Evolvement of Business-IT Alignment over Time: A Situated Change Perspective

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Abstract

How does business-IT alignment change over time? Using a case study in the aerospace industry, we show how governance mechanisms are interrelated with the development of business-IT alignment over time. The case adds insight into a concrete business situation where activities are unfolded to change organizational practices and to increase performance. We demonstrate specific mechanisms influencing alignment patterns, and show that the development of business-IT alignment precedes finding solutions that enhance business value. In addition, we depict the co-evolvement of shared knowledge and mutual understanding over time.

1. Introduction

In a recent study, Wiggins and Ruefli [23] stress that sustained competitive advantage may increasingly be a matter not of sustaining a single advantage but more of creating a sequence of consecutive advantages over time. Therefore, the ability to reconfigure and adapt resources to respond to a changing environment is an important source for a firm’s long-term success [5, 20]. To support the dynamic and changing business environment most firms face, IT has to be strategically flexible enough to cope with uncertain changes and tactically flexible enough to realize optimization potential in the business process by modifying IT and/or process specifications [6].

In this respect, recent literature on IT value creation stresses the importance of business-IT alignment to gain and sustain a strong competitive position. Alignment is considered to be a prerequisite for IT business value creation as a good interplay between a firm’s business and IT resources has been shown to contribute to improved organizational performance [3, 16, 19, 21]. At the same time, a firm’s inability to realize value from IT can often be explained by a lack of (strategic) alignment [8]. In turn, strategic IT business alignment is seen as a dynamic process of continuous adaptation and change that can be interpreted as an organizational learning process that combines business and IT knowledge in order to support business objectives [15].

Yet, to date, literature on the mutual interrelationship between measures to continuously adapt and change, achieved levels of alignment, and business outcome is rare and the goal of achieving alignment in this respect is elusive [see 4]. Hence, the purpose of this paper is to explore the impact of certain governance mechanisms and activities performed on alignment and on business outcomes to answer the questions:

How does business-IT alignment evolve over time?
How are governance mechanisms, business outcomes, and business-IT alignment interrelated?

Building on prior research and using a longitudinal exploratory case study in the aerospace industry, we show how business is drastically changed by the development of business-IT alignment over time.

The remainder of the paper is structured as follows: section 2 gives the theoretical foundation. In section 3 data and methodology are explained. Chapter 4 presents the results from the case study, while section 5 discusses its limitations. Chapter 6 outlines the conclusion and the following steps of our research.

2. Theoretical foundation and research approach

Strategic alignment, which is the extent to which IT strategy supports and is supported by the business strategy [14], was proposed in the Strategic Alignment Model (SAM) of Henderson and Venkatraman [8].

Since then, strategic alignment has emerged as an important issue among researchers and practitioners alike [18]. Several studies investigated the impact of alignment on organizational performance. While a study by Palmer and Markus [12] in the specialty retailing industry could not support an impact of strategic alignment on performance, most research found a positive influence of alignment perspectives on IS effectiveness [18, 19]. The basic proposition of alignment is that at least two factors such as business and IT strategy (strategic alignment) or business and IT
structure (structural alignment) must be congruent to affect organizational performance [2]. Therefore, alignment studies investigate congruence patterns.

Reich and Benbasat [15] model alignment consisting of an intellectual and a social dimension. The intellectual dimension refers to the external validity and internal consistency of business and IT plans and is defined as “as the degree to which the information technology mission, objectives, and plans support and are supported by the business mission, objectives, and plans” [13, 15]. The social dimension is defined as “the level of mutual understanding of and commitment to the business and IT mission, objectives, and plans” (Reich and Benbasat [15]).

The social dimension of alignment, extensively analyzed in Reich and Benbasat [13] in a series of semi-structured interviews, is driven by four enablers, namely 1) shared domain knowledge between business and IT executives, 2) IT implementation success, 3) communication between business and IT executives, and 4) connections between business and IT planning processes. The authors show that shared domain knowledge is the most important driver in the long run.

Building on these insights we propose the following research model.

As discussed above alignment has been shown to positively affect firm performance. This also encompasses the ability to reconfigure and adapt resources to respond to a changing environment that is an important source for a firm’s long-term success [5, 20]. In this respect, business-IT alignment can be seen as a dynamic process of continuous adaptation and change that can be interpreted as an organizational learning process that combines business and IT knowledge in order to support business objectives [15]. Thus the combination of business and IT knowledge both drives and enables business-IT alignment which we will interpret in its social dimension as mutual understanding. In addition, we will investigate shared knowledge because it has been shown to be an important driver.

In order to observe the development of shared knowledge and mutual understanding over time, we inform our study by the situated change perspective. The situated change perspective “proposes change as endemic to the practice of organizing and hence as enacted through the situated practices of organizational actors as they improvise, innovate, and adjust their work routines over time” [11, p. 63]. In our exploration the adaptation process of a primary business process between a defined initial phase and a final phase will analyzed according to governance mechanisms employed, activities undertaken, artifacts used, and levels of alignment achieved.

Thus, we propose that business-IT alignment is affected by situated practices and in turn affects the success of business transformation by combination of business and IT knowledge.

3. Method and Data

3.1. Methodology

The methodology chosen for this research is an exploratory case study approach. Due to the study’s objective to observe alignment’s development over time which is rarely studied so far, a case has been selected that allows the observation of so called polar types, or extreme situations [7]. Accordingly, to observe changes over time, an industry has been chosen that induces external pressure due to massive growth by simultaneously emphasizing supplier resilience. We stick to one industry to constrain variation of external influences. Another selection criterion has been internal pressure due to shifts of strategy and organizational structure as well as an internal situation where alignment patterns are assessed as very low. In addition, and due to the longitudinal approach, a case has been 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 authors had access to the data. Primary data sources have been observation and interviews. The interview questions were developed, discussed within the research community, and already tested before the start of this specific case. These tested interview patterns were used for the actual case study interviews [7, 24]. For the interviews two questionnaires were employed: a structured questionnaire containing indicator questions mostly measured using a Likert scale (fully agree to fully disagree) and a semi-structured questionnaire designed to obtain contextual information. The interviews were structured in a way that first the semi-structured questionnaire with open-ended questions has been employed and then the structured questionnaire exhibiting indicator questions to get a summarized assessment of the situation. The interview questions were developed, discussed within research and practitioner communities, and already tested before the start of this specific case. In addition it is to mention that the structured questionnaire was originally designed for evaluating causal models and has already been used in prior cross sectional surveys by the authors.

Each interview lasted about one hour per interviewee. Per interviewee two interviews at different points in time have been carried out. The interviewees were 13 people from the business side (eight from
engineering (including the senior manager and his deputy) and five from industrial engineering (including the senior manager and his deputy)). Similarly, from the IT department the senior manager, his deputy, and two specialists were interviewed.

<table>
<thead>
<tr>
<th>Department</th>
<th>Role</th>
<th>Work experience in years</th>
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<tbody>
<tr>
<td>Engineering</td>
<td>Senior manager</td>
<td>26</td>
</tr>
<tr>
<td></td>
<td>Deputy</td>
<td>17</td>
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<tr>
<td></td>
<td>3 Engineering project managers</td>
<td>9, 10, 12</td>
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<td>3 engineers (2 mechanical, 1 electrical)</td>
<td>4, 4, 7</td>
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<tr>
<td>Industrial engineering</td>
<td>Senior manager</td>
<td>16</td>
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<td></td>
<td>Deputy</td>
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<td></td>
<td>3 industrial engineers</td>
<td>5, 11, 31</td>
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<tr>
<td>IT department</td>
<td>Senior manager</td>
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<td>Deputy</td>
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<td>2 specialists (1 focus ERP, 1 focus server and network)</td>
<td>3, 9</td>
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Data was complemented by extensive reports, internal firm documentation, process documentation as contained in the quality management handbook, and academic literature. The collected interview 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 [7, 10, 24].

3.2. Data Collection and Analysis

To avoid aggregation problems we follow recent research suggesting a process perspective for the identification of the economic impacts of IT [1] and scrutinize a main business process undergoing a major transformation.

As major success variable we have used cycle time which is the most crucial variable for the process (more details see below). Cycle time has been measured by an ERP system and thus is delivered as objective data.

The case study covers three phases of the business transformation project.

Initial phase: First, there is an initial phase that displays the conditions before the transformation project started. Major challenges in this phase include keeping up with external growth and internal disynchronization. As will be shown below in detail, the relationship between IT and non-IT departments is particularly awful.

Transition phase: Second, the transition phase which is the focus of this paper, comprises a period of over one year and contains a redesign of the way the firm does its business. In the transition phase, the development of alignment and cycle time are traced over time.

Results phase: Third, the results phase displays the business process after the transformation.

From all stages, we used multiple data collection methods [7] consisting of semi-structured and structured interviews, observations of project and department meetings, and archival sources, in particular, meeting protocols and ERP data. We gathered qualitative and quantitative data about alignment (from monthly questionnaires with IT and business staff), on advances of the transformation (from regularly updated value stream analyses), and on the development of cycle time. Overall, structured questionnaires were used in three departments (IT, engineering, industrial engineering) each month over the 12 months period covered in this paper. In addition, meeting protocols and performance data were made available so that qualitative and quantitative measures could be obtained for every month for a full year. If we report certain levels of alignment, these result from the questionnaires (mostly 7-point Likert scales). The constructs and interview patterns were adapted from prior research projects on alignment.

To analyse data, a within-case analysis is used involving detailed description that help cope with the collected data volume. “The overall idea is to become intimately familiar with each case as a stand-alone entity” [7, p. 540]. A major tool for analysis, a longitudinal graph is introduced to track changes and provide sequence analysis. In that respect, two groups (the IT department and the business departments) are distinguished to check for similarities and differences. Categories or dimensions investigated should be chosen from literature to avoid information-processing bias. Consequently, we have chosen concepts from alignment research, i.e., mutual understanding and shared knowledge (see section 2), whereas change events are chosen from Orlikowski’s situated change approach [11] and enriched by governance research.

3.3. Validity and Reliability

During the course of case studies, construct validity is enhanced by three procedures [25]. First, multiple sources of evidence should be used which we
addressed by collecting data by interviews, observation, meeting protocols, and ERP data. Second, key informants should review the transcripts from interviews and check interpretations of data. In our case, we informed the interviewees about the research project before data collection; had the transcribed interviews checked by the interviewees; and also had reviews of our interpretations. Third, a chain of evidence should be maintained. This topic is addressed by taking categories and dimensions we looked at from literature, discussing these categories with interviewees, collecting data appropriately, storing that data in a database allowing cross-referencing from interpretations to original questions.

Internal validity is related to the causality between two variables which we addressed by pattern matching as suggested by Yin [25] and Lee [10].

External validity reflects the findings' generalizability. The findings of our case are, at first sight, valid for the case setting itself, whereas a broad generalization depends on the study's replication in other settings. However, the variables we are interested in are independent from specific company settings or industry boundaries, so that results are indicative for other settings pointing to logical generalizability as suggested by Lee [10].

According to Yin [25] reliability is related to the consistency and stability of findings when applied by other researchers and at other times. To ensure reliability, maintaining case study protocol and database are recommended to provide sort of standardization in terms of how to proceed. In our study, we logged questions of interest, categories and dimensions from literature, questionnaires used, unit of analysis, and situated change approach. In addition, a database encompassing transcripts allowing for cross-referencing was established.

4. Analysis

We draw on prior research for presenting the case [22]. The company investigated is a manufacturer of interiors for airplanes, has approximately 1,000 employees, and manufactures products that is designed to fit specific customer needs.

Regarding IT, there was an ERP system introduced more than ten years ago but it is predominantly used to report financial data. Only parts of business activities were carried out using the ERP system while several other information systems exist along the order fulfilment process in parallel and unconnected to the ERP system for the handling of purchase orders, production planning, etc. In addition to the ERP system, various CAD systems were employed for engineering, but there was no interconnection with the ERP system.

The project under study starts with hiring a new CEO who was asked to lead the company to a path of stable growth. Essentially, the task comprised to lead the company from sort of handicraft to industry, thus involving a tremendous transformation of business. To address this requirement he carried out a business analysis identifying the major issues and then formally initiated a modification project supported by several consultants. Alignment was an overarching issue because of the many disconnects between IT and business but also between different business functions.

Following the operational goal to eliminate a major process bottleneck, a process redesign activity was started to reduce cycle time and to reduce the backlog in industrial engineering. A major measure to achieve this goal was the cross-departmental development of a value stream map to map the as-is process in order to identify improvement potential and to map the to-be process. This section highlights the activities undertaken, achievements in terms of organizational practices, development of alignment.

The following figure represents the longitudinal graph as introduced in section 3.2 and is horizontally split into three parts. The upper part depicts the IT department’s assessment of the level of shared knowledge (solid line) and mutual understanding (dotted line) with regard to their relationship with the business units. The middle parts shows the assessment of the business units (i.e., engineering and industrial engineering) for the level of shared knowledge (solid line) and mutual understanding (dotted line) with regard to their relationship with the IT department. The assessment is on a scale from 1 (=extremely low) to 7 (=extremely high) and is the mean of the respective units’ assessments. This mean is intended to provide a snapshot indication of the assessment that is complemented by respective transcripts from interviews forwarding the assessment as verbal expression. It should not be interpreted in a statistical generalizable sense as their not sufficient data points. Date of measurement is the end of each segment (in case of segment 1 beginning and end). Lines in-between are just connecting measurement points.

The lower part shows the main descriptors for organizational practices as indicated by specialists and by managers. In addition, IT artefacts are shown that are deemed most characteristic for the situation. Finally governance mechanisms used and activities unfolded to promote cross-functional collaboration are listed.

Vertically, the diagram is split into seven segments. Each segment is defined by characteristic activities whose beginning and end provides the delimiter for the
Segment 1:

According to a business review the process involves a number of challenges. One challenge, perceived as the most critical by management, is the IT support for the business process which is both fragmented and not integrated. Among others, this is reflected in many process disruptions at interfaces between process steps due to a disconnect between IS and business process leading to isolated IS use in different process steps that are widely complemented by manual work. This, in turn, causes major problems within business processes. According to an internal audit, on average, 40% of production time was spent on activities that add very little or no value. One major reason based on fragmented systems is missing or faulty parts resulting from drawings not covering all parts needed or displaying parts with wrong
specifications, outdated drawings that have not been updated, master data errors, or insufficiencies along the material provision process. Those errors slow down the production process significantly. Furthermore, as no integrated resource planning system exists, workers plan their daily work according to experience and self-defined pace. As a consequence, capacity and resource planning is not established.

This situation is accompanied by a social process. Interviews show that other departments hardly were knowledgeable of other department’s tasks. One interviewee from the IT department reported: “I have no clue of why industrial engineering produces an increasing amount of backlog work, although we (the IT department) provide a powerful system”. On the other hand an industrial engineering manager stated: “I do not know what they (the IT department) do all the day. If we have problems we are better off by creating our own solutions.”

Asking questions regarding the level of shared knowledge, e.g. please rate your level of knowledge regarding tasks of department x, consistently, and across departments, revealed ratings of 2 and 3 on a 7-point Likert scale (1=extremely low, 7=extremely high).

Similarly, the level of mutual understanding could be named as awful as expressed by one mechanical engineer: “I am really not interested in what IT does and it is not part of my job to think about their requirements. They rather should do their job as I do my job.” Departments were rather ignorant regarding constraints, goals, and priorities of other departments. Apart from the narrative statements we have asked two questions to summarize the verbal statements that should be assessed by the interviewees.

Please rate your department’s level of commitment to the business (or IT, respectively) mission, objectives and plans, and

Please rate: Our department fully understands the constraints, goals, and priorities of department x.

Both questions have been measured on 7-point Likert scale (1=extremely low, 7=extremely high) and revealed a rather symmetric picture of answers. From the IT department four interviewees rated 1 and one interviewee 2 which was the same for the industrial engineering department. The engineering department with respect to IT rated: 6 times 1 and two times 2.

These results indicate that the perceived level of mutual understanding was very low and thus alignment in its social dimension virtually not present.

**Segment 2:**

This segment started with setting-up a governance mechanism in addition to monthly business meetings. This mechanism encompasses the set-up of a cross-functional team composed of members of engineering, industrial engineering, and IT. Team members have been selected on their ability to contribute (i.e., knowledge about daily organizational practice in the company plus knowledge they may have gained at other companies) and their willingness to contribute (i.e, volunteers who are capable have been preferred). The goal for this team was to come up with a value stream map covering the business process in which they are all involved. Top management made clear that it is an important task and mission-critical for the company.

The first meeting exhibits discussions about how critical the situation is at all and spans broad perspectives from “there is not much to do to improve” and therefore “is the effort worth it?” through to “we have to change everything”. Conflicts arose around concrete definitions of targets to be achieved and with what to start. At the end, there was an agreement (rather than a commitment) to split into sub-groups and collect data on the topic in their respective departments and to come together event-driven and from case to case for reviewing what has been found. In addition, a second, formal meeting was agreed upon. In the second meeting conflicts could be observed because of not having collected enough data, or having collected the wrong data that was regarded as blaming specific departments (= biased sampling). People agreed that all should focus on the process part where engineering is involved because if this part is “correct” than many problems following in other departments can be regarded as solved.

At the end of segment 2, the level of shared knowledge and mutual understanding as assessed by business units remained unchanged, whereas the IT department’s assessment of the level of shared knowledge decreased (mutual understanding unchanged). From an analytical standpoint, segment 2 is characterized by first, goal-oriented, formal project meetings. However, work has been done within departments, not cross-departmental which resulted in conflict in the first step and did not lead to an increase of shared knowledge as no knowledge have been mutually exchanged. The same is true for mutual understanding as no information about constraints, priorities, etc. have been discussed. The decrease of the level of shared knowledge on the part of IT may be explained by the conflict between business units of what are the right data to collect
leading to an uncertainty regarding business requirements.

**Segment 3:**

People from all departments were engaged in scrutinizing engineering activities. During that activity, members of industrial engineering and IT formed alliances from time to time and expressed their opinion that engineers do not use IT tools in a correct way producing workload in industrial engineering, or just ignore needs of industrial engineering regarding master data, so that this artefact fits engineering needs but not the needs of other departments. Engineers on the other hand point out what they are doing is relevant to certification without which nothing can be delivered, and that only engineering department has the authority to enter, delete, or alter master data.

At the end of segment 3, the level of shared knowledge and mutual understanding as assessed by business units decreased. The IT department’s assessment of the level of mutual understanding decreased also; whereas the level of shared knowledge remained unchanged (it decreased the period before). Similar to the explanation in segment 4, the conflict between departments, now rather strong compared to segment 2, may lead to the decrease of mutual understanding and also regarding shared knowledge as uncertainty about what is right increases. Apart from that engineering department forwards a power argument in terms of their responsibility for the mission-critical issue of certification which imbalances the relationship between departments.

**Segment 4:**

Segment 4 started with the introduction of another governance mechanism. Top management involved themselves into the meetings, continuously signalling importance, asking questions, and pushing for solutions. Activities have been started to scrutinize each single task starting from the creation of a delivery plan in sales until the delivery of the goods – how and why a task is performed today, which effects does this have on other tasks, how can a task be rearranged especially considering IT support. Rough sketches of ideas and findings on flipcharts but also in form of slides and text documents were produced.

Master data and the standards for it have been acknowledged as key artefact that is necessary to connect all activities performed by different departments and that, hence, master data have to recognize the needs of all departments.

At the end of segment 4, the level of shared knowledge as assessed by business units increased drastically, and the level of and mutual understanding increased slightly. The IT department’s assessment of the level of mutual understanding increased slightly; whereas the level of shared knowledge increased to a higher degree.

Master data is a key artefact as it regulates information exchange between business functions. For coming up with regulations regarding company-wide master data, it is necessary to specify which information and in which quality is needed to fulfil certain task, who is responsible to enter the information, when information have to be keyed in, what will happen if information is correct, or incorrect, respectively, and so on. That is, a very good understanding of the entire business process across functional units is necessary to come up with a viable solution. Top management enforces this sort of standardization of master data which in turn leads to standardized procedures of how to handle, e.g., orders. Serving as sort of template, a cross-functional interpretation of data is achieved leading to an increase of shared knowledge regarding needs and activities of other departments. This increase is drastic on the part of IT because the design of master data enforces learning about the functioning of the business process.

**Segment 5:**

Based on achievements of segment 4, the entire business process was broken down into single functional blocks to be handled as a unit of work that can be assigned to a single employee. The functional blocks were described in detail encompassing each manual or IT-supported step and the interrelations to other functional blocks. How to fill ERP masks and with which contents is also mentioned, including a description of the effects of entering specific data, making exact prescriptions as to why a specific procedure is needed and which effect it has on other functional blocks.

The result of this step was a well-documented, accurate and up-to-date value stream map encompassing the tasks, their interrelations, and the performance indicators for these tasks. This outcome (document) was accompanied by another outcome which is not a document in the first place. The interviews accompanying the procedure to finally come to a document describing the initial situation revealed an interesting phenomenon. This “documentation process” was accompanied by a “social process”.

The procedure of designing a value stream map went along with a further increase of shared
knowledge of the IT department and the business units. Due to the explanation of why certain tasks are performed in a certain form, what are the interdependencies, and so on on the level of knowledge of other department’s work started to increase. By the end of the initial phase the level of shared knowledge has increased to mostly 4 on a 7-point Likert scale (1=extremely poor, 7=extremely high) with one interviewee of the IT department rated 1, two people form industrial engineering rated 5, and one of the engineering department rated 3 and another one 5.

The level of mutual understanding increased more than the level of shared knowledge in business units and IT department.

Similar to the analysis of segment 4, the detailing of the process deepens the knowledge of other departments’ activities which resulted in a cross-functional achievement – the value stream map. The deeper knowledge of what goes on in other departments, what is needed that other departments can work, and what other departments should deliver for one’s own work can be seen to lead at a cognitive level to an increased mutual understanding. In addition, the cross-functional achievement might add to the affective side of mutual understanding.

**Segment 6:**
Taking the value stream map of the initial phase as basis for the business transformation, frequent discussions had been carried out to develop a to-be solution, closing the gaps, addressing the challenges and allowing for industry-like procedures. The result of this phase was a value stream map depicting the To-Be situation.

At the end of segment 6, the level of mutual understanding increased further; whereas the level of shared knowledge only slightly increased (IT department), or remained unchanged (business units), respectively. The explanation for this phenomenon corresponds to what has been said for segment 5.

**Segment 7:**
This segment saw the introduction of additional governance mechanism – a weekly specialist meeting for operational issues and a bi-monthly specialist meeting for mid-term issues. These two mechanisms guided the implementation of the To-Be-value stream map that was “published” as new standard. With this new standard, as in the initial stage, engineering department starts to work after receiving a work order and creates drawings and Bills of Materials (BOM). In contrast to the initial stage BOMs are exclusively created in the ERP system following a master data standard and a BOM structure standard. Then, drawings are converted into TIF-format and stored into a digital archive, whereas the former digital archive was replaced by a new system allowing for automatic indexing and sorting. This in turn shrinks down the time industrial engineering is waiting for print-outs from up to five day to maximum four hours. Due to the complete entering of BOMs into the ERP system following a standard procedure all processing steps dealing with pre-processing can be completely eliminated. Instead of the previous step of restructuring the BOM, now the BOM is already created in the right structure and just master data has to be complemented and maintained in a manner that further automation of processing steps is possible. This allows reducing the processing time for issuing orders and production papers from previously four days down to six hours.

Again a social process accompanied the implementation. By the end of segment 7 the level of shared knowledge has further increased to roughly 5 on a 7-point Likert scale (1=extremely poor, 7=extremely high) with one interviewee of the IT department rated 3, one person from industrial engineering rated 4, and two of the engineering department rated 6.

Similarly, the level of mutual understanding increased slightly at the IT department and remained unchanged in the business units.

5. **Conclusion**

Summarizing the findings we can answer our research questions. Our first question was: How does business-IT alignment evolve over time?

We found that increases of shared knowledge seem to precede increases of mutual understanding. From a process perspective, it gives support to the findings of Reich and Benbasat [13] in a cross-sectional study who found shared knowledge an antecedent to alignment. In our study we could find that changes of shared knowledge temporally precede changes of alignment.

Our second research question was: How are governance mechanisms, business outcomes, and business-IT alignment interrelated?

In that respect, we could observe that increases in the level of shared knowledge precede cross-functionally finding solutions to such as using master data as important artefact to align activities. This finding relates to discussions in the literature that social processes precede materializations, e.g., in form of documents or, in general, artifacts. These considerations can be found in discussion about the social and intellectual dimensions of alignment [13] and of alignment as a process of continuous
adaptation whose result can be integrated IT and business plans [9].

Furthermore, we observed management involvement as opposed to management support and the discussion of know-why as key government mechanisms. This is in line with prior research that point to management involvement [22] and know-why [17] as important prerequisites.

The company was troubled by non-integrated systems and processes and the need to substantially change the ways they produce their products accompanied by a stiff organizational structure characterized by a substantial misalignment between IT and business units. After a one year project we could find that business-IT alignment defined as mutual understanding has drastically increased and helped to fundamentally transform the entire firm. Within about one year, this resulted in a drastic reduction of cycle time in industrial engineering from 19 days to about 8 days by automation and IT-enabled process reorganization.

We could observe that increases in the level of shared knowledge could be used for commonly finding solutions to problems resulting from badly managed interdependencies between units and sub processes that weren’t solvable with a single unit. One business manager reported “Although (we) can think of a better solution for the (...) service, the implemented solution is appropriate”. As a result, overall process performance improved: “More orders can be processed and the cycle time has reduced. The backlog of work starts to decrease.” In addition, especially increases of shared knowledge somehow seem to precede increases of mutual understanding. This is in particular o see in segments 4, 5, and 6 where the level of shared knowledge first increases to a higher degree compared to mutual understanding and then flattens, whereas mutual understanding first increases slightly and then to a high degree.

We could also see that new IT artifacts have been detected when the level of shared knowledge increases to a higher extent (segment 4 and 5).

Regarding governance mechanisms and cross-functional activities, we observe that top management signalling alone and formally setting-up cross-functional teams did not do the trick, and even led to an inferior situation compared to the beginning of the activities.

We found indications that business-IT alignment understood in its social dimension is necessary to develop solutions for the business that are made explicit by the creation of documents (here: value stream map) and by “implementing” these documents into daily business which then results in performance (here: cycle time).

Thus for the company under study, measurable business value could be created by a simultaneous change of IS and business practices that were enabled by an increase in the level of business-IT alignment. Thereby, especially increases in the level of shared knowledge seem to precede increases in mutual understanding. Furthermore, an increased level of shared knowledge leads to the development of IT solutions that greatly supported the business capability. Over time, this resulted in the IT unit being consulted not only in the case of failures but also when redesigning business processes.

Overall, the analysis suggests that the development of business-IT alignment lead to a truly integrated business solution that greatly enhanced business value. It is interesting to see that business-IT alignment precedes viable business solutions.

- Apart from the theoretical implications of the study discussed at the beginning of this section, there are several practical implications as well:
  - A certain level of business-IT alignment seems to be necessary for driving change of business practices and thus has to be promoted, e.g., by enforcing joint projects to create room for mutual work and knowledge spillover.
  - the communication of know-why as opposed to the common know-how and know-what helps to increase understanding for specific measures and prepares the field for a better adoption of know-how and know-what.
  - Top managers should involve themselves into projects to a certain degree to not only express verbally the importance but also in active practice.

Future research should examine further variables that could co-evolve with alignment. Literature points to communication links between units and trust. It would be interesting to know how these variables interact with shared knowledge and alignment. Furthermore, the creation and change of inter-unit networks might add to our understanding of changing alignment. Finally, a more detailed analysis of governance mechanisms appropriate to induce such changes, or to handle emergent changes would be a rich field to study.

6. References