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Co-Designing Sustainable Coordination to Support Inter-Organizational Decision Making

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Abstract: Processes in inter-organizational projects tend to be complex to coordinate. Within these projects, stakeholders have to make decisions together, despite a limited awareness of the other parties' interests and views. Frequently, coordination in inter-organizational projects is ineffective and inadequately addressed, despite the investment of considerable effort, which often results in delays and/or unwanted project outcomes. The purpose of this study is to investigate how a shared problem understanding for inter-organizational decision making can be achieved by means of sustainable coordination. In this study, CIMO logic was used to explore the context of the organizational change, followed by the application of design science research in order to develop an intervision process. The findings of this study are twofold. To manage the complex problem context, additional efforts were needed in order to create awareness of the team's coordination activities. The application of the concept of co-designing resulted in a higher degree of sustainable relational coordination. The resulting intervision process aided the team in gaining a shared problem understanding of the decision making process in the inter-organizational project. The use of the co-designed intervision process can potentially be employed for other complex systematic problems, such as those occurring in the construction industry.

Keywords: co-design; social sustainability; relational coordination; design science research; inter-organizational decision making

Citation: Jakubeit, N.; Haanstra, W.; Braaksma, J.; Rajabalinejad, M.; van Dongen, L. Co-Designing Sustainable Coordination to Support Inter-Organizational Decision Making. *Sustainability* **2022**, *14*, 6467. https://doi.org/10.3390/su14116467

Academic Editor: Edmundas Kazimieras Zavadskas

Received: 10 April 2022
Accepted: 20 May 2022
Published: 25 May 2022

1. Introduction

Inter-organizational projects are inherently complex due to their varying levels of structural, socio-political, and emergent elements [1,2]. Coordination within these complex projects is particularly challenging, due to the need for managers to respond adequately to emerging complexities [3]. As such, complexities in inter-organizational projects tend to lead to coordination challenges that can often slow down project execution, and therefore increase project costs [4]. Relevant factors for projects to achieve sustainable development, not only include time and cost, but also social aspects, such as the consideration of stakeholders and their interconnections [5]. As stated by Missimer and Mesquita [5] (p. 8), enabling social sustainability requires "more robust and encompassing stakeholder engagement", using a high-level definition of success in order to achieve effective coordination. For the purposes of this paper, the notion of sustainability refers to social sustainability.

Large-scale inter-organizational projects are typically characterized by decision making processes in which interdependent, complex tasks must be executed at different moments by different actors, whose interests often conflict [6,7]. A large number of different stakeholders, where each has their respective goals and responsibilities within the system, work on optimizing their own part of the system, possibly unaware of the complex interdependencies between the actors in the system [5]. These differences in goals and perspectives are particularly significant during the problem identification stage of the decision making

process, where stakeholders may not understand the specific problem or each other's perspectives [8]. These decision making problems are often "fuzzy" as information is ambiguous and difficult to quantify [9]. Making decisions while having limited shared problem understanding can cause stakeholder dissatisfaction and delays in the decision making process [10]. Current research that focuses on understanding the complexities of decision making processes fails to make key considerations. For example, processes in inter-organizational projects are often studied from an outside perspective, without incorporating a thorough understanding of how processes inside the projects evolve [11]. Studies which incorporate studying the internal processes of large-scale projects can reveal why projects are underperforming [12]. As such, a change in perspective, so that more emphasis is placed on the inner workings of large-scale projects and their relevant mechanisms for coordination is essential [11]. Moreover, research on complex inter-organizational projects has long demonstrated a tendency towards a 'hard system' view, building on the 'best practice' perspective [3]. However, to adequately deal with the contingencies of complex project dynamics [13], it is often advantageous to have an understanding of the context in which project decisions are executed [8]. Similarly, Climent and Haftor [14] noted that the fit of the business concept with contextual factors is an important driver of value creation. A complicating factor in the decision making process is the need for stakeholders to connect with knowledge sources outside their own organization in order to gain a common understanding of the problem. Such strategic processes are creative, complex and highly subjective, and as such cannot be automated and made objective [15]. An understanding of the complexities of the context in which decisions are made has been underemphasized in the literature up to this point [12]. In order to address this, progress toward establishing the sustainable development of the decision making processes in inter-organizational projects should include proper diagnosis of the complex problem context [16], and employ system-based approaches which involve all relevant stakeholders [5].

Current research on advancing solutions for "fuzzy problems" often focuses on the development of technological solutions [17,18], which means that the socio-technical perspective [19] is often underexamined. To achieve this, any developed processes and support tools need to be thoroughly integrated into the organizations [5]. To ensure this, Litvaj, Ponisciakova, Stancekova, Svobodova and Mrazik [16] suggest using solutions focused on interaction and communication. Such relationship-building responses appear to be important in environments where dominant socio-political complexities are present [20]. These environments are tightly coupled and the information propagation is temporal dynamic [21]. Relational coordination, as a concept which builds on shared goals, shared knowledge, and mutual respect, in order to enable timely, frequent, accurate, and problem-solving communication [22], demonstrates advantages as a basis for solution development in the fuzzy problem contexts of decision making processes in inter-organizational projects. However, up to this point, responses based on relational coordination have often been under-emphasized in inter-organizational collaborations [23].

In outlining the benefits of relational coordination to sustainable decision making processes for dealing with unclear problem contexts, the goal of this study is twofold. Firstly, this paper aims to understand the complexities of the problem context of inter-organizational decision making processes, in order to identify coordination challenges and determine the path to a well-grounded coordination fit. Secondly, this paper aims to support practitioners in dealing with such problems by means of a co-developed design which builds on relational coordination. This study focuses on inter-organizational projects in the railway sector, since these provide a context where system integration is becoming increasingly important [24], and where coordination can benefit from further improvement.

This results in the following research question:

How can the shared decision making process of inter-organizational problem contexts be made more sustainable by means of relational coordination?

The paper is structured as follows. Firstly, previous literature on the potential of relational coordination for sustainable decision making processes in inter-organizational

projects is discussed. Secondly, CIMO logic (Context, Intervention, Mechanism, Outcome) and the design science research (DSR) process steps are introduced. Specific attention is given to an in-depth analysis of the unclear problem context in order to gain awareness of urgent complexities. Particularly relating to DSR, the evaluation of the design propositions plays a fundamental role in understanding how the design works in the specific context. This is followed by a discussion on how the co-designed process aids in building relational coordination for inter-organizational railway decisions and, lastly, a conclusion and suggestions for further research are provided.

2. Literature Review

Complexities in inter-organizational processes form challenges to the coordination in projects of this nature [20]. Often, complex projects are coordinated by means of planning and control responses, a tendency which largely results from Thompson [25]'s theory of interdependencies and coordination mechanisms. Nevertheless, in order for firms to stay competitive in complex situations, it is critical to focus on strategies besides planning and control, such as agility [26]. In order to deal with the dynamic demands of projects, Maylor and Turner [20] developed the complexity-response framework, in which project complexities are linked to preferred response categories. The framework can aid in representing the complexity of the problem context by providing guidance in order to make sustainable decisions by outlining suitable responses [16]. Previous research indicates that the complexities of the problem context are often associated with institutional differences among the large number of involved stakeholders, leading to disagreements [27–29]. These arise because the stakeholders do not thoroughly understand each other's perspectives or the specific problem [8]. As demonstrated in a previous study, this can result in stakeholder dissatisfaction with the decision making process, which slows down the process as a whole [10]. Nevertheless, when disagreement between stakeholders occurs, it is valuable to analyze all possible ideas, which requires paying close attention to interactions and communication between stakeholders in order to allow for sustainable decision making processes [16]. Therefore, the focus of responses to complexities, which build on communication and interaction, is in line with Maylor and Turner's framework, which proposes the use of responses which build relationships between the participating stakeholders, especially when dealing with conflict, politics, and a lack of mutual understanding [23,30]. Despite these benefits, responses building on relational coordination are often under-emphasized in inter-organizational projects [22].

2.1. State of the Art: Relational Coordination

The theory of relational coordination states that shared goals, shared knowledge, and mutual respect, support timely and careful problem solving communication, which facilitates effective coordination among stakeholders [23]. Shared goals motivate stakeholders to look beyond optimizing sub-goals and operate with the larger project in mind [31]. Shared knowledge allows for systems thinking by informing stakeholders about how their contributions, and the contributions of others, add to the larger project [32]. Respect for the contributions of others encourages stakeholders to value the input of others, and to consider how their own actions impact other parties involved. This strengthens the inclination to act with the larger project in mind [33]. Relational coordination is more stable when opportunities are built into both programmed (e.g., shared information systems) and nonprogrammed (e.g., multi-disciplinary meetings) coordination mechanisms. This assists stakeholders in managing their interdependencies across boundaries [34,35]. According to Bolton, Logan and Gittell [23] (p. 308), "relational coordination has begun to evolve into a dynamic theory of learning how to coordinate work by iteratively building structures and relationships across networks of roles, even redesigning the roles themselves when needed". Learning is a crucial aspect of team-based interventions, which focus on building relationships between the interdependent and fragmented stakeholders [36,37].

2.2. Relational Coordination Mechanisms in Sustainable Inter-Organizational Decision Processes

Relational coordination appears to be a good starting point for addressing issues pertaining to inter-organizational decision making in projects. Inter-organizational projects in the railway sector are likely to encounter several challenges, as indicated in the literature on relational coordination. The literature on inter-organizational decision processes has been analyzed with respect to its impact on the three building blocks of relational coordination, namely shared goals, shared knowledge, and mutual respect.

A key consideration for inter-organizational decision processes is the role of shared goals. Stakeholders in these projects need to closely collaborate, but simultaneously have limited power to dictate each other's behavior in the decision making process. Accordingly, Sydow and Braun [38] indicate that inter-organizational projects are coordinated through "shared governance", where the network is rather dense but hardly centralized, and participating organizations cooperate on a consensus basis with a low power differential. In such settings, formal mechanisms are not sufficient to capture the complexities [39], implying that relational mechanisms are also needed. In line with this, Caniëls, et al. [40] identified that researchers have not agreed on how to properly integrate formal and informal mechanisms. Performance problems within inter-organizational projects originate from organizational complexity, ambiguity, and conflict between project stakeholders [41–43]. A common issue for the complex problem context is misaligned interests, which results in coordination challenges for decision making [27,28]. One reason for this misalignment is differences between the parties' risk perceptions [44]. Additionally, institutional differences may occur, which are differences in mindsets, goals, or work practices [29]. According to Van Marrewijk, Ybema, Smits, Clegg and Pitsis [27], this can lead to conflict among stakeholders, which can be addressed through the establishment and maintenance of consensus and the resolving of institutional differences. Consensus-based approaches for dealing with institutional differences are especially appropriate in the problem identification stage of the decision making process when problems are still unclear [8]. Diagnosing such complex problem contexts requires communication and interaction; Litvaj, Ponisciakova, Stancekova, Svobodova and Mrazik [16] suggest this can be achieved by using the "5 × why?" approach. This approach corresponds to what Maylor and Turner [20] call the relationship-building response. Continuing this line of thinking, this paper hypothesizes that relational coordination activities are able to facilitate more sustainable decision making processes.

Another point of concern in inter-organizational project coordination is the stakeholder's need for shared knowledge [45]. A key aspect of organizational productivity is knowledge sharing as it promotes technological change [46]. Shared knowledge in inter-organizational contexts is critical because it increases the chances that communication will be understood, and enables individuals and organizations to behave as if they can anticipate the actions of others [47,48]. Often, an initial lack of shared knowledge between decision makers can be observed when dealing with fuzzy problems [8], as there is a lack of shared language and experience on the basis of which to communicate in order to understand each other [49]. The fuzziness of the complex problem context, where cause–effect relationships are hard to predict, requires specific attention in order to facilitate sustainable decision making processes [16]. Therefore, a lack of shared knowledge has a detrimental effect on working ties [50]. One way to address the lack of shared knowledge is suggested by Orr and Scott [51] who demonstrate that project partners go through phases of ignorance, sensemaking, and response. Such shared sensemaking activities are good examples of relational coordination for addressing socio-political complexities [20]. Similarly, Litvaj, Ponisciakova, Stancekova, Svobodova and Mrazik [16] propose employing tools such as system engineering to create mutual understanding and to diagnose problems in sustainable decision making processes.

Based on the previous, it can be concluded that two of the three aspects of relational coordination are important to problems occurring in inter-organizational decision making, which highlights the need to include the concept of relational coordination in the solution

development for sustainable decision making processes. However, studies on the concept of relational coordination have primarily focused on establishing the theory [23], which means that the concept has not yet been operationalized for use by practitioners. Studies on the operationalization of frameworks are especially useful in fields where the connection between practice and science is reported to be lacking, such as in organizational studies [52].

3. Methodology

3.1. Research Design

3.1.1. Design Science Research Methodology

As mentioned in the literature review, the context of inter-organizational projects can be described as fuzzy, which means it is characterized by ill-defined requirements, complex interactions, design flexibility, and dependence on social and cognitive abilities [53]. Moreover, the collaboration between two or more organizations makes for authentic problem contexts which require in-depth, complex negotiations, which set significant boundaries on the feasibility of potential solutions [54]. As such, the effectiveness of building shared knowledge for relational coordination depends heavily on the ability to analyze and decipher complex inter-organizational contexts and develop solutions that are compatible with these socio-political contexts. DSR as a methodology is driven by problems encountered in a practical setting, and focuses on studying solutions which improve these [55]. Therefore, DSR can be used to create artifacts which solve decision making problems in complex inter-organizational settings. Despite the recognition of the benefits of incorporating DSR in the field of organizational and management studies [52,55,56], it has only been applied in a few cases. One reason for this is that DSR is often approached from a positivist worldview and creates prescriptive knowledge [57,58], which is uncommon for organizational sciences which focus on understanding general patterns.

3.1.2. Organizational Co-Design

While DSR is often applied in technocratic environments and tends to focus on the effectiveness and design principles of the solution, the methodology can also be used to focus on improvement cycles of an iterative design [52]. Van Aken [52] argues that the focus of the research should be placed on the actual learning and development taking place, shifting the focus from the ends (the design) to the means (how and why the design works). He also explicitly identifies the practitioners involved as co-designers, which means that participants engage in a co-development process, gaining an in-depth understanding of the effects of the design choices by evaluating several iterations of the design together, utilizing feedback. This involvement fosters the learning and commitment of the practitioners by collectively considering the problem and the solution [59]. In doing so, it links co-designing directly to relational coordination because the establishment of shared knowledge is a key consideration [23]. Likewise, co-designing is particularly relevant to enable sustainability as it promotes continuous stakeholder engagement [5]. Moreover, a co-designed process can empower the stakeholders to act based on the insights gained from the interventions taking place. As such, employing a co-development-oriented form of DSR in the field of organizational and management studies helps to connect research more closely with practice, a link that is currently often missing. Moreover, when engaging in an organizationally dominant design process, this often involves challenging team members' existing ideas and assumptions about the design by iteratively evaluating the artifact and its design principles [60]. By means of the focus on shared learning in DSR, it also promotes social values such as understanding, trust, and respect [52]. Since the creation of shared knowledge and mutual respect are important aspects of relational coordination [23], DSR directly facilitates the emergence of relational coordination. Therefore, studying relational coordination through the lens of DSR may further aid in understanding the emergence of these mechanisms.

3.1.3. Designing for Inter-Organizational Coordination

Viewing relational coordination in inter-organizational projects through the lens of DSR gives rise to novel research opportunities concerning inter-organizational project dynamics, especially regarding relational coordination. Firstly, currently available instruments do not encourage relational coordination. One of the possible reasons for this is that, traditionally, many projects focus on planning and control mechanisms [61], which are common in the coordination of complex projects, but may not be able to address all the socio-political complexities of inter-organizational decision making processes [20]. For example, a study investigating the fit of coordination mechanisms in complex inter-organizational projects revealed that a focus on planning and control mechanisms at the start of the project, at which point problems were still unclear, led to delays and a lack of satisfaction among stakeholders [10]. A design science perspective, on the other hand, focuses on understanding which principles improve the situation for practitioners [52]. This form of collective learning enables relational coordination, since it builds shared knowledge [23]. Secondly, in organizational studies, such as when relational coordination mechanisms in inter-organizational projects are investigated, it is often noted that the connection between science and practice is lacking [55]. Employing DSR in this context can address this issue as it assists practitioners in adopting more of the suggested design propositions, as well as learning from them [52]. Incorporating the feedback of practitioners into the design iterations thereby closes the loop and aids in bringing science and practice closer together. Additionally, DSR positively impacts the principal aim, since the design propositions provide practitioners with more ideas regarding instruments which facilitate establishing relational coordination. Thirdly, DSR addresses the need of inter-organizational projects to study coordination mechanisms from an inside perspective, focusing on how these projects develop [11].

3.1.4. Generalizing from Case Study Design

Van Aken and Romme [55] propose to generalize the understanding of DSR by making use of design propositions to address problems in the field. Design propositions can be regarded as "a chunk of general knowledge, linking an intervention or artifact with an expected outcome or performance in a certain field of application" [62] (p. 228), thus constituting generalizable solutions to types of problems. Denyer, Tranfield and van Aken [58] link design propositions using CIMO logic, which analyzes the action cycle, employing four phases consisting of Context, Intervention, Mechanism, and Outcome. This not only aids in clarifying fuzzy problem contexts but also aids in communicating the sequence of steps carried out during the research process [63]. Because the generalization of design propositions depends on a thorough understanding of the problem context, CIMO logic is used to analyze the inter-organizational problem context of the case study (see Section 3.3).

3.2. Research Approach

The research design used in this paper is divided into two main phases (see Figure 1). The first phase is focused on understanding the inter-organizational context, the nature of the design problem, and the change desired by the organizations (Section 4). During this phase, CIMO logic is employed to investigate a "what" type question, which leads to the identification of design objectives and criteria. The aim of the second phase of the study is developing and evaluating a fitting design solution for the specific problem context. Its main purpose is investigating "how" and "why" the design propositions work (Section 5), but also how they can be generalized (Section 6). In order to achieve this, the design science research process of Peffers, et al. [64] has been modified. Figure 1 includes a sequential overview of the process steps of the proposed design and features a division into "what" and "how" phases.

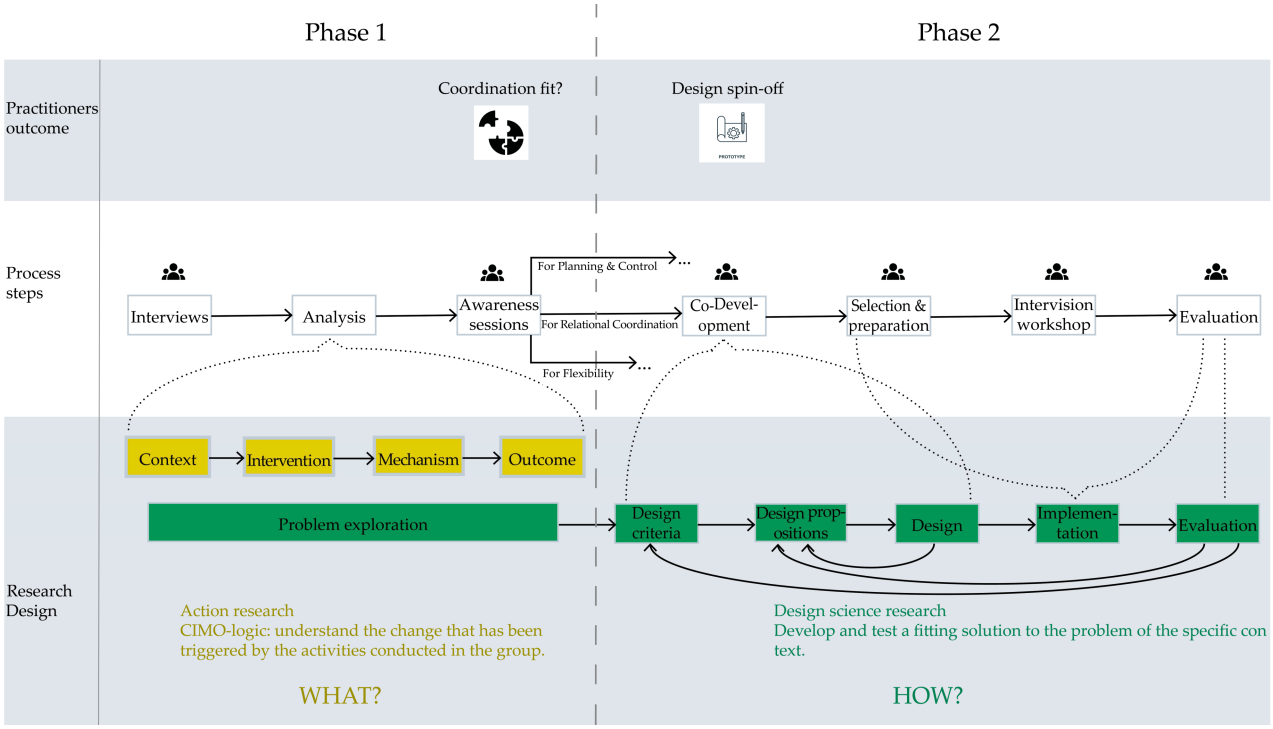

Figure 1. Overview of the methodology.

The research approach is characterized by using established methodological steps as key ingredients for the framework. For the problem exploration, CIMO logic based on Denyer, Tranfield and van Aken [58] was applied. The DSR process has been modified from Peffers, Tuunanen, Rothenberger and Chatterjee [64]. Finally, during the implementation of the designed process, key principles of the case study research were employed [65]. A simplified overview of the methodological steps can be found in Figure 2.

Figure 2. Methodological steps based on established methodologies [58,64,65].

3.3. Rigor and Quality of the Study

To ensure rigor and quality, this qualitative study employs several tests during different process steps (see Table 1). A key measure to establish validity in qualitative studies is triangulation, both regarding data and researchers [66]. Moreover, several tests to ensure design science validity exist [67], from which three validities were chosen. Data input validity ensures that the developed artifact is situated in the context. Theoretical validity ensures that the theory used is well-grounded in concepts from the relevant literature. Design validity ensures that the internal components are derived consistently and transparently.

Table 1. Tests to ensure rigor and quality of the study.

Tests	Approach	Process Step
Triangulation	Multiple sources of evidence: semi-structured interviews, structured interviews, observations. Multiple research observers during the workshop.	Problem interviews Evaluation of workshop Design evaluation
Data input validity	Open coding of semi-structured interview transcripts [68], followed by classifying into meaningful categories according to CIMO, to situate the developed artifact into context.	CIMO analysis
Theoretical validity	Design propositions are grounded in literature and their outcomes are discussed and put into perspective.	Design propositions Design evaluation
Design validity	The components of the design are well-supported and explainable (Appendix A, Table A1).	DSR process

3.4. Case Introduction

The designed process which enables relational coordination was developed and evaluated for the specific problem context of an inter-organizational large-scale project in a Dutch railway system. The goal of this inter-organizational project is the implementation of a system-wide change into the operating system. The project has a span of 11 years and was initiated and directed by the Dutch ministry of infrastructure and water management (GOVT). As part of this large-scale project, this study focuses on a board of safety representatives from the participating stakeholders, who are responsible for ensuring the safe implementation of the new system into the operating railway system. Included on the board are stakeholders who represent: the program direction (PD), the infrastructure manager (IM), transport-(TO) and freight operators (FO), and contractors (CO), all of whom collectively prepare decisions, and advise PD regarding safety-related issues. The board mirrors many other similar boards within the framework of the inter-organizational project. This context was selected to reflect the main decision making challenges in inter-organizational railway projects in situations where interdependencies between stakeholders are high and there is limited power to dictate each other's behavior.

4. Problem Exploration

The fuzzy problem context of inter-organizational railway projects was initially investigated using eight semi-structured interviews with the representatives of the main stakeholders on the safety board. The interviews were transcribed and verified with the interviewees to avoid misinterpretation [69]. The transcripts of the interviews were inductively coded into meaningful categories using the qualitative software Atlas TI, by means of open coding [68].

4.1. CIMO Logic Analysis

Using CIMO logic is an approach that can be used to clarify fuzzy problem contexts as discussed in Section 3.1.4. In accordance with CIMO logic, each meaningful category was classified based on the context theme and the intervention theme. For this analysis, the steps as outlined by Filius, et al. [70] have been followed. The context theme (Section 4.1.1) as derived from the data, shows complexities that are specific to the situation, as was also

mentioned by the respondents. The interventions (Section 4.1.2) derived from separating the data into meaningful categories, show mechanisms (Section 4.1.3) identified by respondents which are currently being used to clarify the problem context of the decision making process. The mechanisms provide insights into why the interventions did not lead to the desired outcome (Section 4.1.4) of reaching a decision.

4.1.1. Context

After these steps, each meaningful category was classified based on the context theme and the intervention theme in accordance with CIMO logic; see Figure A1 for an overview. The context theme as derived from the data shows the following.

Firstly, different interests regarding the decision making process within the safety board exist. Individual members are responsible for different parts of the system, and therefore have different preferences during decision making. These varying interests lead to decision process inefficiency, since meeting time is spent on inefficient discussions, and decisions are re-evaluated several times. As such, the board lead from PD pointed out: "The discussions during the safety board meeting are lengthy and have not resulted in many decisions. The representative of IM holds beliefs over the roles that I understand differently."

Secondly, the stakeholders on the safety board have varying perspectives regarding the decision. The representatives on the safety board work for different organizations and have different backgrounds. Agreements in meetings have been achieved based on assumptions, since more detailed discussions led to the emergence of differences in opinion. This resulted in inaccurate interpretations of statements, which led to false agreements, ultimately prolonging the decision making process as a whole. This is also stressed by a safety representative of IM, who mentioned: "A representative of PD is very enthusiastic about the topic. However, his statements do not correlate to his actions. This can lead to relitigating the issue several times."

Finally, since the meeting time was perceived to be used inefficiently due to repetitive discussions, several stakeholders of the safety board indicated frustration with the process and a decreasing level of motivation to engage in problem-solving and decision making processes. Conversely, others complained about certain board members not taking the work of the safety board seriously enough by attending without proper preparation and canceling meetings at the last minute. This lack of motivation was indicated by a representative of TO: "Discipline during meetings is important. Sometimes participants fail to attend, arrive late, or fail to adequately prepare. Changing this is vital to make progress regarding decision making."

4.1.2. Interventions

In the following section, the interventions that have been implemented by the safety board so far are elaborated on. The primary aim of these interventions was to arrive at better supported and faster decision making. In order to gain a more comprehensive understanding of the processes, the safety board has worked to improve the structure of the meetings, for example by using a standard form in which new information must be presented and using agendas to build consensus on the issues to be discussed. Another intervention already in place is creating an inventory of cases on which decisions need to be made, which they have organized by urgency. As such, the most urgent matters, where there is pressure to make decisions, are addressed first. Additionally, when working out solutions for the cases, these have to be clearly described, including the reasons why they are appropriate for solving the issue at hand. Finally, members realized that a potential problem in the decision making process is the fact that roles and responsibilities were unclear. As a solution to address this problem, process agreements were formulated, including a clear delegation of roles, with which the board must comply.

4.1.3. Mechanisms

The analysis of the interviews revealed that in the context of the safety board, several socio-political challenges, mainly related to the differences in opinion between the stakeholders regarding their roles, complicate the work within the team. The interventions employed to respond to these complexities primarily trigger more planning and control mechanisms, e.g., by establishing more structure during meetings. Additionally, by defining process agreements, the team wanted to create a document that could later be used in verifying that decisions were executed according to these agreements. However, by deciding to establish these in writing first, without having thoroughly examined the context of the problem and gaining clarity about it, a strong focus on solutions among the stakeholders is revealed.

4.1.4. Outcome

These planning and control-based interventions were perceived as not very effective, since they did not aid in arriving at better decision making. This is exemplified by the lead of the safety board reflecting on one of the implemented solutions: "During the previous meeting, the members defined their roles as part of the safety board and the goals of the safety board as a whole. During the meeting itself, everyone was in agreement, but by the next meeting a member had changed their mind, once again challenging this decision." Consequently, the implemented coordination mechanisms appear to not be effective in addressing the issues the safety board faces regarding decision making. Planning and control appears inadequate in addressing the complexities of the inter-organizational railway context and, as such, does not lead to the desired outcome of faster decision making. Planning and control is a mechanism best suited to deal with structural complexities [20], whereas the main complexities faced in the decision making process are of a socio-political nature. Applying the planning and control mechanism in the specific context studied resulted in failure due to continuous re-discussion and re-evaluation of decisions, and ultimately in ongoing frustration with the decision making process. This is stressed by the safety representative of TO: "I expect the safety board to act based on agreements regarding roles that have been made. However, the agreements are not yet universally accepted. Despite good intentions, some parties slow down the functioning of the safety board." This intervention focused on defining agreements; however, there still seems to be a lack of consensus on the problem, indicating that the implemented interventions have not helped to increase understanding between the stakeholders. As such, the strong focus on solutions when working to solve the problem, rather than first obtaining clarity about it, does not lead to the desired outcome of reaching agreed-upon decisions either.

Figure 3 summarizes the problem context of the decision making process of the safety board using CIMO logic.

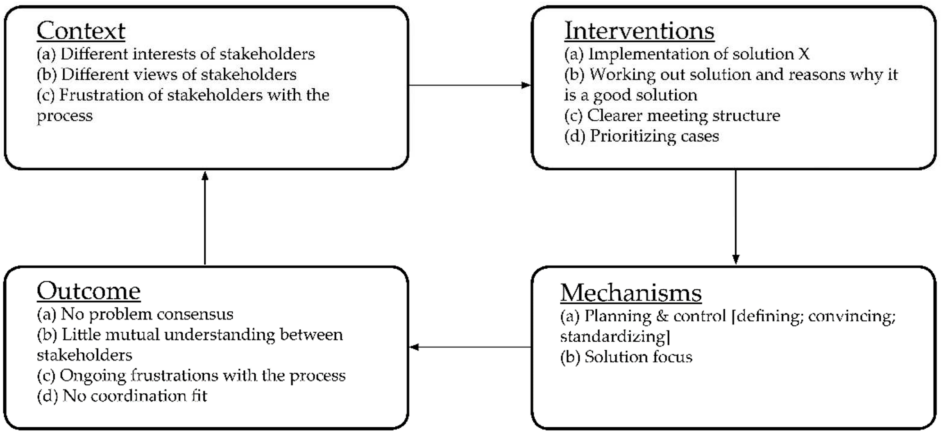

Figure 3. The problem context of the safety board, as explained using CIMO logic.

4.2. Awareness Sessions

The results of the CIMO logic analysis were presented to the interviewees. During the awareness session, which is a result of phase one of the research (see Figure 1), specific attention was paid to emphasizing the low coordination fit of the current approach. This resulted in a discussion among the team regarding more appropriate coordination responses for the situations faced by the safety board. The members of the safety board, as well as the researchers, contributed to the idea generation of potential fitting responses to the identified, complex, problem. It was established that the interventions the board want to implement should have the objective of building relationships in order to deal with the socio-political complexities, as suggested by Maylor and Turner [20]. Consensus in the team regarding this objective was established before work on a suitable solution was initiated. The goal of the second phase of this study is designing a solution based on relational coordination. Therefore, an essential requirement for developing the relationships in the safety board was co-designing the entire process. Essentially, the continuous stakeholder engagement during the co-design process enables shared understanding and ownership, which both contribute to relational coordination.

5. Co-Designing a Process for Relational Coordination

5.1. Design Objective and Criteria

As outlined in the previous sections, decision making in inter-organizational contexts is often hampered by divergent views held by the participating stakeholders. Additionally, a tendency to focus on finding solutions without first completing a proper investigation of the problem was observed. The divergent views of the safety board members contributed to a low level of mutual understanding regarding the problem. Moreover, stakeholders experienced ongoing frustration with the current decision making process, which discouraged participants from addressing the issues they face.

These factors combined illustrate the need to find a better coordination fit between the complexities the safety board faces and the responses the board uses, by engaging in more relational coordination [20,23]. Table 2 presents an overview of the design objective and the criteria.

Table 2. The design science research objective and the criteria.

	Objective and Criteria
Overall objective	Establish better coordination fit to address the inherent complexities by building relationships.
Criterion 1	Establish more problem consensus during the decision making process.
Criterion 2	Create a mutual understanding of the views of the stakeholders.
Criterion 3	Create stakeholder ownership of the decision.

To achieve the overall objective of building relational coordination, three design criteria have been established. The first design criterion was intended to establish clarity regarding the problem for the decision making process [8]. The second criterion aimed to increase understanding regarding the different views of the stakeholders in the group [71]. Lastly, the third criterion was established to ensure the designed process facilitates stakeholder ownership of the decision [72].

5.2. Design Propositions

The design of the relational coordination process borrows from multiple design propositions. In the following sections, their origins and implementations into the process are briefly discussed.

5.2.1. Problem Focus of Decision Making Process

One of the criteria of the design is that it needs to facilitate a higher degree of problem consensus during the decision making process. According to Daft and Lane [8] (p. 452),

"[inter-] organizational decision making is formally defined as the process of identifying and solving problems." As such, decision making can be separated into two stages: the problem identification, and the problem solution stage. Responses focused on diagnosing the complex problem context are especially crucial when decision making processes need to become sustainable [16]. Exploring the problem and its interconnections aids in arriving at new insights and revealing its root causes. Ultimately, this process aids in choosing alternatives on the system level during the problem–solution stage [5]. When goals are ambiguous and/or inconsistent, and/or participants disagree on problem priorities, this leads to bargaining in order to gain support for the matter, which is deemed most urgent. Moreover, participants may have differing viewpoints regarding the problem. By exchanging these perspectives, they gain more information, create mutual understanding, and reduce the ambiguity regarding the problem they face. To deal with such institutional differences, Cyert and March [73] propose a problem-focused investigation in order to build a coalition between the stakeholders. As such, a focus on the problem identification stage of the decision making process, rather than the problem-solution stage, is proposed as a key element of the design.

5.2.2. Collective Learning through Intervision

Relational coordination in inter-organizational projects can be established by creating mutual understanding between the stakeholders by promoting openness and collective learning. In order for processes to be sustainable, opportunities for continuous learning should be provided when engaging with processes of knowledge management [74]. The learning aspect of sustainable processes enables the understanding and management of different stakeholder perceptions [75]. According to Falcón-Cortés, et al. [76] (p. 2) "during collective learning, individuals with different experiences may acquire valuable information through interactions with others, possibly resulting in an increased foraging success compared to what isolated individuals would typically achieve". Some of the benefits of collective learning include an improved capacity for sensing and making decisions. Openness is an important requirement for engaging in collective learning, especially when dealing with situations of conflict, where listening to others' perspectives is vital [71]. In order to facilitate this, a conceptual outset for the design of the relational coordination process for inter-organizational projects is rooted in "intervision", which is a peer-led group reflection method often used in teaching environments [77]. The consultation process is carried out in a group, in which the participants discuss questions based on their professional experience according to a set procedure with assigned roles [78]. Participation in intervision results in improvements in communication and interpersonal skills [78]. It contributes to collegial exchange, fosters inter-professional understanding, and enhances a climate of mutual respect [79,80]. According to Staempfli and Fairtlough [77], this can be achieved by means of non-judgmental communication. Openness and transparency, in particular, are improved by engaging in intervision sessions. Finally, intervision teaches participants how to learn from one's experiences and actions by taking time to examine and review these. Reflection promotes awareness of the methods used and the decisions and judgments made during the process [81].

Using this line of thinking, intervision can be employed to promote collective learning and create openness regarding the perspectives expressed among the safety board. Through active listening and non-leading questions, participants are "forced" to engage with the perspectives presented, without prematurely evaluating them.

5.2.3. Continuous Stakeholder Engagement

Another point of attention is the need to create more ownership of decisions. Therefore, the second leading design goal is the concept of continuous stakeholder engagement in order to create a sense of ownership of the team's work processes and decisions [72]. A sense of ownership is created through the collective understanding that all members are partial owners, and that the team's actions and results are the team's responsibility.

It has been suggested that ownership of the decision increases efficiency by motivating employees to expand their knowledge and authority [82], in this case this means arriving at a mutually supported decision among the safety board. Ownership of decisions can be created through continuous stakeholder involvement [83], which is an important aspect of building social sustainability [5]. Therefore, Armenia, Dangelico, Nonino and Pompei [74] argue that sustainable project management should aim to attain proactive involvement and engagement of stakeholders. These interactive processes create room for discussions and negotiations which aid in building mutual understanding in order to manage the complexities of the process [75]. Consequently, stakeholders participating in the study gain a feeling of "empowerment", which supports them in expressing and analyzing their realities: it is a way to facilitate greater process, and outcome ownership among participants [83]. Table 3 depicts how the design propositions connect to the design criteria and problem areas.

Table 3. Overview of connections between problem areas, design criteria, and design propositions.

Problem Area	Design Criteria	Design Propositions
No fit between coordination and complexities of the situation	Design objective: Establish better coordination fit by working on the relationship [20].	
No consensus on the problem.	Establish more problem consensus.	Focus on the problem identification, not the solution [8].
Little mutual understanding of the different views.	Create a mutual understanding of the views of the case to be discussed.	Engage in collective learning through intervision [79].
Ongoing frustration with the process/decision.	Create ownership of the decision.	Enable continuous stakeholder engagement [5].

5.3. The Process Developed for the Inter-Organizational Railway Context

To develop the design, several iterations were created and used, working closely with the case study team. These iterations included design presentations, individual reflections involving the safety board team members, and preparing the intervision workshop with two experts, namely an intervision expert and the case owner. The process was developed based on the previously mentioned design criteria and consists of three main phases: case selection and preparation, intervision workshop, and evaluation (Figure 4). The design propositions are concepts integrated into the design.

Figure 4. The co-designed artifact: the intervision process.

5.3.1. Selection and Preparation

A decision issue in which different perspectives play a key role was selected. This can be based on urgency and/or relevance to decision making. In order to gain maximum benefit from conducting the process, it is of great importance to select an issue that is currently impeding progress within the team. Once a topic has been selected for the intervision process, it must be prepared for the workshop. Part of the preparation is an exploration of perspectives on the topic. This can be done by consulting with the team manager or by conducting individual interviews with team members concerning the case question. The individuals with the most strongly divergent perspectives are then asked to summarize these in the form of a slide, which is to be presented during the workshop.

5.3.2. Intervision Workshop

During the intervision workshop, which was facilitated by one of the researchers, the selected views were discussed critically. The team which discusses the issue consists of stakeholders who are important to the decision making process and who wish to arrive at a shared definition of the decision problem. In order to reach agreement, the different perspectives on the problem must be exchanged by means of a discussion. As such, the discussion component of the intervision workshop is a requirement for success.

The intervision workshop consists of four process steps. At the start of the workshop, the prepared perspectives are presented to the rest of the team. The explanations should be supported by information summarized on a slide, which should be kept concise to enhance the overview, in order to facilitate understanding and listening. Emphasizing the areas of conflict is important to the outlining of the differences. Visualization offers extensive potential for learning from each other's points of view, and intervision (non-leading questions) can tap into this potential as well. In the sensemaking stage, the group familiarizes itself with the perspectives presented by asking open-ended questions that are non-leading, non-judgmental, and do not offer interpretations. The entire group actively listens to the explanations of the case facilitator. A secondary effect of this is that the case presenter is forced to critically reflect on their own perspectives, which encourages them to identify inconsistencies. After all the group's questions have been addressed, sufficient learning should have taken place to understand the perspectives. The group then brainstorms about commonalities and differences between the perspectives presented. The similarities and differences are then discussed point by point. Once the group reaches consensus, it moves on to the next point. However, if there is no consensus on an item, there may not be enough mutual understanding to draw a conclusion, and the group returns to step two, where additional non-leading questions can be asked. Identified commonalities can be considered focus areas for resolving the issue. Differences require additional problem-solving initiatives that can either be addressed during the workshop or, if time is insufficient, tackled in follow-up tasks. Action items are shared to motivate the team and establish responsibilities. At the end of the workshop, a brief reflection on the process and outcomes of the workshop can help increase motivation and alignment.

5.3.3. Evaluation

After the workshop, a summarizing report was written, listing the questions and answers dealt with as outlined in step two, divided based on perspectives, the commonalities and differences identified in step three, and the specific action items identified in step four. The report was then shared with the team so they could make decisions based on the results gathered during the workshop. It also provided the team members with an opportunity to verify that their input has been interpreted and processed correctly, which potentially leads to better mutual understanding and identification of additional comments.

5.4. Implementation into the Safety Board

The co-designed process was implemented in the safety board. The implementation in a selected case serves to test the intervision process in practice. Within this context, the process was tested on a particularly protracted and sensitive issue about roles that has been a recurring source of disruption over the past two years. Safety board members have discussed this issue at length without making much progress, which has also greatly influenced the decision making process regarding other issues. The reason that no agreement could be reached so far was that the perspectives on this issue were too divergent, which is why it was selected for use with the relational coordination process for this particular issue. The workshop was conducted online, for which the visual collaboration platform, MIRO, was used. Using an online session allowed all the involved stakeholders to participate, which would have been difficult to realize in a face-to-face setting. Moreover, it contributed to the creation of an organizational sustainability identity

by reducing emissions and supporting social interaction [84]. A description of the different phases, including the conducted activities, can be found in Table 4.

Table 4. The phases of the co-designed process.

Nb.	Phase	Description	Main Activities
1	Selection and preparation	Selecting the decision making issue at the safety board and preparing the different perspectives for the workshop.	- Meeting to collect information and decide on the issue to be investigated (manager of safety board). - Individual meetings with members on their perspectives regarding the issue. - Preparation meetings with members who will present their perspectives (2 meetings).
2	Intervision workshop	Perform a workshop to deal with the different perspectives on a particular issue.	- A workshop to perform intervision lasting 2 h (7 safety board members present, representing 5 different stakeholder groups) - Workshop is conducted using MIRO
	Case introduction	Introducing the different perspectives to the other participants of the workshop.	- Presentation of two perspectives - Careful listening of participants
	Visualization	Participants ask open and non-leading questions on the presented perspectives.	- Per perspective, participants ask open and non-leading questions - Case presenter answers to the best of their ability
	Identification: commonalities and differences	Within the team, identify commonalities and differences concerning the presented perspectives and facilitate discussion.	- Group discussion to identify commonalities and differences between the perspectives
	Steps for action	Within the team, identify focus points and follow-up tasks.	- Group discussion to decide on follow-up actions regarding the commonalities and differences
3	Evaluation	Produce a report summarizing the workshop and ask participants for verification.	- Collect all information gathered during the workshop regarding the presented perspectives in a structured way - Collect feedback on the report from the participants - Consult with the project lead on the results - Follow-up session to discuss progress regarding commonalities and differences after a few months

5.5. Evaluation of the Co-Designed Process

Several means were used to evaluate the design: using direct participant reflections and researcher observations during the intervision workshop, and structured interviews and researcher observations during the safety board meetings after the intervision workshop. Finally, the results were summarized according to the design propositions.

5.5.1. During the Intervision Workshop

The application of the intervision process in an inter-organizational context demonstrated that participants accepted the implemented process. Initially, participants resisted using the process when it came to managing complexities specific to them. However, once they became familiar with the concept of intervision, their initial resistance was diminished and they appreciated the usefulness of the concept for addressing their case question. One of the safety experts from PD reflected: "Though I was initially hesitant, I soon realized the value of asking questions according to the principles of intervision. This helped me understand the perspectives of other participants more thoroughly, especially

when aspects emerged that I had not previously considered." This is consistent with the observations of the researchers, who noted instances when the value of the methodology became apparent to participants. Participants noted that intervision benefited both parties, those who presented their perspective and those who listened and asked questions. The presenters learned to critically reflect on their perspectives from different angles, and the members who asked questions gained new insights related to the specific points of view of the presenters.

5.5.2. After the Intervision Workshop

After the initial evaluation, structured interviews with each participant in the co-designed process were conducted. Generally, the results of these interviews indicate that the introduced process was positively perceived. Active listening, and the asking of questions, encouraged mutual engagement. By thinking carefully about what to ask, depth was added to the discussions, and instances of learning were created, which ultimately led to a better mutual understanding of different perspectives. This also led to the board members gaining clarity on the nature of the problem by identifying its root causes. Additionally, the board members were more open to each other's perspectives, as a direct result of the openness of the questioning style. The ability to empathize with other perspectives on the case question, allowed for an increased understanding of the initial institutional differences, and these were even reduced to some extent.

While evaluating the observations made during the safety board meetings, other positive results were noted. The intervision workshop was seen as a starting point for opening up to each other's perspectives and as a way to implement more relational coordination activities in situations where planning and control measures had previously dominated, as well as leading to the respective points of view aligning more closely. In keeping with this, the safety representative of FO indicated: "The meetings are more effective now, this is indicated by a higher degree of bilateral conversations: the group cohesion was increased." As such, it can be concluded that the process was effective in changing the team's preferred approach by introducing more relational coordination activities. In particular, collective learning and understanding of the commonalities in the group were fostered. Some of the participants continued to ask questions in the form of intervision: in an open-ended and non-leading manner. These types of questions were used to gain an understanding of each other's underlying assumptions and interpretations. Thus, the intervision workshop and relational follow-up activities seemed to enhance mutual understanding within the group. Starting from a situation where misinterpretation was common, the frames of reference of the board members became more similar, which contributed to effective teamwork. Accordingly, the safety board lead from PD indicated: "An increase in understanding of the other parties' processes has led to an observable alignment of reference frameworks".

Additional questions, on which there had previously been little consensus, were used to illustrate how the safety board now deals with such matters. When participants realized that they did not have an adequate understanding of a process, they drew on examples from their own experiences and asked the others to elaborate using their respective perspectives. This allowed board members to learn strategies for coping with such problems from each other, and also create a mutual understanding of why certain stakeholders held a particular viewpoint. Going forward, when problems arise, the board has the ability to discuss the issue openly and tackle it as a group. This has also been recognized by the safety manager of TO, who remarked after one of the last meetings: "Today, many issues were discussed and appropriate solutions were found, the meetings are more effective now".

While this did not completely eliminate institutional differences during the problem identification phase, it did lead to a better understanding of those differences and to open discussions. However, after the relational coordination process was conducted, an important new focus was to highlight the commonalities between the perspectives, which helped board members to reach partial agreement on issues and how to approach them.

5.5.3. Results of the Design Propositions

During the application of the co-designed process in the inter-organizational context, both expected and unexpected outcomes were revealed. The outcomes were linked to the design propositions introduced earlier in this paper in a condensed overview to indicate how they function when applied practically (see Table 5). The table presents a summary of the qualitative evaluation performed through observations and interviews, which is a common strategy in design science research [85].

Table 5. Results of the design propositions after the evaluation.

Design Propositions	Results
Problem focus of decision making process	- Openly discussing commonalities and differences between the presented perspectives during the problem investigation stage and engaging in discussions facilitated decision making. - Commonalities became clearer, and a focal point for building consensus concerning problems. - Over the course of the workshop, differences were understood better and some seemed to diminish after the workshop, enabling increased problem understanding among the group. Other differences were defined during follow-up problem-solving activities.
Collective learning through intervision	- Workshop participants kept an open mind regarding the perspectives of other members. - The team learned from, and reflected on, the presented perspectives during the workshop as a group, by asking questions in a non-leading and non-judgmental manner. - More mutual understanding was created in the group regarding their shared and individual perspectives on the system. - Project members continued to work using many examples from their personal experience when presenting their perspectives on a topic, and asking questions in an open and non-leading manner, even after the workshop.
Continuous stakeholder engagement	- Co-development was employed during the design process in order to foster ownership of the design. - Application of design: - Participation in the intervision workshop was continuous and consistent. - Follow-up actions were defined, and participants seemed motivated to engage further. - Proposals for solving further issues by means of an intervision workshop were made. - Continuous bilateral meetings between the members of the safety board were initiated in order to explore the differences and solve the associated problems. - After six months, the manner in which the action points had been addressed was re-evaluated. - Some members still did not take the meetings seriously, and canceled at the last minute, however, the increased levels of trust allowed members to address these concerns directly.

As such, the application of the proposed relational coordination process proved to be appropriate in the case of large inter-organizational railway decisions. Crucially, it facilitated the improvement of mutual understanding by means of relational coordination. The relational coordination was subsequently organized by initiating small team follow-ups, such as bilateral meetings in which opportunities were created for collective learning. Furthermore, the continuous stakeholder engagement which was encouraged by means of this process proved important to ensuring sufficient ownership of the decision making process.

6. Discussing the Design Process

Enhancing the Three Aspects of Relational Coordination by Means of the Co-Designed Process

The results of the DSR application in a large inter-organizational railway project demonstrate that out of the three aspects of relational coordination [23], especially the creation of shared knowledge has been addressed.

Shared knowledge has been created through collective learning, which was one of the main goals of the process. On the one hand, collective learning has been enabled through the intervision workshop to create a mutual understanding of the case question, thus supporting the safety board decision making process. On the other hand, collective learning has been stimulated by the DSR process itself by merit of improving understanding concerning the importance of relational aspects in the specific problem context. It has directly impacted the support for starting additional relational interventions, such as an increase in bilateral meetings, and asking for examples to clarify situations. Vitally, it demonstrated that the principles of intervision worked well in situations where differences between stakeholders play a role due to a lack of mutual understanding. The co-designed process, which built on the principles of intervision, also revealed some challenges. For example, it requires openness from the participants, which in this case has been generated by means of the co-development of the DSR process and its iterations. Moreover, it requires time and effort from the participants until long-term effects of the decision making process emerge. The required resources, however, may not always be readily available. Furthermore, additional ingrained problems may emerge in the meantime, which can diminish or reinforce the effects of the co-designed process. Over the course of the case study, some safety board members changed functions, and thus new members entered the group. Therefore, as some of the gained mutual understanding may be lost, more attention should be paid to building relationships at all times. The long-term effects of the process can only be accounted for in the analysis to a limited extent and should therefore be viewed with caution.

The other two aspects, namely shared goals and mutual respect [23], have only been addressed indirectly. For example, the openness required in order to engage in the co-designed process, and the willingness to work on the relationship within the group, indicate that a degree of mutual respect is required, which might be developed through the co-development aspect of the DSR process. Additionally, the continuous mutual engagement, and careful listening to each other's opinions, demonstrates that mutual respect between the members of the safety board has increased. Nevertheless, some signs that mutual respect in the group was still lacking after the process had been conducted remained, such as one member at times arriving to meetings late or unprepared. As for building shared goals, initially after the awareness sessions, there was alignment in the group to work on relational coordination. Moreover, during the implementation of the co-designed process, there was a general trend towards reducing the differences among the group and focusing on the similarities when investigating the case question. In particular, when re-evaluating the identified similarities and differences after six months, the team members' perspectives were clearly more similar. Therefore, the goals of the safety board seem to be more focused and aligned as well. However, deeper underlying issues could not be solved, since they were outside of the scope of authority of the safety board. These issues can mostly be characterized as differences in goals between the organizations represented by the participating stakeholders. As such, addressing these issues is crucial to the long-term success of the process.

As a whole, it can be observed that the three aspects of relational coordination as described by Bolton, Logan and Gittell [23] are encouraged directly or indirectly by applying DSR and implementing the co-designed process in an inter-organizational decision making process in the railway system.

7. Conclusions

7.1. Sustainable Decision Making Processes through Co-Designing Relational Coordination

This paper posits that increased understanding of relational coordination in inter-organizational projects, in particular in three different ways, has been established.

Firstly, to accomplish the first objective of this study, a shared understanding of the fuzzy problem context of inter-organizational decisions was established using CIMO logic. Moreover, the awareness sessions, which were the result of using CIMO logic, facilitated alignment on how the safety board aimed to proceed in order to enable a good coordination fit and contributed to establishing a shared goal. Additionally, they underlined the need to co-design a process to facilitate relational coordination. As such, they directly enabled a sustainable decision making process through diagnosing the complex problem context by means of CIMO logic.

Secondly, to connect the two different objectives of this study, during the problem exploration it was established that in order to facilitate relational coordination, co-designing the process is important. Therefore, the paper demonstrates that through continuous stakeholder engagement, increased understanding was fostered among the safety board members. The shared problem understanding contributed to establishing alignment on the goal of relational coordination. Practitioners are considered co-designers, who learn collectively through iterative design cycles. As such, these co-designers are involved in problem exploration, as well as providing feedback during the design iterations, which leads to increased ownership of the implemented design. Encouraging relational coordination was established as a core problem during phase one of the research; therefore, by conducting design iterations, the group was able to collectively learn which propositions work well to establish relational coordination when working on inter-organizational decision problems. Consequently, a sustainable decision making process was established through continuous stakeholder engagement during the entire design process: this specifically impacted social sustainability.

Thirdly, in order to meet the second objective of this study, the DSR process facilitated the creation of shared knowledge of the design propositions. As outlined in the discussion of the methodology, in order to make use of DSR in the field of organizational studies, design propositions were developed, which created knowledge on how the concepts operated within the studied context. The implemented design propositions, namely: a focus on the problem identification of the decision making process [8], enabling collective learning in the team through intervision [79] and continuous stakeholder engagement throughout the process [5], facilitated relational coordination. The second design proposition in particular, demonstrated promising results within the railway setting. The intervision workshop fostered collective learning, thereby building mutual understanding among the group members regarding the problems concerning the decision making process of the case which was selected for the implementation. Shared knowledge is a direct result of relational coordination [23], stressing the concepts' value for relational coordination. Fostering shared understanding decreases the uncertainty and ambiguity during the problem identification phase. As such, it can be considered the first step in building a coalition to reach alignment on goals for a sustainable decision making process. Essentially, by considering the different perspectives on the problem and trying to align them, a system-based approach is chosen, which directly contributes to sustainable development [5]. Since this creates shared knowledge on the case question, relational coordination appears to be an important requirement for facilitating more sustainable decision making processes. On the whole, applying DSR in the framework of organizational studies provided a new inside perspective on the field of inter-organizational projects, which has, traditionally, predominately been studied from the outside [11]. As such, the understanding of the context which was gained by using this perspective, and the implemented process, can contribute to improving the performance of the decision making processes within the project.

The combination of the three design propositions presented here is novel and shows promise for application in supporting relational coordination in complex inter-organizational

decision making. This study demonstrates that these propositions are particularly valuable in creating mutual understanding among key stakeholders to enable effective decision making in a complex railway environment. Considering the individual design propositions, it can be observed that they have already been successfully implemented in other contexts. This is also illustrated in Section 3.1.4, where it is outlined that they can be considered generalizable solutions. Collective learning, which originated in complexity research, for example, is a common approach in multi-agent systems, and it has been utilized successfully in ecosystem management research [86]. Additionally, stakeholder engagement has been employed effectively in achieving sustainability in, for example, the construction sector, by assisting in decision making processes with multiple stakeholders [87]. Therefore, the combination of implemented design propositions has the potential to be an effective solution for related systematic decision making problems, e.g., in the construction sector or related fields. Moreover, several steps have been taken to increase the knowledge of complex decision making problems in the railway system and to develop a solution for dealing with this type of problem. The increased understanding of the working of relational coordination in inter-organizational decision making provides a different, more rigorous understanding of how the organizational interventions reinforce each other in this complex setting. Moreover, it helps to decrease the fragmentation of the field, as suggested by Van Aken [52], Ref. [52] by demonstrating how relational coordination works as a means to enable more sustainable decision making processes in inter-organizational contexts. By means of the continuous stakeholder engagement during the design process, the impact on social sustainability in particular is increased, as discussed by Missimer and Mesquita [5]. This paper expands on the methodologies commonly employed in the field by stressing the benefits of using DSR in settings where collective learning is a central aspect of inter-organizational decision making.

7.2. Limitations and Future Research

A limitation of this study is its lack of statistical generalizability [88], since it only consists of a single, in-depth case. Nevertheless, there is no indication that the applicability of the developed process is limited to the railway sector. The individual design propositions have already been used in other fields, e.g., by Bousquet, Barreteau, d'Aquino, Etienne, Boissau, Aubert, Le Page, Babin and Castella [86], and Bal, Bryde, Fearon and Ochieng [87]. As such, the potential exists to apply the developed process in other related domains with complex inter-organizational decision making problems, for example, the construction sector [87]. Furthermore, the primary objective of this study was to improve the understanding of relational coordination in inter-organizational projects and to develop a suitable solution for sustainable decision making processes. This type of study is usually carried out by means of case study research [65], the strength of which is increasing knowledge about a social phenomenon; therefore, statistical generalizability is limited. Another limitation of this study is the limited impact on overall sustainability. The process developed was applied to only one decision making problem faced by the safety board. In order to achieve a long-term and sustainable change in the way decision making problems are addressed, the process has to be properly maintained and applied to different cases dealt with the safety board [89]. Finally, this study only considered the impact on social sustainability, as discussed by Missimer and Mesquita [5]. However, in order to arrive at a more thorough overview of the sustainability impact of the designed process, environmental and economic sustainability factors must also be considered [90]. It is possible that the use of other design propositions is more relevant in these situations, which means that, currently, only limited predictive conclusions can be drawn.

This study provides numerous opportunities for future research. Firstly, this study identifies an opportunity for studying external factors and their effect on relational coordination. By doing so, the functioning of the design propositions can be supported more thoroughly and additional understanding on relational coordination in inter-organizational projects can be gained. Secondly, the impact of the applied design propositions on en-

vironmental and economic sustainability can be explored to provide a comprehensive overview of the impact of the designed process on sustainability in general. In doing so, this study has the opportunity to contribute to a broader discussion on sustainable decision making processes. Thirdly, the examination of other coordination mechanisms: depending on the results of the problem exploration conducted using CIMO logic, one of the other two coordination mechanisms in Maylor and Turner [20]'s framework might have proved more appropriate. In that case, the design goal would be different, resulting in a different design to be implemented. Therefore, the authors propose applying the developed methodology with a strong focus on problem exploration using CIMO logic in another complex environment with significantly different complexities, in order to determine its usability for other coordination mechanisms.

Author Contributions: Conceptualization: N.J. and J.B.; methodology: N.J. and W.H.; validation: M.R.; formal analysis: N.J.; investigation: N.J.; resources: L.v.D.; data curation: N.J.; writing—original draft preparation: N.J.; writing—review and editing: J.B., W.H., M.R. and L.v.D.; visualization: N.J.; supervision: J.B., M.R. and L.v.D.; project administration: J.B.; funding acquisition: M.R. and L.v.D. All authors have read and agreed to the published version of the manuscript.

Funding: This project was funded by the TKI High Tech Systems and Materials (HTSM) via the Dutch Ministry of Economic Affairs and Climate Policy's PPS allowance scheme for Research and Innovation. We wish to sincerely thank the following companies: Netherlands Railways, ProRail and TKI, for providing sponsorship for, and their participation in, the research project.

Institutional Review Board Statement: Not applicable.

Informed Consent Statement: Informed consent was obtained from all subjects involved in the study.

Data Availability Statement: The data is archived according to the research data management policy of the University of Twente.

Acknowledgments: We acknowledge the peer-review feedback leading to improvement of this paper.

Conflicts of Interest: The authors declare no conflict of interest.

Appendix A

Table A1. Operationalization of the methodology, showing consistency between the process steps.

CIMO	Context	Interventions	Mechanisms	Outcome				
DSR	**Problem Exploration**				**Design Objective and Criteria**	**Design Propositions**	**Design and Implement**	**Evaluation**
Operation	(a) Different interests of stakeholders representing different org. (b) Different views of the stakeholders from diverse backgrounds (c) Frustration of stakeholders with pace and decision making process	(a) Implementation of solution x: Define process agreements (b) Clearly describe the solution and describe why it is a good solution (c) Establish clear meeting structures (d) Prioritize cases and work on most urgent ones for the decision	(a) Planning and control [defining]; solution focus (b) Planning and control [convincing]; solution focus (c) Planning and control [standard structure] (d) Planning and control [prioritizing]	(a) No problem consensus (b) Little mutual understanding during process (c) Still frustrated, not much progress (d) No coordination fit	(a) Establish better coordination fit by establishing relational coordination. (b) Establish more problem consensus (c) Create mutual understanding (d) Create ownership of the decision	(a) Focus on problem, not solutions (b) Engage in collective learning through intervision (c) Enable continuous stakeholder engagement	Intervision process	Evaluation of the three design propositions

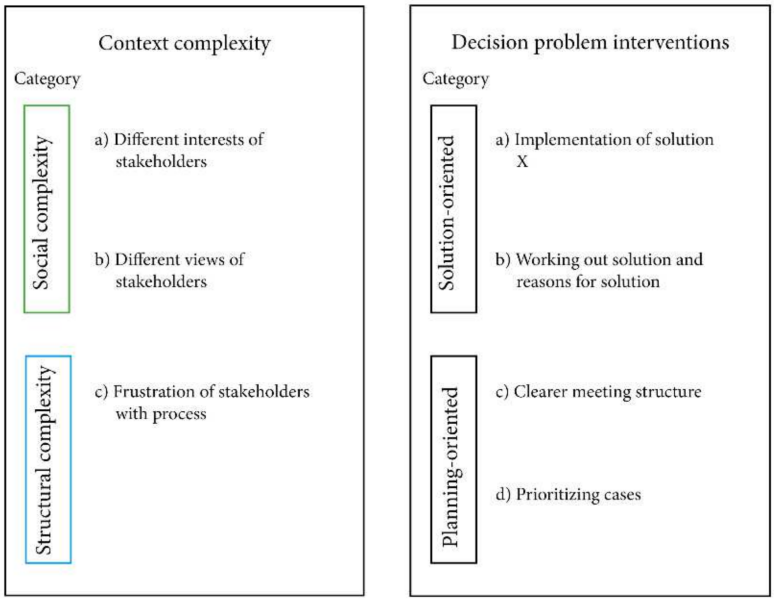

Figure A1. Meaningful categories classified according to context theme and intervention theme.

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