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Coordinating project complexities in inter-organizational railway projects – a multiple case study highlighting the importance of relational coordination (Part II)

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Abstract

Inter-organizational projects are often coordinated by means of planning & control, whereas their complexities are more dynamic. This paper aims to expand the literature on the system life cycle view by demonstrating the importance of relational coordination in the early stages of inter-organizational projects. Especially in the technical environment of inter-organizational transportation projects, it is important to create awareness of the need for mutual understanding of the interests of all parties involved, and early relational coordination. These, when combined, appear to facilitate decision-making and system integration.

Keywords: Decision-making; System integration; Coordination mechanism; Relationship-building

1. Introduction

In part I of this study, the authors established that the operationalization of Maylor & Turner's complexity-response framework can be applied to the railway system context. The framework aids in understanding project complexities and enables the identification of appropriate coordination mechanisms by means of the use of targeted responses [1]. This is essential, because project complexities in transportation projects increase with an increased need for system integration and joint decision-making activities [2, 3], which requires more fitting responses. The purpose of part II of this study is to explore the fit between the proposed coordination mechanisms of the contingency approach of Maylor & Turner, to the experienced coordination mechanisms in inter-organizational transportation projects, and how this affects coordination effectiveness [1].

To investigate this, a multiple case study on the Dutch railway system was conducted. The railway system is an excellent example of a transportation system in which the respective responsibilities are divided along the value chain, and where infrastructure management and train operation have been separated [4]. This division requires collaboration between the entities involved to attain system integration and joint decision-making, in order to ensure that value is created for the customer during operation. To explore the complexities and coordination mechanisms adopted in projects, this paper focuses on the "actual experiences" of project stakeholders, using Maylor & Turner's complexity-response framework as the analytical underpinning [1].

This paper is organized as follows: the first section provides an overview of project complexity and coordination mechanisms. Then, the multiple case study approach and the results of the analysis of the fit are presented. The discussion which follows, addresses this fit and its empirical and theoretical significance. In the conclusion, future research suggestions are offered.

2. Coordination of inter-organizational projects

Various complexities exist within inter-organizational transportation projects, which can be addressed by means of coordination responses [1]. There is often a natural desire to address project complexities with planning and control responses, which can be attributed to Thompson's coordination mechanism [5]. However, in particular in the context of system integration and shared decision making in inter-organizational transportation projects, there seem to be potential difficulties in relying too strongly on the coordination mechanism of planning & control [2, 3, 6].

The complexity-response framework (operationalized in part I of this study) distinguishes between three different categories of complexities [1]. These dynamic complexities pose unique challenges due to their variable nature, as they can consist of structural (e.g., interdependencies), socio-political (e.g., people), and emergent (e.g., uncertainties) elements [7, 8]. For each of these complexity categories, the authors identified a preferred coordination mechanism. Nevertheless, other coordination mechanisms can be used to address the complexity in question albeit in a less effective manner.

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To date, most research has focused on establishing the contingency approach and outlining that not every coordination mechanism can capture each of the complexities equally well. However, little is known about the impact this mismatch has on the project organization, particularly in terms of the satisfaction with the applied coordination mechanisms that project members experience.

3. Research Design and Methodology

The first aim of this study is to identify if there is a fit between the suggested coordination mechanism mentioned in the literature, and the coordination mechanism applied in practice. Afterwards, the study assesses the level of satisfaction of the project members with the coordination applied in practice to draw conclusions regarding the practical impact of the fit.

In order to understand the fit between the coordination mechanisms in both theory and practice, a qualitative multiple case study [9] was conducted. Yin emphasizes that a case study design is particularly useful in context-dependent environments [9], which include inter-organizational projects. According to Eisenhardt, a multiple case study focuses on common patterns among cases and theory and emphasizes the theory-building attributes of case studies [10]. Our multiple case study design is exploratory and empirical in nature; it explores the use of coordination mechanisms in inter-organizational projects in the railway system in order to assess their fit with the underlying context [9].The research design consists of five phases (Fig. 1) which are based on the thematic analysis of Braun [11]. As a first step, a theoretical approach which demands that the literature be studied prior to analysis [11] was selected. After this, data collection by means of semi-structured interviews with project members was conducted, followed by verification of the transcripts with the interviewees. Secondary data, such as project documentation, was used to enhance the researchers understanding of the case and its context. Then, transcripts were coded using the AtlasTI qualitative software. Initial coding was performed, and thematic searching was applied to the transcripts [11] using the complexity-response framework [1] as operationalized in part I of this study. Next, the fit between the proposed- and the applied coordination mechanisms was determined. Finally, a cross-case comparison to identify overlapping patterns across cases was performed [9].

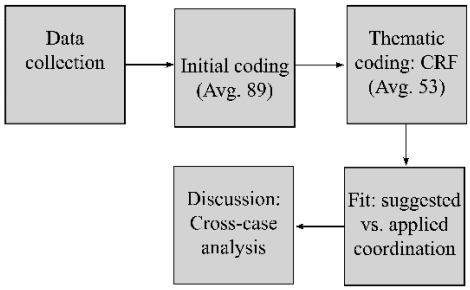

Fig. 1. The research design, adopted from [11]. Provides the average codes of the four cases for both coding steps.

3.1. Case selection & description

This empirical study focuses on inter-organizational railway projects. By adopting a system lifecycle view [2], we assume that the multi-organizational environment unites in the project phase to jointly create value for operations. These projects include aspects of shared decision-making and system integration, which are influenced by the selected project management practice. For case selection, we conduct diverse sampling [12], which allows for a focus on two dimensions. The first dimension is that the sample is representative of inter-organizational projects in the railway system. The second ensures that there is meaningful variation in the project life cycle phase. Table 1 provides an overview of the four inter-organizational projects.

Table 1. Introduction to the four cases.

Case study	Decision context	Scope	Description	Main involved parties	Project lifecycle phase
Braking Criterion	Safety improvement initiative	Material level	Deciding on the effects of an initiative to reduce the amount of signals past at danger.	NS, ProRail, ILT, IenW	Improving during operation / retrofitting
Axle Loads	Introduction new material	Material level	Deciding on the axle load limit of a new train: trade-off passenger capacity vs. infrastructure compatibility.	NS, ProRail, (IenW)	Design phase
Calamity Vehicle	Introduction new vehicle	Corridor level	Deciding on when the new vehicle is ready for operation, e.g. responsibilities, safety assessment.	NS, ProRail, (IenW)	Implement phase
ERTMS	ERTMS program – safety control	Country level	Safety control board deciding on the hazards that are emerging at the interface between 2 or more implementing organizations.	Railway undertaking (passenger & fright), contractors, ProRail, ERTMS program, IenW	Design phase

3.2. Data analysis

The semi-structured interviews with senior project members were coded using the qualitative software AtlasTI. Codes identified in the transcripts were thematically sorted into the three complexity categories (structural, socio-political, emergent) and the three coordination mechanism categories (planning & control, relationship-building, flexibility) of the complexity-response framework ((sub-)categories are discussed in more detail in part I of this study). For instance, when an interviewee reported; "issues in coordination due to different interests of project members", we coded this as "different interests" and assigned the code to the category socio-political complexity. Resulting from that, in Table 2 column 3, primary complexity is given by the category to which the most codes were assigned. Following, secondary complexity is given by the category with the second most codes assigned to. Similar coding steps were performed for the applied coordination (Table 2, column 5). To determine the suggested coordination (Table 2, column 4), we adhered to the literature, which suggests that each of the three complexities is best addressed by a particular coordination mechanism [1]. For example, if project members primarily experience socio-political complexity, responses that help build relationships are most appropriate. Also the fit of the applied coordination mechanisms to the case-specific experienced project complexities was assessed. This was carried out in a similar way by Mintzberg [13], who assessed the fit between organizational structure and situation. In our study, when the suggested and applied coordination mechanisms match, a high fit is identified (Table 2, column 6). Other coordination mechanisms can also be used to deal with a certain type of complexity, but less effectively so. As such, only the degree of fit can be estimated. Additionally, the effectiveness of coordination was determined by comparing codes related to positive coordination with suggestions for improving coordination (Table 2, column 7). For instance, when more positive experiences with coordination, and correspondingly fewer suggestions for improvement of coordination, were mentioned, we rated this as project members being satisfied with coordination. Finally, some of the project members' statements from the interviews were selected to illustrate the results presented in Table 2.

4. Results & Discussion

The case studies revealed different levels of fit between the proposed and applied coordination mechanisms (Table 2). The following section starts by discussing the coordination mechanisms which were applied in the project. After this, the fit between the proposed and applied coordination mechanisms is evaluated, and the coordination effectiveness is assessed by investigating the project members' satisfaction with the chosen approach.

4.1. Coordination mechanisms applied to inter-organizational projects

The project team used multiple types of coordination mechanisms to cope with the complexity of the projects.

In the BRAKING CRITERION case, the applied coordination focused mainly on planning and control mechanisms. Project team members noted the structured approach of the study and a well-planned

Table 2. Results of the interview analysis: assessing fit between suggested and applied coordination.

Case	Decision context	Complexities	Suggested coordination	Applied coordination	Fit	Coordination effectiveness
Braking Criterion	Safety improve initiative	Primary: Socio-political (different interests & viewpoints; low solution acceptance) Secondary: Structural (system parts are interdependent)	Relationship-building	Planning & control (e.g. individual planning and decisions)	Low	Project members less satisfied
Axle Loads	Intro new material	Primary: Socio-political (different interests; conflicting views) Secondary: Structural (interfaces with shared decision responsibility)	Relationship-building	Relationship-building (e.g. regular and intense discussion and exchanging of viewpoints)	High	Satisfied with coordination
Calamity Vehicle	Intro new railway vehicle	Primary: Emergent (unknown & new product / changing processes of organizations) Secondary: Socio-political (problem disagreement & little ownership at beginning)	Flexibility Relationship-building	Flexibility (e.g. test and learn approach); Relationship-building (e.g. short & informal communication)	High	Satisfied with coordination
ERTMS	ERTMS – safety control	Primary: Socio-political (unclarity about roles and responsibilities) Secondary: Structural (many different stakeholders)	Relationship-building	Planning & control (e.g. defining process agreements)	Low	Project members less satisfied

and executed pilot study. They also felt that the preparation of the decision-making process was well done and illustrated all the different impacts of the selected solution on the system performance. Suggestions for improvement regarding the coordination mechanisms employed, focused on relationship-building. Notably, no common understanding of the problem, let alone agreement on a solution, was reached among the various project stakeholders, even after the decision had already been made. For example, the individual responsible for advising on the relationship between planning & safety of the rolling stock company stated:

"My opinion is that it was the wrong decision […] Ultimately, the solution isn't impactful enough to fully reduce the risk."

The safety advisor from the ministry, on the other hand, elaborated:

"Based on the numerous incidents alone, it became clear that something had to change. […] but the actual decision took a very long time, which I can't understand."

In the AXLE LOADS case, the project members employed targeted relational coordination. Emphasis was placed on creating mutual understanding between the different experts by means of facilitated discussions, particularly at the start of the project. Additionally, the focus on stakeholder management and establishing openness within the group was perceived positively. In the words of NS's project manager:

"Stakeholder management was a key success factor throughout the preparation of the decision. Good stakeholder management facilitated discussion at the substantive level in a way that created more understanding of others' perspectives."

Coordination regarding flexibility was also highlighted as a positive aspect; by establishing a small core coordination group to prepare the work, it was made possible to respond to changes more quickly. This meant that the larger project team which included all experts was only called in when required.

In the CALAMITY VEHICLE case, project members noted a high level of coordination by means of relationship-building. At the start of the project, emphasis was placed on informal activities such as team building and demonstrations of the solution to make it more tangible. Additionally, transparency within the group, and following up on concerns were seen as positive. The service and operations manager put it as follows:

"The general teamwork went particularly well. You can always discuss things with each other, we did team-building activities and structural participation."

The project managers themselves emphasized flexible coordination by implementing a test-and-learn cycle, organizing joint "reality check" sessions, and having short lines of communication.

Finally, in the ERTMS case, the main mechanisms used to coordinate the project was planning and control. Two examples of this are the fact that project members were provided with organized and well-planned meetings, and that there was a strong focus on finding process agreements and following up on them. However, little attention was paid to attaining a shared understanding of the root cause of the divergent views regarding their responsibilities. One safety management representative explained this as follows:

"In terms of content, we're pretty much on the same page. But when it comes to roles and mandate, the decision is questioned: Are we even allowed to make a decision here?"

4.2. Fit of coordination mechanisms in inter-organizational projects

In order to expand on the responses preferred by Maylor & Turner [1], the fit between the suggested and applied coordination mechanisms was evaluated. In addition to fit, this paragraph also addresses project members' overall satisfaction with the coordination mechanisms applied. The levels of satisfaction were identified by comparing coordination mechanisms which were described as positive, to those that were described as needing improvement.

In the BRAKING CRITERION case, project members experienced a high degree of socio-political complexity, benefitting from an emphasis on relational coordination. The project members focused strongly on planning- and control-based coordination. This suggests that a rather limited fit existed between the complexities encountered and the coordination mechanisms used, especially in the early stages of the project. This can also be observed based on project members' reflections on project coordination in general. The project members experienced the project as rather slow, with not all of them being satisfied with the final result.

The AXLE LOADS case revealed a high degree of socio-political complexity, suggesting the use of coordination focused on relationship-building would be most useful. Within the project, the team experienced a high level of orientation towards relationship-building, especially at the start. As such, a higher level of fit between these two was observed, which was also reflected in the overall satisfaction of project participants. Most members were satisfied and willing to build on the developed relationship for a follow-up project.

Project members in the CALAMITY VEHICLE case faced a mix of emergent and socio-political complexities, suggesting the use of coordination mechanisms of flexibility and relationship-building could be beneficial. This appropriately illustrates the focus set by the project members, and shows a high

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degree of fit between the proposed and applied coordination. Generally, the degree of satisfaction with the coordination process among project members was very high, although some expressed a desire for more planning and control mechanisms.

Lastly, project members in the ERTMS case encountered high levels of socio-political complexity during coordination, suggesting that attention should be focused on the development of relationships within the group. The project team used a planning and control-based approach to address these complexities. Consequently, the degree of fit between the proposed and applied coordination was lower. This was also reflected in the feedback provided by the group regarding the applied coordination. This was not perceived to be optimal, as members felt they repeatedly discussed the same topic without making much progress.

4.3. Discussion

When comparing the results of the four case studies, it can be observed that in those cases where the fit between the proposed and applied coordination mechanisms is high, more project members are satisfied with the chosen approach. Conversely, in the cases where this fit is lower, the satisfaction with the applied coordination mechanisms among the project members is lower as well. Building on the findings of Maylor & Turner [1], who found that all three coordination mechanisms can be applied in order to address each of the three complexities, this study confirms this for certain cases (e.g., coordinate with planning for socio-political complexities). However, it is important to bear in mind that the success of the applied coordination mechanism depends on its fit with the experienced complexity. As such there appears to be a preferred way to coordinate a given complexity which results in a higher number of satisfied project participants. In the cases with a higher fit, project members were also more satisfied with the pace of the inter-organizational project. It follows that inter-organizational transportation projects can potentially benefit from identifying project complexities during coordination in order to more specifically coordinate the complexities experienced. This is likely to positively influence satisfaction and pace in inter-organizational projects.

Additionally, in the BRAKING CRITERION and ERTMS cases, a tendency to focus on planning & control activities was observed, which may have resulted from using standard project management methods that are heavily influenced by planning & control mechanisms [14]. Especially in technical environments, such as railway systems, a strong focus on planning & control coordination [15] appears to exist. The cases presented in this paper indicate that when pressures or uncertainties arise, project members tend to resort to addressing complexity with planning and control responses. Although this may be the initial response, it does not necessarily lead to coordination satisfaction. For example, in the ERTMS case, project members noticed that the current way did not lead to desired levels of progress, which they wanted to change. Still, the authors observed a tendency towards planning and control mechanisms in their improvement efforts. This appears to indicate that the required behavioral change is difficult to achieve, which is in line with the findings of change management [16]. Following Kotter [16], promoting a sense of urgency is needed as a first step to change people's behavior. Therefore, the authors of this paper suggest that raising awareness regarding the contingencies of project coordination may be a beneficial preliminary step in environments with high levels of socio-political complexity. This includes inter-organizational projects where shared decision-making activities take place [17].

Although there is a strong focus on planning and control measures, satisfaction with project coordination appears to be higher when relational coordination is applied at an early stage of an inter-organizational project. From the case studies, it can be inferred that during the design phase of inter-organizational projects, socio-political complexities are particularly high. These complexities include differing perspectives and a lack of shared understanding which complicates project collaboration. As a result, members of projects which focus on relationship-building in an early project stage, appeared to be more satisfied with the approach. As such, more emphasis needs to be placed on coordination using relationship-building early in the process, as this can benefit the pace of the project and satisfaction with project coordination.

5. Conclusion

This study was started with the goal of investigating the fit between suggested coordination mechanisms and applied coordination mechanisms in mind. The setting of inter-organizational transportation projects seemed particularly relevant because, there is a strong tendency to focus on planning and control responses in these engineering-driven environments. However, the parties in these environments, especially when it comes to project decisions, often have conflicting interests which are difficult to align, so planning and control may not always be the most appropriate mechanism for coordination. To investigate the fit between proposed and applied coordination mechanisms, a multiple case study in the Dutch railway system was conducted using Maylor & Turner's complexity-response framework as an analytical framework [1]. It was observed that in cases with higher levels of alignment between the suggested and applied mechanisms, project members

experienced higher degrees of satisfaction with the chosen approach and the pace of the project. Conversely, in inter-organizational projects which had a lower degree of fit between the two, project members appeared to be less satisfied with the coordination and pace of the project. Additionally, it appeared that in some cases there was a natural tendency to use planning and control-based coordination, even though the complexity experienced suggested otherwise. Especially in the earlier phases of cross-organizational projects, such as the design phase, the need for relational coordination is high. In summary, in the largely engineering-driven environments of inter-organizational transportation projects, more attention needs to be paid to understanding each other's interests, and early relational coordination: together these factors appear to facilitate decision-making and system integration.

The theoretical contribution of this work is twofold. Firstly, it demonstrates that matching coordination mechanisms to the experienced complexity in the inter-organizational project contributes to project coordination effectiveness. This supports the findings of Maylor & Turner regarding a contingency approach to project management. Secondly, this paper demonstrates that in inter-organizational transportation projects, especially in cases where joint project decision-making is a factor, there appears to be a strong focus on coordination by means of planning & control. Relationship-building as a coordination mechanism appears to be underutilized, particularly in the early project phases. In the discussion, a number of possible explanations for this are investigated. Nevertheless, more detailed research is needed regarding the reasons for such an undervaluation of relational coordination at the start of inter-organizational transportation projects.

5.1. Future research suggestions

This paper identifies two areas that would benefit from further research.

Firstly, this paper identifies a degree of high focus on planning and control mechanisms in railway system projects, which do not always match the complexities experienced. A stronger focus on relational coordination in such environments appears beneficial. Despite high levels of socio-political complexity, project teams often relied on planning and control mechanisms rather than relationship-building. A number of potential explanations for this are discussed in this paper, but further empirically grounded research is needed to explore the reasons why relational coordination is difficult to achieve in engineering-driven environments.

Secondly, this paper observes that relationship-building is often required in order to address the specific experienced complexities. However, the field of relational coordination is in a relatively early stage of development, and as such, cannot draw on as many tools and instruments as planning & control-based coordination. Therefore, the authors feel that future research that tests new techniques or instruments contributing to relational coordination will aid the field.

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