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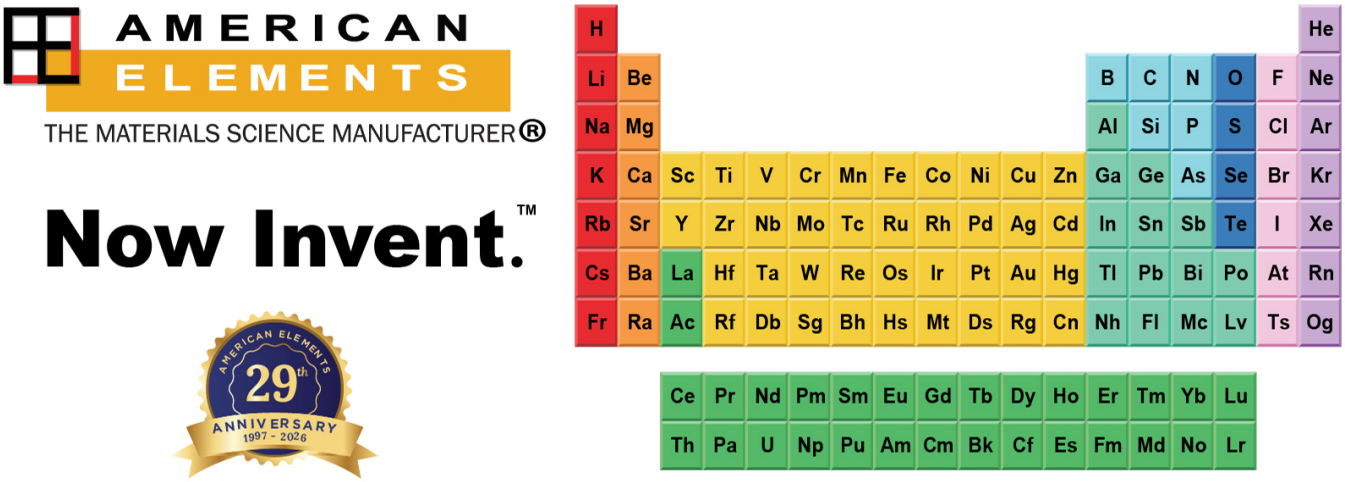
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Collaborative Project Delivery Model: The Materials Science Building at NTNU Campus

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Collaborative delivery models are increasingly used to address persistent challenges in construction projects. This paper examines how a collaborative delivery model functioned in practice within the P2 "Materials Science Building" project, part of a major campus development in Trondheim, Norway. The study asks: (1) What were the advantages and challenges of the model in the case project? and (2) How can lessons inform improvements for future projects? Using a qualitative case study approach based on observations, interviews, and document analysis, the findings show that mechanisms such as early contractor involvement, shared target price with risk-sharing, open-book principles, co-location, and ICE sessions supported collaboration. However, vulnerabilities emerged from a lean client organisation, tensions around target price, ambiguities in open-book practice, demanding user involvement, and limited cultural tools. The paper offers practical implications, emphasising the need for sufficient client capacity, clearer roles, robust target price processes, calibrated open-book arrangements, and cultural mechanisms adapted to organisational capacities.

1. Introduction

Calls for systemic transformation in construction often focus on digital solutions. Yet these technologies address the supporting infrastructure. The operating system of a project is its delivery model. In this paper, we examine a collaborative project delivery model within a case project, focusing on its advantages and challenges, and explores how insights from this case can inform improvements for future projects.

By *project delivery model* we refer to the system of contractual, organisational and operative arrangements that sets out how design, construction and, in some cases, operations and maintenance are structured, procured and governed across the project lifecycle, including roles, responsibilities and risk allocation [1-3]. In the last decades, attention has increasingly shifted from traditional models such as design–bid–build towards relational or collaborative project delivery models such as partnering, alliancing and integrated project delivery [4-6]. These models explicitly seek to counter adversarial contracting by promoting early involvement, shared risk–reward and joint decision-making [6-8]. In this paper, we use the term *collaborative project delivery models* to denote this family of approaches.

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In the Scandinavian context, collaborative project delivery models have largely developed as adaptations of conventional design–build rather than as a broadly adoption of the Alliance or Integrated Project Delivery (IPD) models [9]. Public clients in Norway, Sweden and Denmark increasingly use design–build contracts that embed collaborative features such as early contractor involvement, open-book, target costing and formal partnering obligations (often labelled *collaborative design–build*, *two-stage* or *two-step* design–build contracts) [9, 10]. At the same time, Finland stands out as a partial exception, with project alliancing having been adopted more systematically in the construction sector and now representing a recognised option [11, 12].

Taken together, Scandinavian collaborative delivery models are therefore understood as a heterogeneous field with many approaches to enhance collaboration beyond the formal contract. Building on the growing body of research on collaborative project delivery models, this paper contributes an in-depth empirical study of how a particular collaborative delivery model works in practice in the case project P2 "Materials Science Building" in a large campus development project in Trondheim (Norway). The study explores the following research questions:

1. What were the advantages and challenges of the model in the case project?
2. How can lessons inform improvements for future projects?

2 Literature review

The topic of collaborative project delivery is well-discussed in the project literature [4, 6, 9, 10, 12-21]. The literature reveals the concept is often inconsistently defined. As Eriksson [17] notes, definitions typically fall into four categories, ranging from generic aspirations to structured process sequences. Our research focus on the *mechanisms* (the specific tools and elements used to instil and maintain collaboration). We approach collaborative project delivery model as a question of encompassing both formal mechanisms (such as contracts, organisational structures and procedures) and cultural (informal or relational) mechanisms (such as trust-building, shared norms and collaborative practices). This perspective provides the analytical lens for our empirical analysis and for discussing how the model performs and how it can be improved in relation to the two research questions, thereby contributing to the literature on collaborative project delivery in Scandinavian two-stage design–build projects.

2.1 Relational contracting and collaborative project delivery models

Project governance is a concept at the intersection of corporate governance and project management [22]. It is typically understood as the structures and processes by which the project owner or sponsoring organisation directs and controls projects in line with organisational objectives. It concerns how projects are directed and controlled, including who makes which decisions, with what mandate, and how objectives, risks and benefits are followed up over time [23, 24]. However, dissatisfaction with adversarial relationships, opportunistic behaviour, and fragmentation in conventional design–bid–build and design–build contracts has motivated the development of more relational or collaborative arrangements in many countries [6, 25, 26].

Collaborative project delivery models are closely linked to the notion of relational contracting. Relational contract theory, originating from Macneil's work [See for example; 27], argues that many long-term exchange relations cannot be fully specified before the signing of the contract and are therefore governed not only by formal contract terms but also by relational norms, such as role integrity, reciprocity and solidarity [28, 29]. Thus, rather than focusing mainly on price competition and risk transfer, relational approaches emphasise long term relationships, shared objectives, trust, openness and joint problem solving between the parties [15, 30, 31].

Collaborative project delivery models have introduced new approaches to project delivery as they alter traditional decision-making structures, redistribute responsibilities, and emphasise joint risk management and shared objectives [32]. Furthermore, these models take many forms either as fully or partially developed delivery models or in practice; Best Value Procurement [33], Early Contractor Involvement [See for example; 34, 35], Alliancing [See for example; 36, 37, 38], Partnering [See for example; 17, 31, 39], Integrated Project Delivery [See for example; 40, 41, 42].

As discussed in the introduction, Scandinavian public clients commonly use two-stage or collaborative-based design–build contracts that embed collaborative mechanisms up-front of the detailed design and execution phases [9, 10]. However, collaborative models do not guarantee success. Longitudinal research on Swedish infrastructure projects illustrates how successive "waves" of collaborative initiatives often emerge, are rebranded, or abandoned when early difficulties or shifting political signals undermine their legitimacy and preventing systematic learning and stable practices from taking root [21].

A configuration of different collaboration mechanisms is often used in projects to operationalise relational principles in practice. The literature show that there are many possible ways to categorise such mechanisms [13, 18]. Furthermore, the literature shows that there is a nearly non-exhaustive list of mechanisms that potentially could be implemented (including different variations of the same 'mechanism', i.e. co-location could be implemented differently across different projects). This paper distinguishes between contractual, organisational, and cultural mechanisms, aligning with earlier work that highlights how collaborative delivery models must integrate formal and informal elements. For more in-depth studies and mappings of various mechanisms, see for example Eriksson [17], Hosseini et al. [19], Nyström [20].

Contractual mechanisms include elements such as target price or target cost, bonus–malus schemes, open-book principles, and options for future work, which are discussed as key mechanisms in partnering, alliancing and IPD arrangements [see for example; 6, 10, 43]. Organisational mechanisms concern how the parties organise and coordinate their work, for example through co-location, integrated design sessions (e.g. ICE sessions), structured conflict-resolution procedures, validation processes and agile or non-traditional methods such as Scrum, repeating prior studies that emphasise co-location, workshops and integrated teams as central collaboration mechanisms [see for example: 14, 44]. Cultural mechanisms relate to how people and teams are involved and developed, including user involvement, the selection of key personnel and subcontractors, and deliberate relationship-building activities and mechanisms aimed at improving trust, team functioning and group dynamics that the collaborative project delivery literature consistently links to successful collaboration [see for example: 16, 44, 45].

2.2 Knowledge gap/ contribution

Rather than adding to the existing catalogues of mechanisms, we focus on the actuality of their implementation. Recent research by Bresnen and Lennie [46] argues that collaborative models are best understood as being constituted through "complex and interacting bundles of practices" that span multiple levels of interaction. These bundles can be shaped by many things including institutional influences, situated practices, and specific performance evaluations. Our research adopts this practice-based perspective by focusing on the specific mechanisms used to instil and maintain collaboration. By documenting the performance of specific collaborative mechanisms in a Norwegian two-stage design-build project, we provide "situated understanding" of them and the effects they have on public sector projects.

3. Methodology

Although project delivery models have been studied before, understanding how they are implemented in specific contexts requires insight into participants' experiences and perceptions. Qualitative methods allow for exploring these experiences and uncovering lessons that can inform improvements [47]. A case project was selected to enable an in-depth study of complex processes within a bounded context [47]. According to Yin [48] a case study is also particularly suitable when the researcher has little control over events, and the focus is a contemporary phenomenon.

The case project "P2" is part of the new NTNU[1] campus development in Trondheim. The project was chosen because it uses a delivery model based on collaboration, it is technically complex with laboratories and heavy installations on unstable ground close to staff and students, and is organisationally complex, involving the Ministry of Education and Research as funder, Statsbygg (hereby referred to as just the client), which is Norwegian government's building commissioner, serving as the client and the university as end user. The project was also easily accessible for data collection. Only the collaboration phase was studied. Neither the preceding sketch design phase, the following detailed design -and execution phase were studied.

Data was collected from three primary sources: observations, interviews and documents. Weekly observations were carried out on the project's weekly work sessions (so-called Integrated Concurrent Engineering-sessions, hereby just ICE) with participation from two of the authors. Initial unstructured observations with notetaking were followed by the development of an observation form once the delivery model was mapped and the main mechanisms used in the collaboration were identified. The mechanisms were grouped as contractual, organisational and cultural, with columns for primary and secondary observations. In total, 15 observations were conducted. The majority comprising full day observations of the main collaborative sessions and theme-sessions where participants worked in sub-groups. The 15 observations were also supplemented by shorter observations of specific meetings (e.g., coordination and special-topic meetings). Document studies were also conducted to corroborate and supplement information from observations and interviews [48]. The reviewed project was accessed via the project's document library, with primary emphasis on the contract and the formal description of the delivery model, complemented by selected meeting minutes, procurement documents, and other relevant materials used for contextualization and triangulation.

To complement the observations, 11 semi-structured interviews were conducted (10 face-to-face, 1 via Microsoft Teams), yielding approximately 14 hours of audio recordings; most interviews lasted around one hour (with some shorter and some longer). Interviews were selected as a key source of evidence in line with [48]. An interview guide with predefined and follow-up questions was developed based on the observation guide, with each question linked to a specific delivery model mechanism. The mechanisms are literature-informed categories operationalised from the case i.e. were documented in project materials and observed in use and that were implemented with the explicit intent to enable or enhance collaboration (e.g., open-book, early contractor involvement). The interviewees were selected based on their involvement in the collaboration phase and their central roles related to the delivery model: two representatives from the contractor, two from the client, one architect, one user, three technical advisors and two subcontractors.

The data were analysed using thematic analysis [49]. Interview material and observation notes were first structured in Microsoft Word and organised by the research questions, with the three mechanisms used as top-level analytical categories within each question. The empirical material was then manually coded (including a relevance assessment to the research questions),

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and coded excerpts were grouped within the mechanism categories; material not fitting any mechanism was either assigned to an appropriate category where relevant or excluded when not pertinent to the study's focus. The codes formed the basis for the structure of the paper, with themes centred around the delivery mechanisms in the delivery model and linked to each research question.

4. Results

This chapter reports the empirical results from the case project (P2) in a campus development programme in Trondheim, Norway. The contractor was engaged through a two-stage contract with a one-year collaboration phase followed by detail-design and construction. Interviewees described the collaboration phase as an intensive, co-located working period with frequent joint sessions and weekly large-group meetings. Within this setting, the delivery model worked through: (1) contractual mechanisms that shaped responsibility, incentives, and transparency, (2) organisational mechanisms that structured joint work and decisions, and (3) cultural mechanisms that influenced relationships, competence, and user involvement. The key collaborative mechanisms are listed in Table 1.

Table 1: Key collaborative mechanisms in the project.

Contractual mechanisms	***Organisational mechanisms***	***Cultural mechanism***
Project organisation	Co-location and ICE sessions	User involvement
Very early involvement	Conflict resolution	Relationships- and social activities
Target price with risk sharing	Validation Form	Team competence, composition- and stability, and measurements
Integrating contractor and technical disciplines	Scrum sprints	
Extra incentive		
Open book		

4.1 Contractual mechanisms in the delivery model

Project organisation: The client chose a lean client organisation, yet it was by the informant perceived that this setup altered the relational dynamics of the collaboration phase. By relying on the contractor to lead day-to-day development, the client inadvertently created an institutional "bottleneck" where limited capacity led to slower decision-making. Informants also described a shift of responsibility toward the contractor without sufficiently explicit clarification of roles. This created ambiguity about who should handle emerging issues. Informants also noted less client presence in central meetings, which sometimes resulted in the client not being involved in discussions where key issues and potential solutions were identified. Thus, the team could not always close decisions.

Very early involvement: The contractor entered immediately after the sketch design phase, so the preliminary design was carried out jointly with technical disciplines present in the collaboration phase. Several interviewees nevertheless believed the project would have benefited from involving the contractor earlier because important decisions were already set by then. They argued that earlier joint work could have surfaced cost consequences sooner, reduced time spent on solution paths that later proved unaffordable, and revealed earlier how tight project finances were. Other informants cautioned that contractors may not be best placed to develop rooms and

functional programmes, and argued that the contractor came in at the "right time" because a construction programme was needed as a starting point.

Target price: The Interviewees generally viewed the target price as beneficial because it tied decisions to a shared financial outcome and forced careful weighing of alternatives. At the same time, some described tension between expectations and the project complexity, or as an disconnect between the realities of the project the client's initial budget expectations. They described the process of cost decreasing as "turning over every stone" and that user consultations revealed specialised installations that drove prices upward. The Interviewees described this as difficult because the client wanted to retain existing functions and areas while still reducing cost. The finding reveals a paradox (or effect) where the practice of diving into project details and meeting specific user needs contradicted the target price "logic" that more collaborative work between the disciplines should yield lower prices, which in sum tested the collaboration.

Integrating the contractor and the technical disciplines: The client initially held separate contracts with the consultant group and contractor, with later merging under the contractor's responsibility. However, the experience of this merger was marked by some challenges as project participants struggled to navigate ambiguous roles during the transition. While under separate contracts some interviewees described loops where issues and decision paths became long, as the consultant group often had to check decisions against external organisational levels. They experienced this as reducing decision authority within the project and slowing resolution even when the co-located team had done the technical work.

Extra incentive: The inclusion of an option for potential follow-up work on the wider campus programme acted as a powerful institutional influence that extended the team's perspective beyond the project. Informants described this option as a significant motivation, whereby the contractor's team viewed their current situated practices and collaborative efforts as a real-time performance evaluation for future involvement. Thus, it created an extra level of commitment, and the experience suggests that options for future work can be an effective supplementary incentive.

Open book: The Interviewees described open book as essential because it allowed parties to see figures and understand the cost effects of changes, supporting trust and joint problem solving. Interviewees underlined, however, that there is a need to find an appropriate level of transparency. Not everything has to be visible to everyone, and some information is seen as sensitive within the wider industry. They therefore suggested that future projects should define what falls inside the open-book scope and how shared information is used.

4.2 Collaboration processes and decision-making (Organisational mechanisms)

Co-location and ICE sessions: During the collaboration phase, parties were co-located, with joint sessions scheduled weekly, including ICE (*Integrated Concurrent Engineering*) sessions with around 30 participants. These sessions combined a shared update segment (i.e. client status, design status) with work in theme groups. The theme groups typically included five to eight interdisciplinary participants working on specific project areas. At the start-up meeting, participants chose a theme group based on their expertise, and the different actors were distributed evenly across the groups. Most interviewees experienced co-location as beneficial because it enabled informal coordination and helped participants stay aware of parallel work. They also valued the shared update segment of ICE as an efficient way to align across actors.

At the same time, interviewees described that it was challenging to ensure that all 30 participants experience value in every meeting, and one informant notes that it can at times feel like "many people are sitting and listening to little". Theme-group separation also made cross-

theme coordination harder when solutions spanned multiple areas. A design-team representative questioned the fit of working on partial building areas for some disciplines. Informants linked these issues to decision authority, noting that more consistent client presence would have helped to close issues faster.

Conflict resolution: The contract specified a stepwise procedure for resolving conflicts, escalating from the project group to a collaboration management meeting and then to a senior project board. Interviewees described this structure as intended to keep disputes informal and support joint problem solving. One informant related this to fewer conflicts in collaboration projects because teams address problems early rather than allowing escalation.

Validation forms: Validation forms were used to evaluate alternative solutions against criteria such as cost, functionality, and time, aiming to make trade-offs visible and place decisions at the appropriate level. Interviewees generally agree that the concept was good, but several point out weaknesses in the method. First, weighting criteria was seen as subjective and open to preference-driven results. Second, decisions with major time/cost/quality implications still required escalation, so analysis did not always translate into timely closure. Interviewees therefore portrayed validation as helpful for making trade-offs explicit, but insufficient unless linked to clear decision paths.

Scrum: Scrum was used to handle issues that could not be resolved immediately. Small team of three to four people received a clear mandate to solve a defined problem within a limited period (typically two weeks or less). Several interviewees described scrum as valuable for time-critical dilemmas. One account described a sprint used to clarify the consequences of meeting the client's target price against requirements, including which functions would need to be removed to meet the budget. In this framing, scrum created a focused arena to clarify the problem quickly.

4.3 Cultural mechanism

User involvement: Interviewees described user involvement as highly valuable because building value is judged by user satisfaction. User representatives from both user organisations were invited to all ICE sessions, although they did not attend every session. In addition, the project held dedicated meetings with these representatives to address user-related issues and align on needs and priorities. They linked user participation in decisions to better understanding of needs, and technical subcontractors emphasised user insight as crucial for specialised technical installations. At the same time, interviewees described a constraint as the user side is primarily an operations organisation, affecting capacity and ways of working and making active participation in the project demanding. At the same time, interviewees reported capacity and timing constraints concerning users' ability to participate in the project. One informant stated that a structured user involvement plan was not in place at the right time which limited the user organisation's ability to mobilise resources. User meetings were also described as too short.

Relationships and social activities: Informants describe a strong focus on relationships including a social committee and informal norms such as greeting newcomers. One informant emphasised that informal conversations (e.g., at the coffee machine) often carried important project information and helped coordination across actors, and that helped to "oil the machinery" of the collaboration. Another informant did not value additional organised social events and left after the formal programme due to other commitments. This suggests that relationship practices can support collaboration but are not equally valued or equally accessible for all participants.

Team competence, composition- and stability, and measurements: Interviewees described strong emphasis on key personnel in the project (the contract included a penalty if key personnel were replaced, reflecting an attempt to stabilise the team). One Interviewee from the

client explains that great emphasis is placed on the contractor's key personnel, as these roles are seen as crucial for successful collaboration. At the same time, one interviewee questioned whether CV- and tenure-focused procurement evaluation limits opportunities for new talent. This may limit opportunities for new talents who may be fully capable of doing the job but lack extensive experience. From the contractor's side, an informant explains that subcontractors are selected based on the team's experience, competence and the chosen delivery model. There is no explicit aim to reuse the same subcontractors across projects, but it is considered natural that those who have worked with the contractor before are often chosen again, since they already have the required competence and experience.

The contractor has used both SPGR test (*Systematisere Person–Gruppe Relasjonen*, "Systematising the Person–Group Relationship") and Plus/delta. SPGR which is a tool that, in simple terms, assesses observed behaviour and categorises how different types of behaviour affect the group or team. Interviewees expressed mixed experiences, questioning reliability when participants barely knew each other and describing outcomes as abstract unless translated into concrete feedback with support from the provider. Furthermore, plus/delta evaluations were used at the end of sessions. The project team used it to capture what worked well (plus) and what should change (delta), including ratings of participants' preparation and the usefulness of the session. Project management used this feedback to monitor collaboration between sessions. Interviewees described the tool as effective because it took little time yet revealed dissatisfaction early. They also emphasised the value of involving the entire project team and observed that project management acted on the feedback to adjust and improve subsequent sessions.

5 Discussion

The discussion treats the delivery model as a combination of contractual, organisational, and relational mechanisms. We first discuss how the model performed in P2 (RQ1) and then how it can be improved (RQ2). The collaboration-based delivery model used in P2 combines a broad set of contractual, organisational and cultural mechanisms. The results indicate that early contractor involvement, co-location, ICE sessions, open-book principles support collaboration and shared problem solving. At the same time, the findings reveal challenges related to target price setting, user involvement, decision-making after validation processes and the practical use of tools such as scrum and SPGR.

For the client organisation, the project suggests that a lean client structure can reduce overhead costs but may also weaken the client's ability to manage a collaboration-based delivery model. Rahman and Kumaraswamy [25] argue that successful relational contracting requires adequate owner resources. In P2, limited client capacity contributed to slower decision-making, unclear interfaces, and limited presence in collaboration arenas. These findings extend Engebø et al. [4], who show that a lack of unified approaches can create confusion around roles, responsibilities, structure, and process. They also support Lahdenperä [12]'s emphasis on active owner participation. The client therefor needs sufficient capacity and clearly defined roles to participate actively in shared processes with the contractor.

On the contractual side, the combination of a target price, a 50/50 bonus or malus split, and further incentive distribution helped align interests. Target-cost arrangements are intended to align the parties' goals with overall project interests [10]. Informants described how the shared target price encouraged early detailing and open discussion of cost drivers, consistent with Lahdenperä [12] argument that joint bearing of risks support joint problem solving and open communication. At the same time, the findings reveal a vulnerability related to the correctness of

the target price. Because prices are often set early under high uncertainty, they may require continuous refinement [10]. In P2, the perceived contradiction between the building programme and the target price was addressed through a Scrum sprint to clarify function removals and thus serving as a mechanism that sought to bridge intentions and performance and establish compromise between conflicting interests (*establishing truces*) [15]. The results also fits with Dewulf and Kadefors [16] caution that pain-sharing becomes largely symbolic if the investment budget cannot absorb overruns. Future projects may therefore need more structured processes to validate and refine the target price, so it provides a realistic basis for collaboration.

The open book principle strengthened the target price's collaborative intent. Informants described cost transparency in P2 as unusually high and trust-building, consistent with Eriksson [17], who treats compensation based on open books as a core procedure. This transparency reduced information asymmetry, a central tenet of relational contracting, and supports the view that cost transparency can be more important for trust than the financial incentive itself [16]. However, informants also emphasised the need for a reasonable boundary for what is shared. Open book practice is therefore a matter of degree and design, not an absolute condition, reflecting Nyström [20] where financial monitoring through open books might be interpreted by contractors as a lack of trust rather than its foundation. This points to a need for clearer standards that balance transparency (to build trust and avoid suspicion) with protection against information overload and concerns that detailed data could be used against individual parties. As Nwajei [28] notes, relational norms vary substantially in practice, and in P2, achieving the objectives of open-book practice appeared to require more guidance.

The option to deliver later campus stages also acted as a strong motivator, consistent with Eriksson [17] finding that the prospect of a continued relationship can promote collaboration. Yet the same prospect may discourage parties from surfacing problems if doing so could jeopardise future work. Beyond contracts and incentives, the findings highlight the importance of organisational mechanisms. Co-location and weekly ICE sessions created arenas that combined formal status updates with interdisciplinary work in theme groups. Informants regarded this set-up as useful for rapid clarification, informal dialogue, and reduced rework, consistent with [17, 32] emphasis on joint project offices and core collaborative tools. The informal dialogue generated in these sessions also reflects Bygballe and Swärd [15] argument that partnering becomes institutionalised through routines that enable social learning.

However, the findings also identified meeting exhaustion and a lack of perceived value for all disciplines participating, suggesting a disbenefit of overload and excessive amounts of meetings that can lead to exhaustion if the format is not flexible enough. This indicates that while co-location and ICE sessions are central to the model, their format must be adapted to ensure flexibility. The stepwise conflict resolution procedure, starting at the lowest level and escalating only if necessary, also fits the collaborative delivery logic and was seen as contributing to fewer and less escalated conflicts. Other process tools, such as validation and scrum, were considered strong and useful in critical situations, but their application sometimes revealed subjectivity in weighting and unclear decision paths after their use.

Finally, the delivery model relied on cultural mechanisms. User involvement was considered highly valuable by all informants, especially for specialised technical installations. However, this involvement was complicated by the user organisation's operational focus, which constrained capacity and blurred roles. This aligns with literature suggesting that internal complexity within client organisations can lead user groups to pursue their own interests, constraining involvement and damaging relations with the project team [13].

Co-location, informal behavioural norms and social initiatives were reported to "oil the machinery" of collaboration, together with a the strong focus on key personnel and team composition, confirming Eriksson [17] inclusion of teambuilding as a core procedure. Also, the findings showing that such activities do not suit all participants equally, which is in line with (participation could be experienced as demanding). The SPGR test was perceived as abstract and in need of external support, aligning with the use of facilitators in many partnering definitions [17, 20]. The strong emphasis on CV-based selection and reuse of familiar subcontractors supports literature that highlights soft parameters such as competence and prior experience as important for trust-building. However, it may also limit opportunities for new talent and reduce competitive pressure for continuous improvement.

6 Conclusion

This study has examined how a collaboration-based delivery model functioned in the P2 project, focusing on the interplay between contractual, organisational and cultural mechanisms. Our findings confirm that some mandatory core procedures such as early contractor involvement, a shared target price with risk sharing, open-book principles, co-location and regular ICE sessions, as well as a strong emphasis on relationships and competence, all contributed to collaboration.

At the same time, the case reveals challenges for the delivery model. A lean client organisation with limited capacity led to unclear interfaces and slow decision making. Furthermore, the target price mechanism created alignment but also tension when the financial frame and the building programme were not fully consistent, thus the collaborative intent can come in second-order if the financial frame is too tight. Open-book practices were perceived as trust building yet raised questions about the appropriate level and use of transparency. User involvement was considered essential for quality and functionality but was demanding to organise when the main user organisation was oriented towards operations rather than projects. Our findings on cultural tools showed that simple tools like "Plus/delta" were perceived as efficient, more abstract social tests (SPGR) were difficult to implement, suggesting difficulty to implement without sufficient support.

Taken together, the P2 case suggests that collaborative delivery models can provide a strong foundation, but their performance depends on governance where the mechanisms are calibrated to the project as it unfolds. Future projects may particularly benefit from ensuring adequate client capacity, clarifying roles and interfaces, carefully calibrating target price and open-book arrangements, and tailoring user involvement and cultural tools to the characteristics and capacity of the participating organisations.

To conclude, this case shows that collaboration in a collaborative delivery model is not achieved simply by implementing a checklist of mechanisms. While cost transparency and open-book principles supported trust and reduced information asymmetry, the model became fragile when mechanisms were misaligned with participant capacity or the client's organisational structure. Achieving collaboration, therefore, requires not only adopting collaborative mechanisms but also adapting them to emerging cultural and financial tensions throughout the project lifecycle. This study has several limitations. First, it is based on a single case, which limits generalisability. Second, the empirical focus is on the collaboration phase, and we did not follow the project into the execution phase, which may shape how mechanisms perform over time. Finally, the breadth of mechanisms covered necessarily constrains the depth of analysis for each mechanism. Future research should investigate how project-level collaborative successes can be further institutionalised [21]. Furthermore, more empirical work is needed to directly link specific mechanisms to measurable project outcomes.

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