The Development of IT Business Alignment and Usage Patterns Over Time in SME: A Longitudinal Case Study

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THE DEVELOPMENT OF IT BUSINESS ALIGNMENT AND USAGE PATTERNS OVER TIME IN SME: 
A LONGITUDINAL CASE STUDY

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ABSTRACT
IT Business Alignment has been found to be a driver of both, IT value and business process quality. But as the interplay
between IT and complementary organizational resources is complex and especially as alignment involves humans and their
ways of interacting and coping with these complementarities, a relevant question remains: how to achieve alignment?
We present an excerpt of findings from a one year project in a company belonging to the SME sector focusing on its
warehouse that shows how fundamentally better business processes were implemented by increasing IT business alignment
and IS usage. During the project, different mechanisms to improve alignment were used and the organizational results in
terms of business impact were documented.

Keywords
Alignment, IS usage, Process performance.

INTRODUCTION
For decades, IS research has tried to contribute to our understanding of how IT impacts organizational performance
(Sambamurthy, Bharadwaj and Grover, 2003). The importance of this question is reflected by numerous studies carried out
from multiple perspectives, aimed at researching the contribution of specific factors to firm performance (e.g. Devaraj and
Kohli, 2003). Nevertheless, we still lack a cohesive understanding regarding the contribution of IT to firm performance
(Peppard and Ward, 2004; Sambamurthy et al., 2003).

The purpose of this paper is to explore the impact of IT Business alignment on business process performance over time by
investigating a concrete usage situation. An empirical investigation of alignment as an antecedent of organizational success is
not new, as a number of studies have underlined the importance of alignment (Chan, Huff, Barclay and Copeland, 1997).
Nevertheless, the actual impact of alignment on business process performance, in particular related to IS usage and its
development over time, has rarely been addressed empirically (Avison, Jones, Powell and Wilson, 2004).

The paper is structured as follows. First, based on a review of the existing literature, we derive our research model and
motivate constructs and hypotheses. Then, the empirical analysis is used to test the model. Finally, the results are briefly
discussed.

THEORETICAL FOUNDATION – IT BUSINESS ALIGNMENT
IT business alignment consistently appears among the top concerns of executives (Chan and Reich, 2007; Luftman and
Kempaiah, 2007). The basic proposition of alignment is that at least two factors (e.g. business and IT strategy) must be
congruent to affect organizational performance (Bergeron, Raymond and Rivard, 2004). Therefore, alignment studies
investigate the patterns of congruence between two specific factors proposed by the authors. In the case of IT business
alignment, the fit between strategic and/or structural aspects of the business and the IT domain is in focus. It is the join,
complementary effect between IT and business must be in place that leads to organizational performance. While a study by
Palmer and Markus (2000) in the specialty retailing industry could not support an impact of strategic alignment on
performance, most research indeed found a positive influence of alignment perspectives on IS effectiveness (Kearns and
Sabherwal, 2006; Sabherwal and Chan, 2001).
Most studies focus on the strategic level of IT business alignment (Bergeron et al., 2004) leaving a gap at the operational level (Gordon and Gordon, 2000) that is important to close because strategies can only be effective if implemented (Feurer, Chaharbaghi, Weber and Wargin, 2000).

Therefore, we focus on the operational level of IT business alignment referring to the operational integration between the alignment domains IT and business structure of the Strategic Alignment Model (Henderson and Venkatraman, 1993).

To conceptualize operational IT business alignment, we draw on the social dimension according to Reich and Benbasat (2000) and focus on the following three pillars (for a detailed discussion see Wagner, 2007):

1. Shared domain knowledge, discovered by Reich and Benbasat (2000) to be a significant factor in predicting long- and short-term alignment. Correspondingly, shared knowledge, discovered by Nelson and Cooprider (1996) to be important for IS performance;  
2. The structural linkage between IT and business, (Tiwana, Bharadwaj and Sambamurthy, 2003), which also encompasses the communication enablers; and  
3. The cognitive linkage between IT and business (Tiwana et al., 2003), and is an addition to the work of Reich and Benbasat.

**RESEARCH MODEL**

As illustrated in figure 1, we are suggesting that IS usage mediates the relationship between alignment and business process performance.

![Figure 1. Nomological Network of Relationships between Alignment and Business Process Performance](image-url)

Information systems are used to support a firm’s organizational objectives, whether to improve operational efficiency or to achieve competitive advantage. IS usage has been identified as the missing link explaining the impact of IT on performance (Devaraj and Kohli, 2003).

We define IS usage in the context of a business process as the extent to which an organization deploys IT to support operational tasks (Grover, Jeong and Segars, 1996). The rationale is that “the benefits an IS provides the organization accrue largely by adding value to primary activities at lower levels within the organization and depend on the organization’s operating characteristics” (Ragowsky, Stern and Adams, 2000, p. 192). It is widely accepted that firms cannot gain benefits from IT unless it is effectively used (Soh and Markus, 1995). Therefore, we formulate following hypothesis:

Proposition 1: Higher levels of IS usage directly and positively influence business process performance.

Further, we suggest that the extent of IS usage mediates the relationship between IT-business alignment and business process performance for following reasons. First, the effective utilization is necessary to get business value out of IT. Ravichandran and Lertwongsatien (2002) suggest that a mature IS support process ensures the effective utilization of IS and thereby enhance the business value. The effective utilization of IS can be enhanced by reliable IS operations ensuring the stability and availability of an IS and therefore business continuity. Further, a mature IS support process takes care of both an effective and a continuous use of the IS by job-relevant training, regular refreshers, and the introduction of the incident management. The incident management handles all user requests whether it is a question how to use a specific functionality or a problem.

IT business alignment increases the likelihood of providing a mature IS support process, for almost the same reasons as IT business alignment supports developing systems more relevant for the firm (Avison et al., 2004). This is essentially, achieving a fit between business needs and the capacity of the IT structure to deliver the needed services (Holsapple and Luo, 1996) by enhancing business orientation, business knowledge, and the understanding of business needs.

Therefore, we additionally formulate:

Proposition 2: Operational IT business alignment positively and directly influences IS usage.
ANALYSIS

Methodology
The methodology chosen for this research is a case study. Due to the longitudinal approach a case was selected that provided access to data in the relevant research area over a period of time. This made it necessary to choose a company where the author had access to the data.

For carrying out the case study, case and interview patterns were taken from case studies already performed and adapted to the specific case. These tested interview patterns were used for the actual case study interviews (Eisenhardt, 1989; Yin, 2003). The interviews were carried out using a structured questionnaire containing indicator questions mostly measured using a 5-point Likert scale ranging from “fully disagree” to “fully agree” and a semi-structured questionnaire designed to obtain contextual information. Each interview lasted per reported stage about one hour per interviewee. The interviewees were the senior manager of the warehouse department, his deputy, and six employees of the warehouse. Similarly, from the IT department the senior manager, his deputy, and two specialists were interviewed.

The indicator values of the structured questionnaire were aggregated by calculating an average Likert value that is reported in tables 1 and on in the following sections. Additionally, in these tables typical citations from the interviews are reported to provide more detailed insights. Contextual information are drawn from the semi-structured interviews and used to describe the environment, business processes, and IS solutions. Data was complemented by extensive reports, internal firm documentation, process documentation as contained in the quality management handbook, and academic literature. The collected data were transcribed within three days after the interviews. The interviewees validated the collected data directly after transcription. This procedure is concordant with the literature in case study methodology (Eisenhardt, 1989; Lee, 1989; Yin, 2003).

Case Description

This section starts with a description of the case environment, introducing the company, the product, and an overview regarding the warehouse process. The Company

For reasons of anonymity, we will call the company investigated AIR, Inc. It builds and sells interiors (e.g. galleys) predominantly for Boeing and Airbus aircrafts. It has a centralized manufacturing plant and sells interiors worldwide. Although AIR has inventories of standard components (some purchased and some manufactured), most parts of an interiors products are customized - usually composed of standard and made-to-order components. Therefore the end product is regularly specific to the customer and to the aircraft it is designed for. The company is among the top five companies of its type worldwide and has the largest market share in two of five market segments, and is second largest in the other three segments. It has approximately 1,000 employees. Official SME definitions are designed for statistical and fiscal reasons, and to guide economic policy. Usually the number of employees plus an additional factor such as sales is used as indicator. The U.S. and Canada define a limit of 500 employees, the European Union a limit of 250 employees. Despite these official definitions the CEO of AIR considers the firm as mid-sized company, because AIR is compared to the industry environment of aircraft producers, airlines, and suppliers of aircraft components such as engines relatively small. Furthermore, the firm culture has not changed much from the founding of the firm to now and has still strong local roots and operates in sort of family tradition. While the number of employees nearly tripled within five years, the organizational structure is still not diversified in terms of strategic management processes. Those processes are mainly allocated to the CEO and the CFO. Accordingly, there are neither different legal entities nor different larger sites.

Warehouse

The warehouse is designed as the central material hub. All parts are registered there and distributed. Therefore this is a critical function, impacting delivery time of products. The main information system employed is an ERP system with a warehouse management module termed warehouse management system (WMS) in the following paragraphs and sections. The following section describes the processes at the warehouse.

Once parts are produced, or delivered (in case of purchased parts), these parts are delivered to the warehouse and stored. Parts from production or external suppliers are collected at the incoming goods department (a sub-department of the warehouse), the logistics staff uses a system of manually booking parts via desktop computers into the WMS. Due to the high degree of customized parts more than 40,000 different parts (= different material numbers) with about 2,500,000 single items are handled per month. Therefore the incoming goods area has several entrances and racks to store the incoming goods. Nevertheless only two desktop computers for booking are available. Therefore the process of booking parts is relatively slow,
because it involves going to the rack; take production papers, or delivery papers, respectively; go to a desktop PC; call transaction for booking; enter materials number; press return. In worst case these steps are repeated for each part consisting of at least one item. This takes approximately 15 seconds per part in best case (if the desktop PC is installed near the rack). After that parts are transferred to the warehouse racks to store them.

When the parts are needed, job preparation issues production papers for production indicating which parts they have to collect from the warehouse, and picking lists for the warehouse personnel indicating the parts to pick from the racks. The papers are printed at the job planning department and are delivered to the warehouse twice a day in paper.

Once the picking lists are delivered to the warehouse, the dispatcher separates the lists according to the work orders (indicating a specific customer project) and assigns them to logistics personnel. These personnel is carrying-out the picking run by first, looking-up the warehouse lots assigned to the material listed in the picking list using the materials control system, noting these lots on the picking list per material number, and starting the picking run. The sequence of picking depends on the experience of logistics personnel who know where the lots are located.

After the picking run is complete, the parts are returned to the goods issue. Regularly, not all parts listed on the picking list can be retrieved, because some customized parts are not delivered or produced, or erroneously stored in the wrong lot. This results in an incomplete picking. Therefore the picking list is manually marked according to which part is still missing. After some days and due to the experience of the personnel, the picking run for this specific project is started again to collect the missing parts. This can occur several times until the picking list is complete and all parts are handed out.

The whole warehouse process is a time consuming procedure resulting in a number of negative effects of which the following are highlighted.

- First, both booking parts into the warehouse and handing-out parts is a time-consuming process and not synchronized with internal production or external extended work benches. That is, production mostly waits for parts slowing down the production process and jeopardizing galley delivery dates.
- Second, there is no overview over parts still missing per work order.
- Third, arriving parts needed for an already commissioned work order are collected and stored into the warehouse, and after some time picked by the picking runs to collect missing parts.

Results

Following the description of the initial stage in the previous section, this section presents the actions taken to improve the situation, describes the reached status, and reports on the development of alignment, usage and process performance patterns.

First, the actions taken are described. Facing the situation in the warehouse for a longer period, production managers start to complain about the insufficient material provision and urge for a decision at the CEO level. Production managers stated that they are no longer capable of compensating the time lost due to the insufficient material provision by faster production. The CEO, then, required a solution from the warehouse manager.

To start off the new CEO initiated formal meetings between warehouse department and IT department each Tuesday morning in the warehouse for solving operational problems. Additionally, formal meetings were established each first Wednesday in a month for mid-term issues. These meetings were accompanied by the CEO for the first six times. After that protocols are sent to the CEO, who also asked people responsible for activities according to the protocol for status. He points out the importance of being aligned (the meetings were called "warehouse alignment meeting"), and that everybody must be aware of being capable to produce reasonable results only in common. No single department is able to create value for the firm, but the interlocked working-together. Additionally a logistics-knowledgeable IT consultant was introduced, increasing the knowledge of business procedures within the IT unit, because of a common work on a process mapping and the development of several warehouse solutions as described in the “usage” section. After six month informal contacts are reported by warehouse and IT personnel as evolving and as an important complement to the formal meetings.

The following two tables display alignment indicators and their development over time. The alignment indicators are adapted from Teo and Ang (1999).

Alignment as defined in the previous section is composed of the three dimensions structural linkage, cognitive linkage and shared domain knowledge. At the start of the project levels of alignment were rated extremely low. The following table displays the results at the initial stage:
As table 1 shows regarding structural linkage at the start of the project there were no formal meetings between the IT unit and warehouse staff. Furthermore informal meetings were not existent. Similarly, mutual understanding (cognitive relationships) and also shared domain knowledge were rated very low.

During the first five months the level of e.g. mutual understanding was constantly rated as very low, but then started to rise to “average”.

<table>
<thead>
<tr>
<th>Construct</th>
<th>Indicator</th>
<th>Warehouse</th>
<th>IT unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Construct</td>
<td>Indicator</td>
<td>Warehouse</td>
<td>IT unit</td>
</tr>
<tr>
<td>The IT employees are very competent.</td>
<td>Disagree</td>
<td>“Maximum we have contact with the help desk. We do not know if there is competence. ”</td>
<td>“Competence is average. Especially regarding ERP we have to do something More.”</td>
</tr>
<tr>
<td>IT unit understands the needs and constraints of the business unit.</td>
<td>Fully disagree</td>
<td>“They are sitting in their offices. I do not think they know where the warehouse is located, let alone to know what we need.”</td>
<td>“They need to book parts into the warehouse and commission it quickly. We provide the things they need, but these are used poorly.”</td>
</tr>
<tr>
<td>The IT employees are knowledgeable about the business activities.</td>
<td>Fully disagree</td>
<td>“They do not have a clue of what we are doing” (Business to IT).</td>
<td>Disagree</td>
</tr>
<tr>
<td>There are regular meetings between the IT and the business unit to discuss potential process improvements</td>
<td>Fully disagree</td>
<td>There are no formal meetings. Contacts are only in the case of failures.</td>
<td>Fully disagree</td>
</tr>
</tbody>
</table>

Table 1. Summary of the case study results (initial stage)
The following table depicts the sample results from the final stage.

<table>
<thead>
<tr>
<th>Construct</th>
<th>Indicator</th>
<th>Warehouse</th>
<th>IT unit</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>The IT employees are very competent.</td>
<td>Agree</td>
<td>Agree</td>
</tr>
<tr>
<td></td>
<td>“We have seen lots of innovative ideas.”</td>
<td></td>
<td>“Competence is above average but still not high.”</td>
</tr>
<tr>
<td></td>
<td>IT unit understands the needs and constraints of the business unit.</td>
<td>Average</td>
<td>Average</td>
</tr>
<tr>
<td></td>
<td>“I think during the various projects we had, some of the IT guys learnt a lot about our daily job.”</td>
<td></td>
<td>“The IT consultant was very helpful. He explained us the logistics process, so we were able to adapt the system in a way useful to the warehouse.”</td>
</tr>
<tr>
<td></td>
<td>The IT employees are knowledgeable about the business activities.</td>
<td>Agree</td>
<td>Agree</td>
</tr>
<tr>
<td></td>
<td>“Yes, the main procedures are known to the IT unit – some parts are now system supported, and they had to program it.”</td>
<td></td>
<td>“The knowledge of warehouse procedures is far greater than before. Otherwise we were not able to implement the solutions we did.”</td>
</tr>
<tr>
<td>Alignment</td>
<td>There are regular meetings between the IT and the business unit to discuss potential process improvements</td>
<td>Agree</td>
<td>Agree</td>
</tr>
<tr>
<td></td>
<td>There are regular weekly meetings.</td>
<td></td>
<td>There are regular weekly meetings.</td>
</tr>
</tbody>
</table>

Table 2. Summary of the case study results (final stage)
Along with an improvement of alignment patterns, usage situation changed quite drastically. The following table depicts the ratings at the initial stage based on measures of prior research (Massetti and Zmud, 1996).

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Warehouse</th>
<th>IT-Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>All functionalities of the warehouse management system (WMS) are used.</td>
<td>We do not know all the functionalities, and functionalities we know are not easy to use.</td>
<td>Despite trainings and the manual distributed, transactions are not used adequately. We see that from questions we get and with a lookup of the system that tells us that some important transactions are not or seldom used.</td>
</tr>
<tr>
<td>The existing functions of the WMS should be used more intensely.</td>
<td>There is still a lot to learn, but we do not know what happens inside the machine and better keep a backup Excel sheet.</td>
<td>There is a great potential in using the system. Our support staff reports unnecessarily complicated usage patterns and some transactions are simply not used although trained.</td>
</tr>
<tr>
<td>The employed peripherals should be used more intensely.</td>
<td>We are not against the use of the new peripherals, but we have lots of errors when using them.</td>
<td>We deployed eight WLAN scanners. Only five of them are in use; three further people use the desktop PC instead of a scanner. People using scanners often report problems, may it be loss of network connection, unintended duplicate bookings, or long response times.</td>
</tr>
</tbody>
</table>

Table 3. Summary of the case study results (initial stage)

Usage situation at the daily operational level were supported by permanently locating IT personnel at the warehouse for the carrying-out following tasks:

- Helping immediately in cases of problems (e.g. booking not possible due to master data error)
- Teaching the use of the materials order system and creating an up-to-date documentation
- Looking for improvement potentials regarding the use of the materials order system

Furthermore, using the meetings dedicated to mid-term solutions, a customization was developed to help routing parts quickly to production and to provide an overview of parts delivered or still missing.

This solution encompasses a labeling process. When parts arrive at the incoming goods department, these parts are scanned using newly introduced PDAs. After scanning the material orders system determines the next waiting open demand from production for this part, retrieves all information such as material number, work order allocation, waiting production step, and sends this information to a label printer. The label, then, is attached to the part and the part immediately routed to location indicated at the label, thus saving the whole process of first storing the part and second performing a picking run. Furthermore if the material orders system detects that the arrived part is a so called missing part that should have been already delivered to production or extended work benches then it is indicated at the label that it is a part to be expedited.

Beside this improvement in parts routing, the system now provides a complete real-time overview over parts already handed out and parts still missing per single work order. Thus, transparency was greatly improved.
Following tables displays the rating of the usage situation at the final stage.

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Warehouse</th>
<th>IT-Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>All functionalities of the WMS are used.</td>
<td>The typical functionalities as trained and documented we know fairly well. There are some cases such as handling of parts having errors in master data where we need help to manage bookings.</td>
<td>Routine work is handled by the warehouse personnel. Systems statistics show a level of usage appropriate to the amount of material movements. However, except for one person warehouse personnel is hardly capable to cope with exception situations such as wrong allocation of material to production steps. In the latter case they are not able to analyze the situation let alone to solve the problem.</td>
</tr>
<tr>
<td>The existing functions of the WMS should be used more intensely.</td>
<td>We work all day with the system and do not see any need to have more functions, or use them more intensely. The functions used are complex enough. When we detect errors and assume that master data and routing of material are incorrect then we call job planning to help us. That is, we do it like before and we know it works.</td>
<td>The functions used provide far more possibilities then is used. Many questions regarding status reports, or material handling would be obsolete. Further some procedure carried out manual today could be handled automatically.</td>
</tr>
<tr>
<td>The employed peripherals should be used more intensely.</td>
<td>To work with the scanners and the label printer makes life easy. It works fine.</td>
<td>From systems reports we see that the peripherals are used on a regular basis. Errors are rare.</td>
</tr>
</tbody>
</table>

Table 4. Summary of the case study results (final stage)

Finally the performance situation in the warehouse is presented in the following paragraph.

The implementation of the warehouse solution brings about a number of advantages listed by the warehouse manager: elimination of manual booking; elimination of manual zero-stock management; time saved by optimized picking run; time saved by reduction of picking failures; reduction of stocking time; faster routing of parts; and a complete overview of the current stock situation.

Just focusing on the warehouse, thus not reporting on the effects in production, the implemented solution lead to a savings in time needed for the different warehouse activities and finally in a decrease of the time for commissioning. The savings summed up to 75 hours per week equivalent to two temporary workers.

<table>
<thead>
<tr>
<th>Construct</th>
<th>Indicator</th>
<th>Effects</th>
<th>Remark</th>
</tr>
</thead>
<tbody>
<tr>
<td>Process performance</td>
<td>Elimination of manual booking</td>
<td>20 hours per worker and week saved</td>
<td>Capacity doubled</td>
</tr>
<tr>
<td>Time saved by optimized picking run</td>
<td>30 hours per worker and week saved</td>
<td>Capacity quadrupled</td>
<td></td>
</tr>
</tbody>
</table>

Table 5. Process Performance
CONCLUSION
Methodologically, we used a longitudinal single case study of an operations process in a company of the aerospace industry with focus on alignment and IS usage. The case study setting allowed us to observe the development of alignment levels, the complementary development of business practices and information systems over time. Furthermore, the case provides relevant insights into a concrete situation at the operational level of a business process which is also very rare in literature.

This paper contributes to literature by reporting on the development of alignment, usage, and performance measures over time. Thereby it is shown how an increase in the levels of alignment are followed by an increase in IS usage levels, and this in turn impacts performance measures. Following the proposed nomological network of relationships between alignment and business process performance this paper suggests that the alignment at an operational level influences IS usage which leads to effects on performance. It was shown that specific alignment measures lead to the simultaneous and intertwined development of work practices and information systems leading to a viable solution accepted by users and better fitting the requirements of the business. Furthermore lag effects could be detected highlighting that activities, e.g. initiating formal meeting, need some time to exhibit an effect. Additionally, concrete activities to achieve higher alignment levels could be reported in its real-life context providing managerial information of how to promote alignment as a means to drive performance using IS usage patterns as a mediator.

REFERENCES


