Governing Individual Learning in the Transition Phase of Software Maintenance Offshoring: A Dynamic Perspective

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Abstract

Prior studies suggest that clients need to actively govern knowledge transfer to vendor staff in offshore outsourcing. In this paper, we analyze longitudinal data from four software maintenance offshore outsourcing projects to explore why governance may be needed for knowledge transfer and how governance and the individual learning of vendor engineers interact over time. Our results suggest that self-control is central to learning, but may be hampered by low levels of trust and expertise at the outset of projects. For these foundations to develop, clients initially need to exert high amounts of formal and clan controls to enforce learning activities against barriers to knowledge sharing. Once learning activities occur, trust and expertise increase and control portfolios may show greater emphases on self-control.

1. Introduction

Companies continue to outsource software maintenance work to offshore vendors given scarce domestic personnel and labor cost advantages. Yet, many offshore outsourced projects do not meet the clients’ expectations. Insufficient knowledge transfer (KT) to vendor staff is a frequent source of failure [1-4]. Unsuccessful KT may result in tasks not taken over by offshore teams [3] and in extra costs for KT, specification, coordination, and control that offset the savings through labor cost advantages [2].

Software maintenance may be particularly prone to problematic KT. Software maintenance is a cognitively demanding task, in which engineers heavily rely on their tacit knowledge to identify where maintenance actions need to be made and to conceive solutions [5]. Their performance is primarily driven by their knowledge of the particular software application system [6]. In offshore outsourced software maintenance (OOSM) projects, this knowledge needs to be transferred during the transition phase at the outset of projects. During transition, vendor employees are typically present at the client site to acquire the knowledge through extensive interaction with subject matter experts (SMEs) such as former delivery personnel [3, 7]. Yet, the coexistence of SMEs and vendor staff makes the transition phase a particularly costly phase in OOSM projects. This poses a dilemma to management. Whereas tacit knowledge is difficult to transfer [8] and central to project success, long transitions may jeopardize the business case of offshoring. Strategies for effectively managing KT during transition may help mitigate this dilemma.

Prior studies suggest that client management needs to actively govern KT in offshore outsourcing to facilitate effective KT [2, 9]. Consistent with the information systems (IS) outsourcing literature, we use the term governance to refer to structures and actions that guide behavior towards desired objectives [10, 11]. Governance may be needed because KT in offshore outsourcing faces barriers specific to the nature of offshore outsourcing such as cultural and semantic distances, frequently low absorptive capacity, and interorganizational conflict. For instance, client management may need to establish formalized communication structures and to define KT procedures to enforce effective interactions against low motivation of client staff [9].

Although effective KT therefore seems to depend on governance, we know little on how existing governance and control theories apply to the governance of KT. The relationship between governance and KT may be far from simple. Both governance portfolios [12, 13] and knowledge evolve over time. Knowledge may be both an antecedent to and an outcome of governance [14]. In OOSM transitions, this raises questions such as: Does KT governance need to be adapted over time to accommodate changes in the expertise of vendor engineers?

In this research, we strive to explore the interaction of governance and KT in OOSM. Although knowledge may be transferred at various levels, we focus on the individual learning of vendor engineers because of the central role of individual maintainers’ knowledge. To summarize, this paper addresses the following research question:

_How do governance and individual learning interact during the transition phase of OOSM projects?_
The paper is organized as follows. In section 2, we present our conceptual framework. In section 3, we describe how we conducted a longitudinal multiple-case study to explore the relationship between governance and individual learning. In Section 4, we describe and discuss the interactions of governance and learning in the cases and build a process theory. In section 5, we discuss implications of our study.

2. Conceptual framework

Consistent with Eisenhardt’s [15] recommendations for theory building, we entered the field with an a-priori selection of constructs taken from the literature, but without hypotheses. Figure 1 shows the constructs along with the theoretical lenses that suggest their relevance. Next, we provide rationales for the choice of the theoretical lenses and relate the constructs to prior literature. Definitions of the constructs included in the developed theory are given in Appendix A.

2.1. Outsourcing Governance and Control

The IS outsourcing governance literature aims to explain how clients influence behavior in outsourcing projects through governance [10]. A refined conceptualization [11] suggests that governance comprises the foundations and actions that guide behavior towards desired objectives. Prominent foundations of governance include the contract and relationship attributes such as trust [11]. These foundations enable actions of governance, to which we refer as control [11]. Control therefore denotes actions intended to align individual behavior with organizational objectives [16]. For instance, a contract may prescribe that vendor personnel must be able to independently solve particular software maintenance problems at the end of the transition phase (foundation). This enables client management to measure, evaluate and reward or sanction vendor performance (control).

Control theory has been established in the IS literature as a framework to describe and predict control [17]. Control theory distinguishes four modes of control: outcome control, behavior control, clan control, and self-control (see Appendix A for our adapted definitions). Whereas outcome control and behavior control are instances of formal control, clan control and self-control have been referred to as informal control. Control may not only be described with regard to its mode, but also with regard to its amount. The amount of control has been defined as the variety of mechanisms and the extent to which each of the mechanisms is used [18]. Findings of control theory include that control portfolios are chosen based on task characteristics, the controller’s knowledge, and relationship characteristics [12, 13, 16, 18] and that control portfolios may change when these contextual factors change [12, 13].

While control theory has been used to study how control influences software delivery, we adopt control theory to study how control influences learning. In this context, outcome control includes actions targeted at enforcing specific learning outcomes such as levels of understanding or task performance standards. Behavior control may refer to the enforcement of KT procedures such as the compulsory use of replay sessions [9]. Similarly, clan control and self-control can be used to informally steer behavior in a way that aligns it with the learning goals desired by the client.

2.2. Cognitive Load Theory

Cognitive load theory (CLT) [19, 20] is currently one of the most influential theories in learning psychology [21, 22]. It is positioned as a theory to explain the learning of rather complex tasks [19], such as software maintenance [23, 24], in settings that impose heavy cognitive load on the learner, such as in the transition phase of offshoring projects [3].

According to CLT, learning is an increase in expertise through the acquisition or automation of schemas [21]. Cognitive load theorists concur that meaningful learning occurs when the learner engages in authentic tasks as long as the cognitive load imposed by the task is manageable for the learner and the learner is motivated to engage in schema construction [21, 25]. When the complexity of a task exceeds the processing capacity indicated by the learner’s expertise, strategies to reduce cognitive load are necessary. These strategies include supportive information and specification [25]. Supportive information activities such as informal explanations, formal presentations, and document study
help the learning engineer to acquire schemas that relate to nonrecurrent aspects of tasks. Specification reduces the decisions that the learning engineer needs to make when engaging in a task by partially or fully indicating the solution to a problem. For instance, an SME may compile the design of a modification request and leave only its implementation to the learning engineer.

The discussion of CLT suggests that the combination of work on tasks, supportive information, and/or specification results in meaningful learning. Given the objective of this paper, it will be desirable to understand how governance influences the occurrence of these activities and what impact the resulting expertise has on governance.

2.3. KT Theory

Adding to the perspective provided by CLT, the KT literature explains under which conditions knowledge is communicated from a source so that it is learned and applied by a target [26]. Although this conceptualization does not grasp learning that occurs outside of communication processes, such as during the work on tasks, the KT literature has enhanced our understanding of antecedents to KT, in particular those that are specific to cross-border and interorganizational KT.

The antecedent conditions to KT include characteristics of the SME, of the learner, and of their relationship. Relevant characteristics of the SMEs are their motivation [26, 27] and their encoding competence [26]. Characteristics of the relationship include trust [28], distance [29], and conflict [30]. The characteristics of the learners include their motivation and their absorptive capacity [26, 27] (their ability to assimilate and apply outside knowledge [31]). We did not incorporate absorptive capacity as it is strongly related to the construct of expertise in that both denote the ability to relate novel information to former experience.

Taken together, the existing literature provides us with constructs to describe activities that are likely to result in learning (learning activities), conditions under which these activities are likely to occur, and foundations and actions through which these activities may be enforced (governance). In this study, we aim to explore how governance and learning activities influence each other over time in the transition phase of OOSM projects. Next, we describe the methods that we adopted to this end.

3. Methods

We chose a longitudinal multiple-case study approach to develop theory [15]. We deemed the case-study approach suitable because we addressed a how question in a context in which the boundaries are not clear and of which researchers have no control [32].

We adopted an embedded case study design. One transition of a software maintenance job to one vendor employee represented one case. We only included cases in which the vendor team consisted of initially one staff. Within a case, we used temporal bracketing [33] to divide transitions into phases that show consistent configurations of the constructs of our conceptual framework. Any significant discontinuity of a construct demarked the start of a new phase. Hence, the phases were used as embedded units of analysis “for the exploration and replication of theoretical ideas” [33]. Bracketing has already been used as an analytic technique to explore the evolution of control [12].

We gathered data on four transition projects. The transitions were conducted on site in Switzerland on the premises of a Swiss bank, which represented the client in all four projects. In all projects, the learning engineers were planned to take over the role of onsite coordinators. Hence, our data focus on the transitions from SMEs to onsite coordinators, whereas subsequent KT to offshore teams were outside the scope of our analysis. We believe that this focus is well-grounded because transitions are typically conducted onsite [2], because the learning of onsite coordinators has been reported to be influential for the success of offshore projects [9], and because this setting still reflects many of the KT barriers specific to offshore outsourcing such as cultural and semantic distances and conflict. We decided to investigate the KT to individuals who independently take over maintenance tasks to distill the role of individual learning. All projects were based on time-and-materials contracts [34] and were considered successful by the stakeholders.

Data were collected through semi-structured interviews, observation of KT sessions, and document analysis based on a case-study protocol [32, p. 79]. Table 1 gives an overview of the data sources. To increase the validity of longitudinal data, several interviews with the learning engineers were conducted at different points in time. All interviews except for one were tape-recorded and transcribed. In addition, the first author observed KT sessions. The documents analyzed included contract extracts, KT plans, the KT methodology used [35], and software specifications.

The data analysis process is displayed in Figure 2. Data were coded at nodes and relationship nodes using NVivo 9. Because the existing literature did not provide rich descriptions of the governance of learning in OOSM projects, data were initially coded at nodes at the construct level. This first coding run was done by two researchers and was guided by definitions of the a-priori constructs. The coders then discussed the disagreements that emerged in five interviews and reasons
for disagreement were documented. The reasons for disagreement and the results of the first coding run allowed us to inductively define most of the coding rules, while some rules were inspired by the literature (see Appendix A). This approach was consistent with Eisenhardt’s recommendations for positivist theory-building according to which “measures often emerge from the analysis process itself, rather than being specified a priori.” [15]

### Table 1: Data Sources

<table>
<thead>
<tr>
<th>Case</th>
<th>Interviews: number of interviews/number of interviewees</th>
<th>Ses. observ.</th>
<th>Docs.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Ln. eng.</td>
<td>SMEs</td>
<td>Managers</td>
</tr>
<tr>
<td>1</td>
<td>5/1</td>
<td>2/2</td>
<td>2/1</td>
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<tr>
<td>2</td>
<td>2/1</td>
<td>2/2</td>
<td>3/3</td>
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<tr>
<td>3</td>
<td>3/1</td>
<td>2/2</td>
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<td>4</td>
<td>2/1</td>
<td>2/2</td>
<td>1/1</td>
</tr>
</tbody>
</table>

### Figure 2: Data Analysis Process

In addition to the coding at nodes, the first author coded interview statements that indicated a causal link between the constructs at relationship nodes. Relationship nodes indicate relationships between two nodes. For instance, the following statement was interpreted as suggesting causal links between expertise and self-control and between self-control and supportive information:

*He gathered a lot information independently from others. Because he had very vast knowledge on the tool, he knew where to look up what information.*

Next, the first author drew one visual map [33] per case, in which he arranged events that had been coded as control or as learning activities on a timeline. The resulting displays provided first illustrations of the evolution of control and learning activities over time. He then marked events that suggested changes in all constructs beyond control and learning activities.

Subsequently, the first author determined construct instances such as high, medium, low, while looking for discontinuities in the constructs to divide the transition into phases (bracketing). This iterative process resulted in 15 phases. Out of these 15 phases, three were eliminated due to lack of triangulation. Construct instances were determined by the first researchers through the measures developed. Examples are provided in the next section.

We proceeded with developing and validating propositions of a process theory to explain the interaction of governance and learning. Process theories depict events that are assumed necessary for an outcome to occur [36]. To this end, we looked for causal interview statements that were able to explain changes in learning activities or governance from one phase to another. Next, we validated the statements by within-case analysis in the other cases and by cross-case analysis. We terminated data analysis once the process theory could explain the evolution of governance and learning in all cases. Explanation development reduced the a-priori set of constructs to the subset that proved relevant in data analysis [15]. While developing propositions explaining the occurrence of learning activities, we controlled for a decreasing need of supportive information and specification with increasing expertise [25].

### 4. Case Analysis

This section presents the results of data analysis. First, we illustrate the analysis by providing a narration of case 1 and explaining how we determined the construct instances in case 1. Second, we describe and analyze the interactions of governance and learning in all four cases.

#### 4.1. Illustration of Construct Evaluation

Phase 1 of case 1 started when the learning engineer arrived at the client site. Management commanded that she should participate in knowledge elicitation sessions that were accompanied by a KT coach of the client firm (behavior control). This was based on the KT methodology [35] adopted by the client. Phase 2 started in week 3, when no supportive information activities were commanded by client management any more. Instead, the coach assigned the responsibility for arranging further sessions to the learning engineer (self-control). Yet, no formal sessions took place in phase 2, while informal discussions served as the main mechanism for obtaining supportive information. In addition, the learning engineer was assigned (behavior control) first tasks in phase 2. She spent considerable effort working on these tasks (work on tasks). In phases 1 and 2, the SMEs experienced high work loads on duties other than KT (conflict). In phase 3, the fourth month of her onsite stay, the learning engineer was not assigned any tasks by management (low behavior con-
In her search for learning opportunities, she approached one SME to work on a task together with him (self-control). This helped the SME to deliver the task (low conflict).

Next, we illustrate how we obtained the subset of the construct instances in case 1. Appendix A shows how we applied the coding rules to obtain the construct instances. Outcome control was evaluated low across phases. Target learning outcomes were not explicit and not related to a timeline:

*It will surely take some time [...]. My expectation is not that any specific status is reached after a month. It is very difficult to measure this.* (manager, case 1)

Behavior control of learning was evaluated medium in phases 1 and 2. In phase 1, management prescribed approaches for providing supportive information, but did not assign any tasks to the learning engineer. In phase 2, the opposite was true. We consider both prescribing forms of supportive information and assigning tasks as behavior control because managers specify how the learning process is to be organized.

Clan control was considered medium during phases 1 till 3, because the learning engineer’s learning was not discussed in any meetings, but seems to have been influenced by values of the team members:

“*[Learning-by-doing] is of great importance. [...] I think our team shares this perspective.*” (mgm. case 1)

Self-control was considered to increase from medium in phases 1 and 2 to high in phase 3. In phase 1, the learning engineer asked a moderate amount of questions and replayed her own understandings to a moderate extent during the observed knowledge elicitation sessions, as indicated by the count of statements. This was particularly salient in the first of the two sessions. These observations indicate that she took moderate action when goals such as understanding were not met. Furthermore, she reported to engage three hours per day in code study, although she later conceded that this activity was less effective for learning:

*As such, just code study is pretty tough. Especially where implementation is quite complex. It's tough.* (learning engineer, case 1)

This suggests that the engineer did not trigger significant improvements of learning strategies at that stage. Taken together, the observations suggested medium self-control. In phase 2, the learning engineer frequently engaged in informal discussions to clarify queries. However, although the learning engineer was assigned the responsibility of arranging formal sessions and although she indicated a need for them to the SMEs, they did not take place in phase 2. We therefore consider self-control still medium in phase 2. In contrast, self-control was high in phase 3, when the learning engineer independently approached a SME to become involved into a task:

*Actually, it is not my task, but I was with [SME 2] when he was developing one of his tasks. – Was that to learn or to help him? – It was for learning and a little bit of help.* (learning engineer, case 1)

Finally, we illustrate how we evaluated conflict. Conflict was considered medium in phases 1 and 2, and low in phase 3. In phases 1 and 2, SME 1 reported high work load through tasks other than KT:

*Has the overall picture session already taken place? – No, not yet, I am currently a little bit under stress, but that will improve.* (SME 1, case 1)

On the other hand, the SMEs reported benefits from the learning engineer’s learning, which overall suggests a medium level of conflict:

*It was good that [learning engineer] freed me of ties by working on these small things.* (SME 2, case 1)

Conflict was less in phase 3, when the involvement of the learning engineer in the task of SME 2 resulted both in learning for the learning engineer and in help for the SME to get his task accomplished.

Construct evaluation was paralleled by the subdivision of the transitions into phases based on discontinuities between the phases. From phase 1 to phase 2, we observed changes in the mechanisms of behavior control, in self-control, and in work on task. Conversely, phase 3 is distinguished from phase 2 by a decrease in behavior control, because the learning engineer was assigned no tasks, by a decrease in conflict, because the SME now benefited from providing the learning engineer with learning opportunities, and by an increase in self-control.

### 4.2. Results and Discussion of Cases

Table 2 shows the construct instances across phases. For reasons of parsimony, behavior and outcome control have been grouped to formal control. Because the table provides an aggregated overview of the cases, it does not reveal the multifaceted details of the qualitative data, of which we made use during data analysis.

Next, we describe and analyze the evolution of governance and learning over time in the four cases. Because all cases indicated similar configurations of control towards the end of the transition, we start our discussion with the end states and the events that may have led to these end states.

Across cases, we find significant levels of self-control towards the ends of the transitions, while there is more variation in the initial levels of self-control. Causal interview statements suggest that trust and expertise may explain the increases of self-control. For instance, the following statement indicates the impact of trust on self-control from the perspective of the learning engineer:
I always do ask a lot of questions. But it is always better to share a good rapport with the other person. After that, I feel much more comfortable in asking my questions, and have the confidence that my doubt will be clarified. Also, I am aware that the question will not be turned down. (learning engineer, case 1)

Another statement may illustrate how trust and expertise enable self-control from the perspective of client management:

He is [...] very strong in asking questions. He is active and he has a very good knowledge. This is why we did not have to pay a lot of attention to his knowledge acquisition. We had the confidence that he will be able to do it. (manager, case 1)

Different levels of expertise in the cases 3 and 4 seemed to enable different amounts of self-control. In case 4, high expertise from former projects involving the same standard software facilitated self-control:

[The learning engineer] gathered a lot of information independently from others. Because he had very vast knowledge on the tool, he knew where to look up what information. (manager, case 4)

Conversely, relatively low expertise of the learning engineer in case 3 constrained his ability to effectively self-control learning activities:

You go to this document immediately, you do not understand anything. [...] Then I asked [the SME] ‘What is this?’ Then he said: ‘You do not understand this now, you need to read first these 3 documents.’ It could have been easier if he had said: ‘You just read this first.’ (learning engineer, case 3)

A refined conceptualization of governance [11] has proposed the term foundation to describe the basis of governance that enables control. We propose that trust and expertise may constitute foundations of self-control of individual learning. Once these foundations are established, learning engineers may engage in high amounts of self-control:

P1: High amounts of self-control require significant expertise and trust (foundations of self-control).

The central role of self-control towards the ends of transitions raises the question of how the foundations of self-control, i.e. trust and expertise, developed. Our data suggest that learning activities were the main antecedents to changes in these foundations. Many interview statements suggest a causal link between learning activities and increases in expertise such as

He is now able to do what he has previously done. That is what he is able to do. (SME 1, case 1)

Likewise, we find statements explaining how learning activities increase trust such as:

You slowly noticed that you can give him tasks after you saw that he well accomplished the first task in the project with [SME] and that it did not consume much of his time. Suddenly you noticed, there is someone to whom you can assign responsibility. (manager, case 4)

We therefore propose:

P2: Expertise and trust develop through learning activities.
If learning activities play a central role for the development of trust and expertise, there is interest in understanding the antecedents to learning activities. While we observed relatively high amounts of learning activities towards the ends of all transitions, there was more variation at their beginnings. Our evidence indicates that high amounts of learning activities initially only manifested under rather high levels of formal and clan controls. In case 1, significant supportive information was given only through the knowledge elicitation sessions in phase 1, when the process was under the control of the KT coach (behavior control). In contrast, supportive information activities were less in phase 2, when the responsibility for arranging formal sessions was assigned to the learning engineer (low behavior control regarding supportive information). Not only supportive information, but also work on tasks seemed to depend on formal control in case 1. Work on tasks started only in phase 2, when the learning engineer was formally assigned a change request (behavior control). Likewise, the learning engineer of case 4 only had the opportunity to work on new tasks once management increased the behavior control on the SMEs to delegate tasks. All these discontinuities are increases of formal control that are associated with higher amounts of learning activities. In case 3, formal and clan controls were relatively high from the beginning and so was the amount of learning activities, confirming thereby a strong link between control and the amount of learning activities.

Yet, the amount of control needed for significant learning activities varied within and across cases. Our data suggest conflict, distance, lack of motivation of SMEs, and lack of trust as barriers that needed to be overcome by control. The higher these barriers were, the less learning activities took place under unaltered control. For instance, knowledge elicitation sessions [35] in case 3 only took place once delivery activities for a release (source of conflict) were completed. The decrease in conflict led obviously to an increase in learning activities while control remained unchanged. In case 4, similar amounts of control led to more learning activities in phase 4 than in phase 3 after trust increased, while cultural distance was still present:

I appreciate him a lot, as a colleague and as a human. He showed me that the wall between the cultures is not that big. The wall is broken down. (SME, case 4)

Suddenly we noticed that we could give certain things to [learning engineer]: “Can you write this script for me? (SME, case 4)

The preceding discussion suggests that high amounts of learning activities only take place under significant amount of control. The required amount of control seems to be a function of the barriers to knowledge sharing. We propose therefore:

P3: High amounts of learning activities manifest only when control outweighs the barriers to knowledge sharing (conflict, distance, lack of motivation of SMEs, lack of trust)

Taken together, the propositions form a process model that explains the evolution of governance and learning over time. The model is depicted in Figure 3.

![Figure 3: Process model of the interaction of governance and learning](image)

5. Implications

Although the existing literature suggests that KT and its governance are central to the success of OOSM projects, we knew little on how KT and governance interact. In this paper, we focused particularly on the interaction of governance and individual learning during the transition phase of OOSM projects. Based on in-depth data from four transitions, we developed three propositions of a process model of the interaction of governance and learning in OOSM transitions.

Our paper contributes to the existing literature in various ways. First, we suggest explanations for how and why governance portfolios may change in OOSM transitions. Initially, client management needs to engage in control that outweighs the barriers to KT, i.e. conflict, distance, lack of motivation of the SME, lack of trust. The higher these barriers are, the more control may be needed. Because the foundations of self-control, i.e. expertise and trust, may be rather low at this stage, control portfolios need to be complemented by significant formal and clan controls. Only when control exceeds the level imposed by the barriers, learning engineers will engage in high amounts of learning activities. Over time, these learning activities will result in increased expertise and trust and thus allow for more self-control. As a result, formal and clan controls may be reduced over time and governance portfolios may have a strong emphasis on self-control towards the end of successful transitions.

Second, to the best of our knowledge, our study is the first to apply control theory to learning. Our results suggest that control theory may be used to explain the occurrence of learning activities. The coding rules developed in this study to grasp the control of learning may be a connecting point for future research.
Third, our paper confirms that conceptualizing governance as foundations of governance and control helps understand how governance evolves over time. Our paper extends this perspective by proposing expertise and trust as foundations of self-control. The results thereby also suggests an extension to control theory, at least if the task to be controlled is learning. Control theory posits that the controller’s knowledge enables behavior control [16]. This argument may similarly apply to self-control. Because the controller is controller at the same time, she/he may require knowledge to effectively exert control of his own behavior. Educational research on the impact of domain knowledge on self-regulated learning [37] lends support for the proposition that expertise fosters effective self-control.

Fourth, the prior literature [26-28] has shown a strong link between trust and knowledge sharing. Our study suggests that these findings do apply to learning in OOSM projects. Moreover, our paper explains that trust may be essential for KT because it plays a dual role. On the one hand, lack of trust is a barrier to knowledge sharing by SMEs. On the other hand, trust seems to foster self-control. Put another way, trust is an antecedent to both control and knowledge sharing.

Our study has several limitations. First, although two coders were involved during early data analysis, the final coding was done only by one coder. We attempted to mitigate negative effects of this by specifying detailed rules for the evaluation of constructs. Second, we investigated only rather successful transitions. It is possible that control and learning interact ways other than anticipated here in less successful projects. Third, our study is limited to individual learning by onsite vendor coordinators. While this scenario is typical for transitions in offshore projects, our findings may not necessarily apply to transitions to teams that are placed offshore. Fourth, all projects were based on time-and-materials contracts. Governance may play different roles in fixed-price contracts, in which the vendor may not be paid for KT activities. Fifth, all projects referred to the same client and were small-scale. Sixth, we did not report rival explanations.

Future research may connect to this study. Researchers may repeat the study under different conditions such as in fixed-price or large-scale projects involving offshore teams. Other extensions of our study are to build a variance theory or to test the process theory. Finally, our study has highlighted that self-control may play an influential role in individual learning. This suggests that theories of self-regulated learning [38] may serve as a powerful lens to understand learning in the transition phase of OOSM projects.

Acknowledgements

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Appendix A: Construct Definitions, Coding Rules, and Construct Instances in Case 1

<table>
<thead>
<tr>
<th>Definition</th>
<th>Measures</th>
<th>Phases of Case 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Work on Tasks</td>
<td>The LE strongly engaged in one or more software maintenance tasks.</td>
<td>- - ++ ++</td>
</tr>
<tr>
<td>Supportive Information</td>
<td>The LE strongly engaged in supportive information activities such as informal discussions, document study, formal presentations, knowledge elicitation sessions, Google search.</td>
<td>++ 0 0</td>
</tr>
<tr>
<td>Specification</td>
<td>M + 0</td>
<td></td>
</tr>
<tr>
<td>The extent to which tasks are specified [25]</td>
<td>The solution approach of the task(s) in which the learner engaged was strongly specified.</td>
<td>- - ++</td>
</tr>
<tr>
<td>Outcome Control</td>
<td>The LE reported to be aware of a timeline for the completion of KT.</td>
<td>- - ++</td>
</tr>
<tr>
<td>The software products created by the LE were tested or reviewed.</td>
<td>- - ++</td>
<td></td>
</tr>
<tr>
<td>Learning outcomes were measured regularly beyond the results of software tests or reviews.</td>
<td>- - ++</td>
<td></td>
</tr>
<tr>
<td>CM regularly evaluated learning outcomes against targets.</td>
<td>- - ++</td>
<td></td>
</tr>
<tr>
<td>The vendor was rewarded or sanctioned depending on learning outcomes.</td>
<td>- - ++</td>
<td></td>
</tr>
<tr>
<td>Behavior Control</td>
<td>CM prescribed that supportive information activities such as formal presentations, informal discussions, and document study should take place.</td>
<td>++ - -</td>
</tr>
<tr>
<td>CM influenced how supportive information activities were conducted.</td>
<td>++ - -</td>
<td></td>
</tr>
</tbody>
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3550
| Behavior against articulated procedures of behavior that results in learning [12, 17] | CM prescribed that the LE should work on tasks. | - - | ++ | - - |
| CM or SMEs considered task complexity and the LE’s expertise when assigning tasks. | - - | ++ | - - |
| CM prescribed the degree of specification of tasks (e.g. design taken over by SME). | - - | ++ | - - |
| Clan Control | The amount of selection processes or social mechanisms to control the behavior of individuals that results in learning [17] | The LE was part of regular meetings in which learning was informally discussed. | - - | - - | - - |
| | | The SMEs reported values that indicate the importance of the LE’s learning to them. | ++ | ++ | - - |
| | | CM reported their appreciation towards any approach for conducting KT. | ++ | ++ | ++ |
| Self-control | The amount of actions in which the LE sets own learning goals, monitors learning, and rewards or sanctions herself/himself accordingly [18] (Some measures were taken from the literature on self-regulated learning [38].) | CM expressed that they expected self-control. | ++ | ++ | ++ |
| | | CM or SMEs reported that the LE took control of his learning process. | ++ | ++ |
| | | The LE reported target learning outcomes. | ++ | ++ |
| | | The LE actively approached the SMEs whenever she/he had doubts that could not be answered based on nonsocial knowledge sources. | 0 | 0 | ++ |
| | | The LE effectively consulted nonsocial knowledge sources. | - - | ++ |
| | | The LE insisted to take over tasks. | - - | ++ |
| | | The LE reported reflections on the effectiveness of own learning strategies. | + + |
| | | The LE triggered improvements based on reflections of learning effectiveness. | - - | ++ |
| Expertise | The power of the LE’s schemas, i.e. memory structures that categorize information in a manner specific to perform a particular task [20] (measured based on the categories of the body of knowledge [39]) | The LE demonstrated strong expertise in task-specific application knowledge. | - | - | 0 |
| | | The LE demonstrated strong expertise in task-specific application domain knowledge. | - | - | 0 |
| | | The LE demonstrated strong expertise in task-specific IS development process knowledge. | - | - | 0 |
| | | The LE demonstrated strong expertise in task-specific technical knowledge. | + | + | ++ |
| | | The LE demonstrated strong expertise in task-specific organizational knowledge. | - | 0 | + |
| Trust | The reciprocal willingness of the LE and the SME to depend on another person’s actions that involve opportunism [28] | The LE reported to expect friendly answers when approaching the SME with questions. | 0 | + |
| | | The SME appreciated the personal traits of the LE. | ++ |
| | | The relationship between the LE and the SME is cordial. | ++ |
| | | The SME reported that the LE possessed strong skills from prior experience. | ++ |
| | | The LE reported that (s)he perceived the SME as competent. | ++ |
| SME Motivation | The willingness of the SME(s) to provide the LE with learning opportunities | CM reported that the SME was willing to create learning opportunities for the LE. | 0 | 0 |
| | | The LE reported that the SME was willing to create learning opportunities for the LE. | 0 |
| | | The SME reported to enjoy rather than to detest sharing knowledge. | 0 |
| Distance | The cultural, semantic, and geographic distances between SME and learner [2] | The SME and the LE come from countries with different national cultures. | ++ |
| | | The SME reported that cultural differences strongly affected the interactions. | - - |
| | | The SME reported that language barriers strongly affected the interactions. | 0 |
| | | The LE reported that language barriers strongly affected the interactions with the LE. | 0 |
| | | The observation notes indicate that the LE or the SME struggle with English. | 0 |
| | | The LE and the SME worked in the same room. (inverted) | ++ |
| Conflict | The degree of incompatibility of activities, resource share, and goals between partners [40] | The SME had high work load of tasks other than KT. | ++ |
| | | Providing the LE with learning opportunities helped the SME get own duties done. (inverted) | - - | - - | ++ |
| | | Increasing the productivity of the LE lies in the SME’s interest. (inverted) | ++ | ++ | ++ |

(L.E: learning engineer, CM: client management, empty cell: no basis, - -: low, -: medium-low, 0: medium, +: medium-high, ++: high)

**Literature**