to each of the new data sets. Table 5 summarizes the results of the multi-group analysis.

<table>
<thead>
<tr>
<th>Table 5: Multi-group analysis results</th>
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<tbody>
<tr>
<td>High pronounced moderators (49 samples)</td>
</tr>
<tr>
<td>PVR -&gt; ISI</td>
</tr>
<tr>
<td>Path coefficient</td>
</tr>
<tr>
<td>PVR -&gt; ISI</td>
</tr>
</tbody>
</table>

The difference of the path coefficients is 0.16. High pronounced moderators seem to reduce the effect of the process virtualization requirements. However, this moderating effect is not significant. We calculated a t-value [52] of 0.88, which is far away from the critical t-value of 1.65. For this reason, we cannot support the hypothesis H3b with regard to the moderating effect in context of process virtualization.

5. Discussion and implications

This study explains the IS integration for OpBI in order to analyze and control business processes. We applied a research model that considers the four theories of dynamic capabilities, organizational information processing, process virtualization, and work systems to examine different perspectives on business process coordination and improvement. We found out that the analysis and control of business processes is influenced by dynamic capabilities, information processing capacities and process virtualization requirements. Aspects of information processing needs, process virtualization moderators and work system change are secondary in this context. The following presents the key observations regarding a business process analysis and control.

5.1. Implications from dynamic capabilities

Dynamic capabilities have a significant relationship with IS integration. This result shows that changing environment conditions are associated with integration efforts in order to analyze and control business processes. The need to react fast and flexible on changes to achieve competitive advantages requires a comprehensive view on the organizational value chain. The high load on the reconfiguration item emphasizes this aspect also during the model evaluation. Hence, flexibility and readiness for changes do not act as opponent to the integration of data, functions and processes along the value chain and among the value activities. The impact of a dynamic management of internal and external competencies in process-oriented organizations depends on the possibility to identify leverage points for changes and to bring them into action. This justifies and confirms the relevance of an analysis and control of business processes by OpBI.

5.2. Implications from organizational information processing

The concepts of information processing needs and information processing capacity have a different relationship with business process analysis and control. The concept of information processing needs does not seem to be a suitable perspective to explain the IS integration for OpBI to analyze and control business processes. A reason can be seen in inconsistencies of the construct weights. Both are significant, but their relative importance has different signs. According [28], both indicators should have a positive importance for information processing needs. This is only evident for the aspects of slack resources. Organizations seem to consider buffers for completion times or budgets in their processes. However, the creation of self-contained tasks plays only a tangential role and is not estimated as a beneficial design strategy. Likely, the building of output-based business units can be difficult,
because changes on the service or product portfolio would constantly restructure these autonomous units.

Information processing capacity is significantly related to the analysis and control of business processes and the associated integration efforts. An improved utilization of organizational communication channels is positively associated to IS integration and advances therewith an analysis and control of business processes. Such capabilities refer to IT for a connection of transactional and decision-oriented systems. Additionally, information processing capacity focuses on organizational aspects to enable a comprehensive information flow between decision makers. The effect in the structural model indicates that these capacities are relevant and beneficial for an analysis and control of business processes.

5.3. Implications from process virtualization

In context of business analysis and control, IS integration highly depends on the characteristics of a process-oriented organization. This confirms the significant effect of the process virtualization requirements. Synchronism has the highest importance in the structural model followed by sensory requirements. Hence, the analysis and control of business processes depends on a high degree on the characteristics of the products or services and the need to schedule process activities with minimal delays. The importance of the identification and control requirements is not as highly pronounced in the structural model. These requirements are likely to be more homogeneous for business processes and seem to depend not to such a high degree on organization specifics as sensory or synchronism requirements. Relationship requirements could not achieve enough importance for consideration in the structural model. Physical interactions between process participants are likely to be unimportant, since IT and communication techniques support the communication within and among organizations.

The process virtualization moderators do not significantly counteract the effect of the synchronism, sensory, and identification and control requirements on IS integration. This observation is surprising, because this is contrary to the origin of process virtualization theory [29]. It is questionable if a consideration of a larger sample size can lead to a necessary doubling of the t-value in order to achieve an adequate significance level. Organizations obviously use IT to manage and perform their processes. Therefore, possibilities to gain benefits from the IT’s representation, reach, or monitoring capability are available. The distinct missing significance indicates that the impact of IT on business process analysis and control depends on the design and use in specific cases rather than on a simple availability.

5.4. Implications from work systems

Work system change is not significantly related to IS integration for OpBI to analyze and control business processes. This finding can be reasoned by case specifics of organizational work systems. However, the weights of the construct items are above 0.4 and positive. This indicates that the decision alternatives to change and advance work systems have an importance for process-oriented organizations. Therefore, a larger sample size or a concentration on certain industries could be an opportunity to further investigate this relationship of work system change on business process analysis and control.

6. Conclusions

The practical effect of an analysis and control of business processes by IS-driven integration approaches such as OpBI depends on factors, which characterize the insider’s and outsider’s view on organizations. A positioning in changing market environments increases the relevance of operational decision making concepts like OpBI. The same effect comes along with strategic considerations to create complex services or products in highly interconnected process organizations. An analysis and control of business processes benefits from capabilities ensuring a convenient information flow through adequate communication channels.

The multi-theoretical framework and its empirical validation allow general implications among which conditions OpBI is able to support an analysis and control of business processes. This enhances case-specific applications of OpBI. The paper proposes a unique consideration of four theories to explain the role of IS integration in a context of business process coordination and improvement. This provides interesting theoretical findings to examine the interactions of business processes, IT-driven decision-making and organizational performance. These insights are also worthwhile to evaluate the adequacy of OpBI in a practical context. However, the validation of the research model indicates insignificances for the perspectives of work system change, information processing needs and IT characteristics moderating the influence of process virtualization requirements. Especially in context of work system change, a larger sample size can face this limitation. Furthermore, the choice of a multi-theory approach limits the opportunity for a highly detailed operationalization, which overwhelms survey respondents and reduces the
probability of a high number of completed response sets. However, common quality criteria for structural PLS models are met in our research study so that the resilience of the results is confirmed.

Further research activities should investigate the single influence of the presented theory perspectives on OpBI with detailed measurement instruments. This will extend the theoretical knowledge about OpBI to analyze and control business processes. Furthermore, studies which confute the practical effect of an analysis and control of business processes by IS-driven integration approaches are of interest. Such knowledge beyond decision-making benefits enables a more particular discussion of conditions and obstacles of concepts like OpBI for a coordination and improvement of business processes.

7. References


