GERMAN - MONGOLIAN INSTITUTE FOR RESOURCES AND TECHNOLOGY

The present work was submitted to
the German-Mongolian Institute of Resources and Technology

COLLABORATIVE APPROACH IN RESEARCH PROJECT MANAGEMENT

Bachelor's Thesis

By

Temuulen Boldbaatar

Study program: Industrial Engineering
Student ID: B2200530

1st Supervisor/Examiner: **Prof.Dr. Enkhzaya Chuluunbaatar**

2st Supervisor/Examiner: **Prof.Dr. Bolormaa Purevdorj**

Ulaanbaatar/Nalaikh

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Statutory Declaration

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I hereby affirm in lieu of an oath that I provided the submitted bachelor thesis

COLLABORATIVE APPROACH IN RESEARCH PROJECT MANAGEMENT

I did not use any sources other than those stated. In case that the work is additionally submitted on a data medium, I declare that the written and the electronic form are completely identical. The work was not submitted in the same or similar form to any examination authority.

Ulaanbaatar,Nalaiakh 05/28/2026	
Place, Date	Signature

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Acknowledgements

First and foremost, I would like to express my sincere gratitude to my first supervisor, Prof. Dr. Enkhzaya Chuluunbaatar, for her continuous guidance, encouragement, and support throughout the process of writing this thesis. I am especially grateful for her ability to recognize potential in me that I had not yet seen in myself, and for giving me the opportunity to grow both academically and personally. Her constant encouragement, constructive pressure, and belief in my abilities motivated me to keep moving forward. I am also deeply thankful that she trusted me and allowed me to become part of the ToSMM project team, which became an important learning experience for me.

I would also like to extend my heartfelt appreciation to my second supervisor, Prof. Dr. Bolormaa Purevdorj, for her valuable support and guidance. With her help, I was able to develop the framework of this thesis, and her contribution played an important role in shaping the direction and quality of my research. I am truly grateful for her encouragement, advice, and continuous support throughout this process.

My sincere thanks also go to the ToSMM project team. I am grateful for the opportunity to work with such a supportive and dedicated team. Throughout the challenges and difficult moments of the project, we supported one another, shared responsibilities, and learned together. This experience not only contributed to my thesis but also helped me understand the value of teamwork, trust, and collaboration in practice.

Finally, I would like to thank my family and friends for their unconditional love, patience, and encouragement. Their support gave me strength during difficult times and helped me complete this thesis with confidence and determination.

List of Abbreviations

Abbreviation	Full Form
ESG	Environmental, Social, and Governance
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit
GMIT	German-Mongolian Institute for Resources and Technology
HIL	Human-in-the-Loop
MNMA	Mongolian National Mining Association
SRDF	Strategic Research Development Fund
ToSMM	Towards Sustainable Mining in Mongolia
TSM	Towards Sustainable Mining
WBS	Work Breakdown Structure

List of Tables

Table No.	Title
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1. Introduction

1.1 Background of the Study

Collaboration has become an important part of contemporary project management because many projects are implemented by teams with different roles, expertise, and responsibilities. In such settings, project success depends not only on technical knowledge, but also on communication, coordination, feedback, and shared problem-solving.

In research project management, collaboration is especially important because research projects are often uncertain, iterative, and knowledge-based. Tasks may change during implementation, new information may emerge, and outputs may require repeated review before completion. Therefore, research project management requires both formal planning and flexible collaboration.

This thesis examines the “Towards Sustainable Mining in Mongolia” (ToSMM) project as a case of collaborative research project management. The project is relevant because it combines academic research, practical guidebook development, stakeholder interaction, and coordinated implementation. According to the Project Charter, the main goal of the project is to develop a localized and practical TSM Mongolia Guidebook for engineers and mining professionals, while also producing educational and policy-related outputs.

The ToSMM project was also implemented under practical constraints, including stakeholder availability, mining company responses, data access, and fieldwork scheduling. These conditions make the project suitable for examining how collaborative management supported communication, coordination, workflow continuity, and project implementation under changing conditions.

1.2 Problem Statement

Although collaboration is widely recognized as important for project success, its actual functioning in research project settings is not always examined systematically. In many projects, teamwork is assumed to be useful, but the specific mechanisms through which collaboration supports project implementation remain unclear.

This issue is especially relevant in mixed research teams where students, professionals, and academic supervisors work together. Such teams can benefit from diverse expertise, but they may also face challenges such as unclear responsibilities, duplicated work, delays, and communication problems if collaboration is not actively managed.

The ToSMM project was organized through a collaborative model from the beginning. The WBS and Project Charter show that the project included role allocation, communication planning, regular meetings, internal review, stakeholder coordination, and milestone-based monitoring. However, the project has not yet been examined as a focused case of collaborative research project management.

Therefore, the main problem addressed in this thesis is the lack of systematic analysis of how collaborative management functioned within the ToSMM project and what lessons can be learned for future multidisciplinary research projects.

1.3 Aim of the Study

The aim of this study is to analyze how collaborative management functioned in the ToSMM project and to evaluate its effectiveness in supporting research project management and implementation.

This thesis argues that collaborative management in small multidisciplinary research teams should not be understood only as a supportive team condition. Instead, the ToSMM case shows that collaboration can function as a structured research management mechanism that connects formal project design with adaptive implementation. Through communication, coordination, role clarity, feedback, mutual support, workflow continuity, and collaborative learning, collaboration helped the project maintain progress and generate learning under conditions of uncertainty.

At the same time, the study does not assume that collaboration was perfect or problem-free. It also examines the tensions created by collaboration, including time pressure, hidden coordination costs, uneven participation, and leadership-related pressure. In this way, the thesis analyzes collaboration not only as a positive project value, but as a practical management process that required continuous effort, adjustment, and facilitation.

1.4 Research Objectives

To achieve this aim, the study pursues the following objectives:

1. To identify the formal and informal collaborative practices used in the ToSMM project, including planning, communication, feedback, review, and stakeholder-related routines.
2. To examine how collaborative management supported participation, mutual learning, and knowledge exchange among students, experts, and academic supervisors within the project team.

3. To assess how collaborative practices influenced communication, coordination, role clarity, mutual support, and collaborative learning within the 12-member mixed project team.
4. To analyze how the collaborative approach supported workflow continuity and task adjustment when the project faced external disruption, particularly the delay in field-based activities.
5. To develop practical recommendations for strengthening collaborative management in future multidisciplinary and multi-stakeholder research projects.

1.5 Research Questions

This study is guided by one main research question and five sub-questions aligned with the research objectives.

Main Research Question

How did collaborative management in the ToSMM project support effective research project management and implementation?

Sub-questions

1. What formal and informal collaborative practices were used in the ToSMM project?
2. How did collaborative management support participation, mutual learning, and knowledge exchange among students, experts, and academic supervisors?
3. How did collaborative practices influence communication, coordination, role clarity, mutual support, and collaborative learning within the 12-member mixed project team?
4. How did the collaborative approach support workflow continuity and task adjustment when the project faced external disruption, particularly the delay in field-based activities?
5. What practical lessons and recommendations can be drawn from the ToSMM project for future multidisciplinary and multi-stakeholder research projects?

1.6 Significance of the Study

This study is significant both academically and practically. Academically, it contributes to the understanding of collaborative management in research project settings. While collaboration is often discussed as a success factor, fewer studies examine how it functions as a structured management process within a small multidisciplinary research team.

The study is also significant because it analyzes collaboration through practical dimensions such as communication, coordination, role clarity, feedback, mutual support, workflow continuity,

and collaborative learning. This helps show how collaboration is organized and sustained during project implementation.

Practically, the study provides lessons for future multidisciplinary and multi-stakeholder research projects. The ToSMM project shows how a mixed team of students, academic supervisors, professional contributors, and stakeholders worked through weekly meetings, review routines, shared responsibility, and adaptive coordination.

The study is also relevant to the Mongolian context because research on collaborative project management in Mongolia, especially in mining-related projects, remains limited. Therefore, the findings may support better planning and implementation of similar research and development projects in the future.

1.7 Scope of the Study

This study focuses on the collaborative approach in research management within the ToSMM project. The scope is limited to the internal collaborative process of the project team and how this process supported project implementation.

The study examines collaboration through seven analytical dimensions: communication, coordination, role clarity, participation and feedback, workflow continuity, mutual support, and collaborative learning. These dimensions are used to analyze how project members shared information, coordinated tasks, understood responsibilities, contributed ideas, supported one another, continued work under disruption, and learned across roles.

The study does not evaluate the technical quality of the TSM guidebook or the long-term policy impact of TSM in Mongolia. External stakeholders such as MNMA, GIZ, SRDF, and mining companies are considered only where they influenced project implementation, feedback, field-related activities, or external constraints. The main unit of analysis is the internal project team and its collaborative management process.

2. Literature Review and Analytical Framework

2.1 Research Project Management in Structured and Adaptive Project Environments

Research project management refers to the planning, organization, implementation, monitoring, and completion of research activities within a defined timeframe and limited resources [1] . Like other forms of project management, it involves setting goals, assigning tasks, scheduling activities, and tracking progress.

However, research projects are often more uncertain and iterative than routine implementation projects. Their outputs may not be fully predictable at the beginning, and the workflow may change as new evidence, interpretations, and constraints emerge. For this reason, research project management requires both structured planning and adaptive coordination.

This is relevant to the ToSMM project because the project used formal tools such as the Work Breakdown Structure, milestones, communication planning, reporting routines, and review stages, while also relying on weekly meetings, shared drafting, and repeated feedback cycles. This combination makes ToSMM a useful case for examining collaborative research project management in practice.

2.2 Collaborative Management and the Logic of Collaborative Governance

Collaborative management refers to the structured organization of work through communication, coordination, joint problem-solving, and shared responsibility. In this study, it is understood not

simply as teamwork, but as a management process through which project members align tasks, exchange knowledge, review outputs, and respond to implementation challenges together.

This perspective is especially relevant for research projects because such projects often involve uncertainty, iterative work, and participants from different academic and professional backgrounds. In these settings, collaboration helps reduce misunderstanding, clarify responsibilities, support feedback, and improve the quality of shared outputs. It also helps teams maintain progress when tasks need to be adjusted during implementation.

For this thesis, collaborative management is interpreted through the broader lens of collaborative governance. Collaborative governance is useful because it explains how actors from different roles, institutions, and expertise areas work together through structured interaction, shared processes, facilitation, and outcome-oriented cooperation [2]–[4] . In the ToSMM project, this lens is relevant because the project involved students, academic staff, professional experts, MNMA, GIZ, and mining-related stakeholders.

Therefore, collaborative governance provides the main theoretical framework for this study. It allows the research to examine how collaboration was shaped by initial conditions, organized through institutional design, enacted through collaborative processes, supported by leadership and facilitation, and reflected in project outcomes. Because collaborative management is understood here as a structured process rather than a general idea of teamwork, it is necessary to identify the practical dimensions through which this process can be observed. The following section therefore presents the seven analytical dimensions used to examine collaboration in the ToSMM project.

2.3 Seven Key Dimensions of Collaboration in Research Projects

This study examines collaboration in the ToSMM project through seven analytical dimensions: communication, coordination, role clarity, participation and feedback, workflow continuity, mutual support, and collaborative learning. These dimensions connect the broader collaborative governance framework with observable project practices.

Communication refers to how clearly and regularly information was shared among project members. Coordination refers to how tasks, timelines, responsibilities, and outputs were

aligned. Role clarity refers to how clearly members understood their own responsibilities and the responsibilities of others.

Participation and feedback refer to opportunities for members to contribute ideas, join discussions, review work, and improve outputs through comments. Workflow continuity refers to the team's ability to maintain progress despite constraints or disruption. Mutual support refers to how members helped one another through advice, shared problem-solving, and practical support.

Collaborative learning refers to the knowledge and experience gained through working with people from different roles and expertise areas. In the ToSMM project, this includes learning among students, academic supervisors, professional experts, and stakeholders through meetings, feedback, field-related experience, and guidebook improvement.

Together, these seven dimensions provide the operational basis for analyzing collaboration as a practical research management process.

2.4 Types of Collaborative Management in Multidisciplinary Project Settings

In the ToSMM project, collaborative management appeared in four practical forms: team-based, participatory, cross-functional, and partly multi-stakeholder collaboration. These forms are not treated as separate theoretical categories in this thesis, but as practical ways in which collaboration was organized and experienced during project implementation.

The project was team-based because the internal team worked through regular meetings, task updates, shared responsibilities, and internal review. It was participatory because members contributed ideas, received feedback, and discussed project outputs. It was cross-functional because students, academic supervisors, lecturers, and professional experts worked together across different areas of expertise. It was also partly multi-stakeholder because the project involved external actors such as MNMA, GIZ, SRDF, and mining companies.

Therefore, the ToSMM project provides a useful case for examining how different forms of collaboration were combined within one research project. The focus of this thesis is not to classify collaboration types in detail, but to analyze how these collaborative practices supported project coordination, learning, feedback, and workflow continuity.

2.5 Previous Studies on Collaboration, Governance, and Project Execution

Existing literature on project management consistently emphasizes the importance of collaboration as a factor associated with project success. Communication, trust, and collaboration have been linked to project management success, while effective project work also depends on communication structures, coordination mechanisms, and collaboration across organizational and cultural boundaries [5,6]. These studies reinforce the idea that collaboration matters, but they often focus more on its importance than on how it operates as a structured day-to-day management process.

A more process-oriented perspective is offered by collaborative governance literature. Collaborative governance is commonly understood as a structured process in which actors from different organizations, roles, and sectors work together through dialogue, institutional design, facilitation, shared motivation, and outcome-oriented cooperation [2]–[4]. Bryson, Crosby, and Middleton Stone also emphasize that cross-sector collaboration requires careful structuring, active management of tensions, and attention to accountability and results [7]. These studies are important for this thesis because they show that collaboration should not be treated only as informal teamwork, but as an intentionally organized process.

Research on cross-boundary teaming adds another important insight. Diverse teams can generate stronger learning and innovation, but they also face practical challenges related to communication, coordination, and role ambiguity [8]. Similarly, collaboration can produce collaborative advantage only when actors sustain the difficult work of joint effort across boundaries [9]. These insights are particularly relevant for small multidisciplinary research teams like ToSMM, where collaboration depends not only on formal structure, but also on mutual support, repeated feedback, and learning across roles.

Taken together, previous studies suggest that collaboration is important, but they also indicate that it must be deliberately structured, supported, and sustained. This makes it necessary to examine not only whether collaboration was present in the ToSMM project, but how it was organized, enacted, and maintained in practice.

2.6 Research Gap in Small Multidisciplinary Research Project Collaboration

While existing literature emphasizes the importance of collaboration for project success, it remains unclear how collaborative practices function as structured management processes within small, bounded, multidisciplinary research teams [2]-[5]. Much of the literature focuses on large organizations, public-sector partnerships, cross-sector governance arrangements, or broad project environments. These studies provide useful theoretical insights, but they do not fully explain how collaboration is translated into everyday project routines such as task coordination, review meetings, feedback discussions, role clarification, workflow adjustment, and learning within a small research project team.

This gap is important because many research projects involve students, academic supervisors, professional experts, and external stakeholders working together under practical constraints. In such teams, collaboration is not only a general condition for success. It becomes a practical management mechanism through which members share information, coordinate tasks, clarify responsibilities, give and receive feedback, support one another, maintain workflow continuity, and learn across roles.

This study addresses the gap by analyzing the ToSMM project as a qualitative single case. It examines collaboration not only as a positive team value, but as a structured management

mechanism that connects formal project tools with adaptive implementation practices. In doing so, the study bridges the gap between abstract collaborative governance theory and day-to-day research project management practice.

The contribution of this study is therefore to show how collaborative governance can be operationalized through concrete analytical dimensions within a small-scale research project. By examining communication, coordination, role clarity, participation and feedback, workflow continuity, mutual support, and collaborative learning, the study explains how collaboration supported project implementation while also creating tensions such as hidden coordination costs, time pressure, and uneven participation.

2.7 Analytical Framework: Collaborative Governance and Project Management Theory

This study applies an analytical framework grounded in collaborative governance and supported by project management theory [1–4]. Collaboration is analyzed through five categories: initial conditions, institutional design, collaborative process, leadership and facilitation, and outcomes.

Initial conditions refer to the context in which collaboration begins, including team composition, stakeholder environment, available expertise, and external constraints. In the ToSMM project, this includes the 12-member multidisciplinary team and the project's dependence on stakeholders such as MNMA, GIZ, SRDF, and mining companies.

Institutional design refers to the formal structures that organize collaboration, including role allocation, communication planning, milestones, monitoring, reporting routines, and review procedures. In the ToSMM project, these were reflected in the WBS, project timeline, project documents, and meeting routines.

Collaborative process refers to the day-to-day interaction among participants. This includes communication, participation and feedback, mutual support, and collaborative learning. Leadership and facilitation refer to how collaboration is guided, monitored, and adjusted over time, especially when implementation conditions change.

Outcomes refer to the effects of collaboration on project implementation, including workflow continuity, guidebook improvement, collaborative learning, team building, and overall progress. Across these five categories, the seven analytical dimensions serve as the operational basis for analysis.

This framework connects the theoretical discussion in Chapter 2 with the case context, methodology, findings, and discussion chapters.

3. Case Context: The ToSMM Project

3.1 Overview of the ToSMM Project and Its Practical Context

The ToSMM project, short for Towards Sustainable Mining in Mongolia, is the case selected for this study. The project emerged in response to the need to adapt the Towards Sustainable Mining framework to the Mongolian mining context in a practical and locally relevant way. According to the Project Charter, mining companies in Mongolia face challenges in applying sustainable mining practices because structured frameworks such as TSM are not yet fully localized for national conditions.

The project was designed as a research and development initiative with applied outputs, including a localized guidebook, educational materials, and policy-related recommendations. It was supported by the Strategic Research Development Fund (SRDF) and the Mongolian National Mining Association (MNMA).

The ToSMM project is relevant to this thesis because it provides a real example of collaborative research project management. It involved a mixed team working through regular meetings, shared review, stakeholder interaction, and coordinated implementation under practical constraints.

3.2 Project Goal, Final Output, and Expected Deliverables

The main goal of the ToSMM project was to develop a localized, practical, and standardized TSM Mongolia Guidebook for engineers and mining professionals. According to the Project Charter, the guidebook was intended to support the consistent adoption of the TSM framework across Mongolian mining companies.

The guidebook was designed as a digital and user-friendly resource written in clear Mongolian. It was expected to include protocol overviews, roles and responsibilities, documentation and evidence, step-by-step guidance, and possible implementation challenges.

In addition to the guidebook, the project included two other expected deliverables: a TSM-based Sustainability in Mining Operations module for engineering students and research and policy recommendations. These outputs show that the project combined practical, educational, and policy-oriented objectives within one research process.

3.3 Team Composition, Expertise, and Role Distribution

The ToSMM project was implemented by a 12-member multidisciplinary team that included professors, lecturers, senior university students, and industry professionals. This composition is important because the project required different forms of knowledge, experience, and responsibility to be integrated within one project structure. The team was not made up of members with the same background; instead, it combined academic, student, professional, and coordination-related roles.

Academic staff contributed conceptual guidance, research supervision, and review of project outputs. Student members supported research, drafting, documentation, and coordination-related activities. Industry professionals contributed applied knowledge, practical experience, and protocol-specific expertise related to mining practice. This role diversity made the ToSMM project a suitable case for examining collaborative research management because collaboration was necessary for connecting different types of expertise into one shared output.

The team structure also reflected task specialization. Responsibility for different TSM protocols was distributed among team members according to their backgrounds and expertise. This helped members focus on specific areas while still contributing to the broader guidebook development process. At the same time, protocol-based work required coordination because individual sections had to be reviewed, aligned, and integrated into one consistent guidebook.

The Work Breakdown Structure shows that role clarity was planned from the beginning through project objectives, scope definition, role assignment, communication planning, timelines, and milestones. This indicates that the team worked within a structured management arrangement rather than through informal cooperation alone. Therefore, the team composition supports the relevance of this case for studying communication, coordination, role clarity, mutual support, and collaborative learning in a small multidisciplinary research project.

3.4 Project Workflow, Milestones, and Formal Management Structure

The ToSMM project was organized through a formal workflow that included task planning, role allocation, timeline development, document preparation, guidebook drafting, review, and final submission. This structure helped the team understand the sequence of work and how individual responsibilities connected to the broader project process.

At the beginning, the workflow followed a more waterfall-style structure because tasks and milestones were planned in sequence. During the guidebook development stage, the process became more iterative and closer to a human-in-the-loop (HIL) style working process. In this thesis, HIL refers to a working mode in which human review, feedback, monitoring, and repeated improvement are continuously included in the development process.

This iterative stage was necessary because the guidebook required repeated discussion, terminology review, practical feedback, and revision. Later, when the guidebook structure became clearer, the workflow became more stable and returned to a more sequential process focused on final editing, review, and submission.

In this way, the ToSMM project can be understood as a mixed workflow that combined formal planning with adaptive improvement.

3.5 Weekly Collaboration Routine and Internal Working Process

A central feature of the ToSMM project was its weekly collaboration routine. The team met regularly to share progress, discuss ongoing tasks, exchange ideas, and improve outputs through feedback. This practice is especially important for the present study because it illustrates how collaboration was embedded in the project's everyday working process rather than treated as a secondary or informal activity.

The interim report provides strong documentary support for this routine by stating that the team had already conducted 12 structured working meetings, held on a weekly basis, by the end of 2025. These meetings enabled continuous coordination, joint problem-solving, and timely decision-making, while also helping maintain alignment among academic, industry, and development perspectives throughout the project lifecycle (Interim Report, 2025).

The collaborative routine is also visible in the WBS, which includes regular team meetings, internal discussion, internal peer-review sessions, consultation on drafts, progress reporting, review of internal task completion, and a closing and reflection meeting. The WBS is included as a visual supporting document in Appendix E. Together, these routines show that collaboration in the project operated through repeated interaction, monitoring, and review, rather than through one-time coordination.

3.6 Stakeholder Environment, Constraints, and External Dependencies

The ToSMM project operated within a broader stakeholder environment that included GMIT, GIZ, SRDF, MNMA, and mining companies. SRDF and MNMA were especially important as funding and support actors, while mining companies represented the practical users of the guidebook.

The stakeholder environment supported the practical relevance of the project. MNMA provided industry input, review support, and access to mining-sector networks, while GIZ contributed coordination and mentoring support. Mining companies were also important because the guidebook was intended for use by mining professionals implementing TSM in practice.

At the same time, the project faced external constraints. The Project Charter identifies risks such as delays in data collection, timeline slippage, and dependence on stakeholder cooperation and site access. Field-related activities and feedback processes also depended on external schedules. These conditions make ToSMM useful for examining how collaboration supported workflow continuity under practical constraints.

3.7 Why ToSMM Is a Suitable Case for This Study

The ToSMM project is a suitable case for this thesis because it provides a bounded and document-rich example of collaborative research project management. The project has a clearly defined team, timeframe, management structure, stakeholder environment, and expected outputs. These boundaries make it possible to examine collaboration within a specific project setting rather than in a broad or abstract way. The availability of project documents, including the Project Charter, Work Breakdown Structure, and implementation records, also allows the study to compare planned collaboration with actual implementation.

The case is especially relevant because the ToSMM project was based on multi-sided collaboration. It involved students, academic supervisors, lecturers, professional experts, partner organizations, and mining-related stakeholders. These participants brought different educational backgrounds, professional experiences, and areas of expertise into one shared research project. For this reason, the project provides a useful setting for examining how collaboration works when different roles and knowledge areas must be coordinated toward one output.

Another reason why this case is suitable is that collaboration was not only planned formally, but also practiced regularly. Weekly meetings, feedback discussions, guidebook review, field-related interaction, and stakeholder communication created repeated opportunities for communication, coordination, team building, mutual support, and collaborative learning. This makes the case useful for studying collaboration as an active research management process rather than only as a general team value.

The ToSMM project also fits the analytical framework of this study. It includes identifiable initial conditions, formal institutional design, recurring collaborative processes, facilitation through coordination and monitoring, and observable outcomes such as guidebook development, stakeholder engagement, workflow continuity, team building, and collaborative learning. For these reasons, ToSMM provides an appropriate and meaningful case for examining how collaborative management functions in practice.

4. Methodology

4.1 Research Design and Methodological Approach

This study adopts a qualitative single-case study design, guided by an interpretivist approach. This design is appropriate because the research aims to examine how collaboration was experienced and practiced within one bounded project setting rather than to generate broad statistical generalizations. The ToSMM project is treated as a single case because it has a clearly defined team, timeframe, management structure, stakeholder environment, and expected outputs.

A qualitative approach is suitable because the study focuses on meaning, experience, process, and context. Collaboration is examined not only as a formal management structure, but also as a social and practical process shaped by communication, coordination, feedback, mutual support, learning, and adaptation. Since the ToSMM project involved students, academic supervisors, lecturers, professional contributors, and external stakeholders, different participants may have experienced collaboration in different ways.

The interpretivist perspective allows the study to understand these experiences and connect them with project documents and implementation evidence. Therefore, the research does not rely only

on subjective accounts, but compares participant perspectives with formal project design and observable project progress. This design creates a direct link between the analytical framework developed in Chapter 2 and the empirical case examined in Chapters 5 and 6.

4.2 Researcher Positionality

The researcher was directly involved in the ToSMM project as a Project Management Assistant. This creates an insider-researcher position, meaning that the researcher had direct familiarity with the project's meetings, communication routines, coordination practices, documentation, and implementation challenges.

This position provides useful contextual knowledge because it allows the researcher to understand the project process closely. It also supports the interpretation of project documents and participant responses because the researcher is familiar with the project environment, terminology, and workflow. However, this position also creates a risk of subjectivity and over-familiarity. Certain practices may appear normal to the researcher and may therefore require careful reflection during analysis.

To reduce this risk, the study does not rely only on the researcher's own experience. Instead, it uses multiple sources of evidence, including survey responses, interviews, document review, and descriptive project evidence. The findings are also interpreted through the analytical framework developed in Chapter 2. In this way, the insider position is treated as both a strength and a limitation.

This positionality shaped the researcher's access to the project context, but the empirical analysis is based on participant responses, project documents, and descriptive project evidence rather than personal experience alone. The insider position is therefore treated reflexively. It provides contextual depth, but it also requires caution in interpretation. To strengthen validity, the study compares survey patterns, interview explanations, project documents, and implementation evidence through triangulation. This allows the study to produce valid case-based knowledge by explaining how collaboration worked within a bounded project setting, rather than by claiming detached or statistically generalizable findings.

4.3 Participants and Unit of Analysis

The primary unit of analysis in this study is the internal collaborative process of the ToSMM project team. The study focuses on how collaboration functioned during project implementation rather than on the technical quality of the guidebook itself or the broader long-term policy impact of TSM in Mongolia.

The participants are members of the ToSMM project team who were directly involved in project activities such as meetings, drafting, communication, review, coordination, feedback, and stakeholder-related work. The team included students, academic supervisors, lecturers, professional experts, and coordination-related members. This mixed composition is important because the study examines how collaboration worked among people with different educational backgrounds, expertise areas, and project responsibilities.

The internal project team is the main focus because these members were directly involved in the day-to-day collaborative process. External stakeholders such as MNMA, GIZ, SRDF, and mining companies are considered as part of the project context, especially where they influenced stakeholder coordination, feedback, field-related activities, or implementation constraints. However, they are not the main unit of analysis.

For the survey component, all 12 internal team members were invited to participate because the team is small and each member has relevant experience with the collaborative process. A total of 10 valid survey responses were received. For the interview component, five participants were selected for follow-up semi-structured interviews in order to explore the survey patterns in greater depth. These participants represented different project roles, including student members, a professional contributor, and an academic participant.

Because the internal project team was small and directly involved in the collaborative process, the study used purposive sampling to select relevant participants. The sampling strategy is explained in the next section.

4.4 Sampling Strategy

This study uses purposive sampling. Purposive sampling is appropriate because participants are selected based on their direct involvement in the ToSMM project and their ability to provide

relevant information about collaboration, coordination, feedback, role clarity, mutual support, learning, and project implementation.

For the survey, all 12 internal team members are invited to participate because the team is small and each member has direct experience with the collaborative process. This full-team approach is suitable because the purpose of the survey is not statistical generalization, but a descriptive overview of collaboration within the project team.

For the interviews, selected participants are chosen from different project roles, including students, academic supervisors, professional contributors, and coordination-related roles. This helps the study capture different perspectives while remaining feasible within the scope of a bachelor thesis. The aim is not to create a statistically representative sample, but to include participants who can explain how collaboration functioned in practice.

After identifying the relevant participants, the study used several data sources to examine collaboration from both formal and experiential perspectives. The next section explains the data collection methods.

4.5 Data Collection Methods

This study uses four sources of data: survey responses, semi-structured interviews, document review, and descriptive project evidence. These sources were selected because collaboration in the ToSMM project had both formal and experiential dimensions. Project documents show how collaboration was planned, while surveys and interviews show how collaboration was experienced by participants.

The survey was used to identify broad patterns across the seven analytical dimensions. Interviews were then used to explain these patterns in greater depth. Project documents and descriptive evidence were reviewed to connect participant perceptions with the formal project structure and actual implementation process.

Using these four sources allowed the study to compare planned collaboration, experienced collaboration, and observable project progress.

4.5.1 Survey of Project Team Members

The survey was used to identify general patterns in how collaboration was experienced across the ToSMM project team. Because the internal project team consisted of 12 members, the survey was distributed to all team members through Google Forms. A total of 10 valid responses were received.

The questionnaire included background questions, scaled items, and three open-ended questions presented in Appendix . The scaled items were organized around the seven analytical dimensions: communication, coordination, role clarity, participation and feedback, workflow continuity, mutual support, and collaborative learning. Additional items related to leadership and overall collaboration effectiveness were included to support the broader collaborative governance framework.

Since the team is small, the survey results are interpreted descriptively and cautiously rather than statistically.

4.5.2 Semi-Structured Interviews with Selected Participants

Semi-structured interviews were conducted after the survey to explain the survey patterns in greater depth. Five participants were selected from different project roles, including student members, a professional contributor, and an academic participant. This helped capture different perspectives within the multidisciplinary project team.

The interview guide was organized around the seven analytical dimensions and included questions about communication, coordination, role clarity, feedback, workflow continuity, mutual support, collaborative learning, team building, external delays, and future recommendations The semi-structured interview guide is presented in Appendix B. The interviews explored both positive and challenging aspects of collaboration.

4.5.3 Document Review and Descriptive Project Evidence

Document review was used to examine the formal design and implementation record of the ToSMM project. The main documents included the Bachelor Thesis Assignment Sheet, Project Charter, Work Breakdown Structure, and interim report. The internal project documents reviewed for this thesis are summarized in Appendix E. These documents provided evidence of project goals, role allocation, milestones, communication routines, review processes, stakeholder involvement, and implementation constraints.

Descriptive project evidence included milestone progress, guidebook drafting, workshops, field visits, stakeholder presentations, weekly meetings, internal review, and feedback discussions. This evidence helped connect collaboration to visible project progress and allowed the study to compare planned collaboration with actual implementation.

4.6 Data Analysis Procedures

The data analysis is guided by the analytical framework developed in Chapter 2. Survey data are analyzed descriptively, interview data are analyzed thematically, and project documents are reviewed in relation to the seven analytical dimensions and five collaborative governance categories.

The analysis follows three steps. First, survey responses and project documents are used to identify broad patterns of collaboration. Second, interview data are used to explain these patterns through participant experience and examples. Third, findings from all data sources are compared through triangulation in order to develop a balanced interpretation of how collaboration functioned in the ToSMM project.

4.6.1 Descriptive Analysis of Survey Data

Survey data are analyzed descriptively. The analysis focuses on simple frequencies, percentages, and average scores for each analytical dimension. The survey analysis is based on 10 valid responses from the 12 internal project team members and is used to identify broad patterns rather than to make statistical generalizations.

For each dimension, an average score is calculated by adding the scores of all Likert-scale items under the same dimension and dividing the total by the number of items in that dimension.

The survey results are used as descriptive indicators. These patterns are then explored through interviews and compared with project documents and descriptive project evidence through triangulation. The survey data handling and interpretation procedure is summarized in Appendix C.

Dimension Average Score = Σ item scores / n

where **Σ item scores** refers to the total score of all Likert-scale items under one dimension, and **n** refers to the number of items included in that dimension.

The scaled items use a five-point Likert scale:

1 = Strongly disagree
2 = Disagree
3 = Neutral
4 = Agree
5 = Strongly agree

To make interpretation systematic, average scores are classified into three categories.

Table 1 Collaboration Dimension Interpretation Criteria

Average Score Range	Interpretation	Meaning
3.50-5.00	Strong / Positive	Respondents generally agreed with the statements. This indicates that the dimension was experienced positively and functioned as a strength of collaboration.
2.50-3.49	Moderate / Mixed	Responses were mixed or neutral. This indicates that the dimension was present, but not consistently experienced as strong by all respondents.
1.00-2.49	Weak / Needs Improvement	Respondents generally disagreed with the statements. This indicates that the dimension may represent a challenge or an area requiring improvement.

A score of 3.50 or higher is interpreted as a positive perception of the dimension. A score between 2.50 and 3.49 is interpreted as mixed or moderate. A score below 2.50 is interpreted as weak and may indicate a collaboration-related challenge.

Some negatively worded items are reverse-coded before calculating the dimension average. Reverse coding is applied using the following formula:

Reverse-coded score = 6 − original score

This ensures that higher scores consistently represent a more positive evaluation of collaboration across all survey items.

The survey results are used as descriptive indicators. These patterns are then explored through interviews and compared with project documents and descriptive project evidence through triangulation.

4.6.2 Thematic Analysis of Interview Data

Interview data were analyzed using thematic analysis. The purpose was to explain the survey patterns in greater depth and identify why participants experienced certain dimensions as strong, mixed, or challenging.

The analysis followed the general logic of Braun and Clarke's thematic analysis approach [10]. Interview notes or transcripts were reviewed, meaningful statements were coded, and similar codes were grouped into themes connected to the seven analytical dimensions. Examples of codes included communication routines, coordination practices, role clarity, feedback, mutual support, collaborative learning, team building, and responses to delay.

The final themes were reviewed together with survey results, project documents, and descriptive project evidence. This helped ensure that the interpretation was not based only on individual opinions, but connected to the wider project structure and implementation process.

The final themes were reviewed together with survey results, project documents, and descriptive project evidence. This helped ensure that the interpretation was not based only on individual opinions, but connected to the wider project structure and implementation process. The interview evidence handling and anonymization procedure is summarized in Appendix D.

4.6.3 Triangulation Across Data Sources

After the survey and interview analysis, the study uses triangulation across data sources. Triangulation means comparing survey responses, interview data, project documents, and descriptive project evidence in order to develop a balanced interpretation of collaboration in the ToSMM project.

Each source provides a different type of evidence. Survey responses show broad patterns, interviews explain the meaning behind those patterns, project documents show how collaboration was formally planned, and descriptive project evidence shows how collaboration appeared in implementation.

Table 2. Triangulation Across Data Sources

Data Source	Role in Analysis	Example of Use
Survey responses	Identify broad patterns across the project team.	Shows whether dimensions such as communication, coordination, role clarity, participation and feedback, workflow continuity, mutual support, or collaborative learning were experienced as strong, mixed, or weak.
Interview data	Explain the meaning behind survey patterns.	Explains why participants experienced weekly meetings, feedback, role distribution, support, learning, or project delays in a certain way.
Project documents	Show how collaboration was formally planned.	Provides evidence from the WBS, project plan, role allocation, communication planning, meeting routines, milestones, and review structures.
Descriptive project evidence	Show how collaboration appeared in actual implementation.	Provides evidence from weekly meetings, guidebook drafting, internal review, feedback discussions, stakeholder communication, field-related planning, and milestone progress.

For example, if the survey results show a strong score for communication, this result is compared with interview explanations and project documents showing regular meetings and communication

routines. If the survey results show a mixed score for role clarity, this is compared with interview comments about how responsibilities were understood or clarified during the project. Similarly, if workflow continuity is evaluated positively, this is compared with evidence showing how the team continued guidebook development, terminology refinement, or internal review when some field-related activities were delayed.

Through triangulation, the study avoids relying only on numerical survey results or only on personal interview accounts. Instead, it connects participant perceptions, qualitative explanations, and project evidence. This supports a more credible and evidence-based analysis of how collaborative management functioned in the ToSMM project.

The combined analysis of survey results, interview themes, and project evidence forms the basis for the findings presented in Chapter 5.

4.7 Trustworthiness of the Study

Trustworthiness is addressed through credibility, transferability, dependability, and confirmability. Credibility is supported by using multiple data sources, including survey responses, interviews, project documents, and descriptive project evidence. This reduces the risk of relying on only one type of evidence.

Transferability is supported by providing a clear description of the ToSMM project context, team structure, stakeholder environment, workflow, and implementation conditions. Dependability is strengthened by explaining the research design, sampling approach, data collection methods, and analysis procedures. Confirmability is supported by grounding the interpretation in participant responses and project evidence rather than relying only on the researcher's own experience.

Because the researcher was directly involved in the ToSMM project, the insider position is acknowledged as part of the study's reflexive approach. Triangulation and the analytical framework are used to reduce possible bias and connect findings clearly to the evidence.

4.8 Ethical Considerations

Ethical considerations are important because the study involves project participants and project-related information. Participants were informed about the purpose of the study, the voluntary nature of participation, and the academic use of the data before taking part.

Survey and interview responses are treated confidentially. The study avoids unnecessary identification of individual participants, especially because the ToSMM team is small and some members may be identifiable through their roles or expertise.

Project documents and internal materials are used only for thesis analysis and not to evaluate individual performance. Overall, the study follows ethical principles of informed consent, voluntary participation, confidentiality, responsible data use, and respectful representation of participant views.

4.9 Methodological Limitations

This study has several methodological limitations. First, it is based on a single case, so the findings are not intended for broad statistical generalization. The purpose of the study is not to claim that all multidisciplinary research projects function in the same way. Instead, the purpose is to develop an analytical understanding of how collaboration operated within one bounded project setting.

Second, the project team is small. Although 10 valid survey responses were received from the 12 internal team members, the survey results are interpreted descriptively rather than inferentially. The value of the survey lies in identifying broad patterns across the project team, not in producing statistically generalizable results. The small team size also allows the study to examine interaction, coordination, learning, and workflow adjustment in greater contextual depth.

Third, the interview sample is limited to five selected participants. These interviews provide useful qualitative insight, but they cannot represent every individual experience in the project team. For this reason, interview findings are not treated as standalone evidence. They are interpreted together with survey results, project documents, and descriptive project evidence.

Fourth, the researcher’s insider position may create a risk of subjectivity. The researcher’s involvement provided useful contextual knowledge, but it also required reflexive caution. To reduce this risk, the study uses multiple data sources, triangulation, and the analytical framework developed in Chapter 2. The analysis is therefore grounded in participant responses and project evidence rather than personal experience alone.

Finally, the findings reflect the ToSMM project during a specific period of implementation. Stakeholder availability, field-related scheduling, administrative conditions, and the stage of guidebook development may also have influenced the project process.

Despite these limitations, the study provides valid analytical knowledge because it explains how collaboration functioned as a management mechanism within a real project setting. Its strength lies in contextual depth rather than numerical breadth. The case is used not for statistical generalization, but for analytical generalization: to show how collaboration can support

coordination, learning, and workflow continuity in small multidisciplinary research projects while also creating tensions that must be actively managed.

5. Findings

5.1 Overview of the Evidence Base

This chapter presents the findings of the study based on survey responses, semi-structured interviews, project document review, and descriptive project evidence. The findings are organized according to the seven analytical dimensions developed in Chapter 2: communication, coordination, role clarity, participation and feedback, workflow continuity, mutual support, and collaborative learning.

The survey results provide a descriptive overview of how collaboration was experienced across the project team, while the survey instrument and data handling procedure are presented in Appendices A and C. The interviews explain these patterns through participant experiences and examples. Project documents and descriptive evidence are used to connect participant views with the formal project structure and actual implementation process.

Table 3 presents the descriptive survey results by analytical dimension.

Analytical Dimension	Average Score	Interpretation	Main Pattern
Communication	4.31	Strong / Positive	Communication was generally experienced as clear, regular,

			and useful for project progress.
Coordination	4.44	Strong / Positive	Task alignment and connection between members' work were evaluated positively.
Role Clarity	4.74	Strong / Positive	Participants generally understood their own roles and the responsibilities of others.
Participation and Feedback	4.44	Strong / Positive	Participants generally felt able to contribute, receive feedback, and take part in review processes.
Workflow Continuity	4.56	Strong / Positive	The team was able to maintain progress despite delays and external constraints.
Mutual Support	4.58	Strong / Positive	Team members generally felt supported and shared responsibility for progress.
Collaborative Learning	4.85	Strong / Positive	Collaborative learning was the strongest dimension, showing strong knowledge exchange across roles.

While all seven dimensions were evaluated positively, this pattern should be interpreted cautiously. The high scores may reflect the small team context, shared project commitment, and the researcher's insider position. Therefore, the survey results are not treated as proof of perfect collaboration. Instead, they are used as descriptive indicators that require further interpretation through interview findings, open-ended responses, project documents, and triangulation.

The results show that all seven dimensions fall within the strong / positive range according to the interpretation criteria presented in Chapter 4. Collaborative learning received the highest average score, followed by role clarity, mutual support, and workflow continuity. This suggests that

respondents generally experienced the ToSMM project as a collaborative research environment where members could learn from one another, understand responsibilities, support each other, and maintain progress under changing conditions.

These results are interpreted descriptively rather than statistically because the project team is small. The survey findings are therefore used as broad indicators of participant experience and are further explained through interview data, open-ended survey responses, project documents, and descriptive project evidence.

5.2 Communication Practices in the ToSMM Project

The communication dimension received an average score of 4.31, which falls within the strong / positive range. This suggests that respondents generally experienced communication as clear, regular, and useful for project progress. Weekly meetings were especially important because they helped members stay informed, discuss problems, receive feedback, and clarify next steps.

The interview data explain that communication became more open over time. At the beginning, some participants described the communication atmosphere as formal because team members did not know one another well. However, repeated meetings, feedback discussions, and field-related interaction helped members become more comfortable and communicate more

openly. Some challenges remained, especially in relation to online communication and occasional unclear instructions.

Overall, communication functioned as a foundation for other dimensions of collaboration. It supported coordination, feedback, role clarification, and shared understanding. This shows that communication was not only an informal exchange of information, but a practical management routine that helped the team sustain collaborative work.

5.3 Coordination Mechanisms and Task Alignment

The coordination dimension received an average score of 4.44, which falls within the strong / positive range. This indicates that respondents generally experienced project coordination positively. Participants especially understood how their own work connected to the work of others, which suggests that individual tasks were linked to the broader project workflow.

Coordination was supported by weekly meetings, protocol-based task division, and formal project tools such as the WBS and project plan. Interview responses show that weekly meetings created a regular cycle of task assignment, reporting, feedback, and adjustment. These routines helped the team maintain progress without needing constant daily coordination.

However, coordination also involved challenges related to time and scheduling. Because the project included students, academic staff, professional contributors, and external stakeholders, aligning everyone's availability was sometimes difficult. Therefore, coordination in the ToSMM project can be understood as both a formal planning process and an ongoing adjustment process.

5.4 Role Clarity and Distribution of Responsibilities

Role clarity was one of the strongest survey dimensions, with an average score of 4.74. This indicates that participants generally understood their own responsibilities and the responsibilities of other team members. This was important because the project involved people with different roles, expertise areas, and levels of experience.

Interview responses suggest that role clarity was supported by protocol-based task allocation and project documents such as the WBS and Project Charter. These tools helped members understand the overall project structure and their specific contribution to the guidebook development process.

At the same time, role clarity also developed during implementation. Some participants explained that their understanding became clearer as individual protocol work was connected with guidebook drafting, stakeholder feedback, and team review. This shows that role clarity was supported by both formal task allocation and ongoing collaborative interaction.

5.5 Participation, Feedback, and Inclusive Contribution

The participation and feedback dimension received an average score of 4.44, which falls within the strong / positive range. This suggests that respondents generally felt able to participate, share ideas, receive feedback, and contribute to project improvement.

The interview data show that feedback was especially important for guidebook development. Weekly meetings, internal review, and peer discussion allowed members to improve their work

through repeated comments and revision. Some participants noted that feedback was difficult to receive at first, but later became useful because it improved the quality and practicality of the output.

However, participation was not experienced equally by all members. Confidence, experience, personality, and role differences influenced how actively some participants contributed. This suggests that participation existed, but future projects may need more deliberate facilitation to support quieter or less experienced members.

5.6 Workflow Continuity Under External Disruption

The workflow continuity dimension received an average score of 4.56, which falls within the strong / positive range. This suggests that respondents generally perceived the project as able to maintain progress despite external delays or changing conditions.

Interview data strongly support this finding. Participants explained that field-related activities and stakeholder-dependent tasks sometimes faced delays. However, the team continued internal work such as guidebook drafting, terminology refinement, internal review, feedback integration, and preparation activities. Weekly meetings and monitoring helped the team identify which tasks could still move forward.

This finding shows that workflow continuity was maintained not only through the original plan, but also through adaptive coordination. The project moved from a more sequential early workflow into a more iterative guidebook improvement stage, and later returned to a more structured finalization process. This flexibility helped the team sustain progress under disruption.

5.7 Mutual Support Within the Project Team

The mutual support dimension received an average score of 4.58, which falls within the strong / positive range. This indicates that respondents generally felt supported by other team members and perceived a sense of shared responsibility within the team.

Interview responses show that mutual support developed gradually. At the beginning, some participants described the team atmosphere as formal because members did not know one

another well. Over time, repeated meetings, feedback discussions, shared work, and field-related interaction helped the team become more comfortable and supportive.

Mutual support was visible through asking questions, receiving advice, sharing professional experience, and helping one another understand project tasks. This shows that team building

was not only a separate activity, but developed through the regular collaborative routines of the project.

5.8 Collaborative Learning Across Roles and Expertise

Collaborative learning was the strongest survey dimension, with an average score of 4.85. This indicates that participants strongly agreed that the project created opportunities for learning, knowledge exchange, and broader understanding.

The interview data show that learning occurred across different roles and expertise areas. Students learned from academic supervisors and professional experts, while experienced members also recognized the contribution, responsibility, and task focus of student participants. Participants described learning not only technical knowledge, but also communication, teamwork, responsibility, confidence, and the ability to give and receive feedback.

Collaborative learning was therefore both a process and an outcome of the ToSMM project. It occurred through weekly meetings, feedback, guidebook review, stakeholder interaction, and field-related activities. This supports the argument that the ToSMM case is suitable for studying collaborative research management because collaboration created practical learning opportunities across different roles and backgrounds.

5.9 Cross-Cutting Insights from Open-Ended Survey Responses

These questions asked participants to describe: [1] the strongest aspects of internal collaboration, [2] the main challenge related to collaboration, and [3] what should be improved in future similar projects.

Table 4. Summary of Open-Ended Survey Responses.

Open-Ended Question	Main Themes Identified	Link to Analytical Dimension
What were the strongest aspects of internal collaboration in the ToSMM project?	Knowledge sharing, learning from others, open communication, mutual support, team diversity, and positive team atmosphere.	Communication; mutual support; collaborative learning; participation and feedback
What was the main challenge related to collaboration?	Time and scheduling difficulties, different availability of members, external delays, and coordination challenges.	Coordination; workflow continuity; participation and feedback
What should be improved in future similar projects?	Clearer time planning, more structured meetings, stronger coordination, clearer task distribution, and better preparation for external delays.	Coordination; role clarity; workflow continuity; institutional design

As shown in Table 4, the open-ended responses support the main patterns identified through the scaled survey items. The strongest aspects of collaboration were connected to knowledge sharing, open communication, mutual support, and learning from people with different educational and professional backgrounds. This supports the strong survey results related to collaborative learning, mutual support, and communication. It also shows that collaboration was not limited to task completion, but included learning, discussion, feedback, and shared improvement.

The main challenge identified in the open-ended responses was time and scheduling. Because the project involved students, academic supervisors, professional experts, and external stakeholders, it was sometimes difficult to organize meetings or ensure equal participation from all members. The weekly meeting routine supported coordination and helped the team maintain progress, but it also created pressure for some members because they were involved in other projects, academic work, professional responsibilities, or personal schedules at the same time. Some responses also pointed to external delays and stakeholder-dependent activities, especially in relation to field-related work. This shows that collaboration carried hidden coordination costs. Effective collaboration did not remove complexity from the project; rather, it required continuous effort to manage different schedules, workloads, expectations, and external dependencies.

For future similar projects, participants suggested clearer time planning, more regular and structured meetings, stronger coordination, clearer task distribution, better preparation for delays caused by external actors, and stronger early-stage team-building activities. These suggestions show that although collaboration was generally experienced positively, future projects could benefit from stronger planning and more systematic coordination.

Overall, the open-ended responses show that the strongest aspects of collaboration were knowledge sharing, mutual support, team diversity, and open communication, while the main challenges were related to time coordination, external dependency, and maintaining consistent participation. These insights provide additional context for interpreting the seven analytical dimensions and help connect the survey findings with the interview analysis.

5.10 Summary of Empirical Findings

The previous sections presented the findings according to the seven analytical dimensions of the study. To bring these findings together, this section summarizes the main empirical patterns from the survey, interviews, open-ended responses, and project evidence. Table 5 provides a concise overview of the main interview themes that help explain the survey findings.

Table 5. Main Interview Themes by Analytical Dimension.

Analytical Dimension	Main Interview Theme	Interview Evidence Summary
Communication	Communication became more open over time, but not equally for everyone	Some participants felt that the team atmosphere was open from the beginning, while others experienced communication as more formal at first. Repeated meetings, feedback discussions, and field-related interaction helped communication become more open over time.
Coordination	Weekly meetings supported alignment but also created coordination pressure	Participants described weekly meetings as useful for task alignment, feedback, and progress monitoring. However, some participants also felt that weekly meetings were demanding because they had to balance the

		project with other academic, professional, or project-related responsibilities.
Role Clarity	Roles were mostly clear, but understanding deepened during implementation	Participants generally understood their own responsibilities because protocols and tasks were divided clearly. However, some role understanding became clearer as the project progressed.
Participation and Feedback	Feedback improved work quality, but participation was not always equal	Participants described feedback, internal review, and peer discussion as useful for improving the guidebook. However, differences in confidence, role, experience, and availability influenced how actively members participated.
Workflow Continuity	The team continued internal work during external delays	Participants explained that even when field-related activities or stakeholder-dependent work were delayed, the team continued guidebook drafting, review, preparation, and internal tasks.
Mutual Support and Team Building	Support and team atmosphere strengthened over time	Participants noted that the team became more comfortable and supportive over time. Weekly meetings, feedback discussions, and on-site activities helped build stronger team relationships.
Collaborative Learning	Learning was reciprocal across roles	Students learned from professors, academic supervisors, and professional experts through feedback and guidance. At the same time, professional and academic members recognized the effort, motivation, and responsibility of student members, showing that learning and respect developed in both directions.

Although the overall findings were positive, the interview data show that collaboration was not experienced in the same way by all participants. Weekly meetings were valued because they

helped the team stay informed, coordinate tasks, receive feedback, and maintain progress. However, some participants also felt that meeting every week became demanding because they were balancing the ToSMM project with other projects, academic work, professional responsibilities, and personal schedules. This shows that weekly meetings supported coordination, but also created hidden coordination costs for some members.

The interviews also show that openness developed unevenly. Some participants felt that the team atmosphere was open from the beginning, while others experienced communication as more formal at first. Over time, repeated meetings, feedback discussions, and field-related interaction helped communication become more open. This suggests that collaboration was not automatic; it developed through repeated interaction and growing familiarity.

The findings also show that collaborative learning worked in two directions. Students learned from professors, academic supervisors, and professional experts through feedback, review, and guidance. At the same time, professional and academic participants recognized the effort, responsibility, and motivation of student members. This suggests that collaborative learning was not only a one-way transfer of knowledge from senior members to students, but also a reciprocal process that supported mutual respect and motivation.

The findings presented in this chapter show that collaboration in the ToSMM project functioned as a structured management process rather than as an informal background condition. The survey results showed generally positive perceptions across the seven analytical dimensions, while the interview data explained how these dimensions were experienced in practice.

The strongest finding was collaborative learning. Both survey and interview evidence show that the project created opportunities for members to learn from different educational backgrounds, professional experiences, and areas of expertise. Role clarity, mutual support, and workflow continuity also appeared as strong dimensions. Responsibilities were generally clear because tasks were divided by protocols and supported by project tools such as the WBS and Project Charter. Workflow continuity was maintained because the team continued internal work even when field-related or stakeholder-dependent activities were delayed.

At the same time, the findings should not be read as evidence of problem-free collaboration. The project also involved tensions related to time coordination, uneven participation, online communication, leadership-related decision pressure, and dependence on external stakeholders. These tensions are important because they show that collaboration was not automatically

effective. It had to be actively maintained through meetings, feedback, monitoring, and task adjustment.

Overall, the findings suggest that the ToSMM project combined formal project management structures with collaborative routines that supported communication, learning, team building, and workflow continuity. These empirical findings provide the basis for the discussion chapter, where the ToSMM case is interpreted through the five collaborative governance categories: initial conditions, institutional design, collaborative process, leadership and facilitation, and outcomes.

6. Discussion

6.1 Overview of the Discussion

This chapter discusses the findings of the study in relation to the analytical framework developed in Chapter 2 [1,2,4]. While Chapter 5 presented the empirical findings according to the seven analytical dimensions, this chapter interprets those findings through the five broader categories of collaborative governance: initial conditions, institutional design, collaborative process, leadership and facilitation, and outcomes. Project management theory is also used to explain how coordination, role clarity, workflow continuity, monitoring, and adaptation supported the management of the ToSMM project.

The main argument of this chapter is that collaboration in the ToSMM project functioned as a structured research management system rather than as an informal team characteristic. Collaboration enabled the integration of formal project structures with adaptive coordination. Through role allocation, weekly meetings, feedback routines, mutual support, and task adjustment, the team was able to maintain progress, manage uncertainty, and generate both project outputs and learning outcomes.

However, the discussion also shows that collaboration was not automatically smooth or equally experienced by all members. The same practices that supported coordination, such as weekly meetings and feedback routines, also created pressure for some participants because of workload, scheduling conflicts, and differences in confidence or experience. Therefore, the value of collaboration in the ToSMM project lies not in the absence of difficulty, but in the team’s ability to manage these tensions through structure, communication, and adjustment.

The ToSMM case is especially useful for discussion because it involved a mixed team of students, academic supervisors, lecturers, professional contributors, and external stakeholders. The project also included practical outputs, such as guidebook development, stakeholder communication, field-related activities, and internal review. These features make it possible to examine collaboration not only as a positive team atmosphere, but as a practical management approach that supported research project implementation.

6.2 Initial Conditions: Multidisciplinary Team and Stakeholder Context

The first collaborative governance category is initial conditions [2][,4]. In this study, initial conditions refer to the starting context of the ToSMM project, including team composition, stakeholder environment, available expertise, and external constraints. The findings show that the ToSMM project began with both opportunities and challenges for collaboration.

One important initial condition was the multidisciplinary nature of the project team. The project included people with different educational backgrounds, professional experiences, and areas of expertise. This created a strong foundation for collaborative learning because team members were able to learn from one another and approach the project from different perspectives. The strong survey results for collaborative learning and the interview findings both support this interpretation.

However, this diversity also created a need for stronger research management. Because members had different roles, responsibilities, work styles, and levels of experience, collaboration could not depend only on informal communication. The team needed clear role allocation, regular meetings, feedback routines, and coordination mechanisms to connect individual contributions into one shared project output. This shows that the multidisciplinary team structure was not only a strength, but also a condition that required active management.

The stakeholder environment was another important initial condition. The ToSMM project was connected to external actors such as MNMA, GIZ, SRDF, mining companies, and field-related activities. This made the project more practical and relevant to the Mongolian mining sector. At the same time, it also created external dependencies. Some activities depended on stakeholder schedules, company responses, field trip planning, and data access. These conditions shaped the need for workflow continuity and adaptive coordination.

Therefore, the initial conditions of the ToSMM project both enabled and complicated collaboration. The team's diversity supported learning and knowledge exchange, while the stakeholder-dependent environment created practical constraints. This supports the collaborative governance view that collaboration is shaped by the conditions under which actors begin working together. In the ToSMM case, these conditions made a collaborative approach necessary for effective research management.

This also shows a limitation of collaborative governance theory when applied to small research teams. The theory explains why initial conditions matter, but it does not fully show how everyday micro-level tensions, such as student confidence, academic hierarchy, time pressure, and uneven availability, shape collaboration in practice. The ToSMM case therefore shows that initial conditions should be understood not only as formal starting conditions, but also as relational and practical conditions that affect day-to-day project work.

6.3 Institutional Design: Role Clarity, Coordination, and Formal Project Structure

The second collaborative governance category is institutional design, which refers to the formal rules, structures and procedures that organize collaboration [2],[3]. In this study, institutional design refers to the formal structures and management tools that organized collaboration in the ToSMM project. These included role allocation, protocol-based responsibilities, the Work Breakdown Structure, project planning, milestones, weekly meetings, and monitoring routines.

The findings show that institutional design was one of the main reasons why collaboration functioned effectively. Role clarity was one of the strongest survey dimensions. Interview responses also showed that participants generally understood their responsibilities. This was mainly because the project divided tasks according to protocols, areas of expertise, and project outputs. Each member had a specific contribution, but those contributions were connected to the broader guidebook development process.

Coordination was also supported by formal project tools. The Work Breakdown Structure and project plan helped organize the work into clear tasks and milestones. Weekly meetings created a repeated structure for checking progress, assigning tasks, receiving feedback, and clarifying next steps. These tools helped the team maintain alignment even though members had different schedules, backgrounds, and responsibilities.

However, the findings also show that institutional design was not only about formal documents. Formal structures became useful because they were connected to active collaborative routines. For example, the WBS helped clarify tasks, but weekly meetings and feedback discussions helped members understand how those tasks were connected in practice. This means that institutional design worked through both planning and interaction.

From a research management perspective, this finding is important. It shows that collaborative research projects need both structure and flexibility. The ToSMM project did not rely only on spontaneous teamwork. It used formal planning tools, but also adjusted work through meetings, monitoring, and feedback. This combination helped maintain order while allowing the project to respond to practical changes.

Therefore, institutional design in the ToSMM project supported the collaborative approach by giving the team a clear management structure. It helped organize roles, coordinate work, and maintain a shared understanding of project progress.

6.4 Collaborative Process: Communication, Feedback, Mutual Support, and Learning

The third category is collaborative process. In this study, collaborative process refers to the day-to-day interaction among project members. It includes communication, participation and feedback, mutual support, and collaborative learning.

The findings show that communication was a basic condition for the rest of the collaborative process. Weekly meetings, information sharing, and open discussion helped members understand project progress and clarify problems. Interview responses showed that communication became more open over time. At the beginning, some participants felt less comfortable because members did not know one another well. However, repeated meetings, feedback discussions, and field-related interaction helped the team become more open and comfortable.

Participation and feedback were also central to the collaborative process. The guidebook was not developed through one-time task completion. It required repeated review, terminology discussion, internal feedback, and practical improvement. Survey and interview findings both show that feedback helped improve the quality of work. Some participants noted that feedback was difficult

to receive at first, but later became useful because it improved the output. This suggests that feedback became part of the team's learning process.

Mutual support also developed gradually during the project. The findings show that members supported one another through advice, shared problem-solving, and knowledge exchange. Team building was not treated as a separate activity only. Instead, it developed through regular collaborative routines such as weekly meetings, internal review, field-related activities, and feedback discussions. These routines helped members become more familiar with each other's roles and working styles.

Collaborative learning was the strongest dimension in the survey results. This is important because it shows that the ToSMM project created learning opportunities across different roles and expertise areas. Participants learned from academic supervisors, professional experts, students, and stakeholder-related discussions. This learning was not only technical. It also included communication skills, responsibility, teamwork, confidence, and the ability to give and receive feedback.

This learning outcome is important for understanding the collaborative approach in research management. The project did not only produce a formal output. It also helped develop the capacity of the team. Members learned how to connect individual tasks to a larger project goal, how to work with people from different backgrounds, and how to improve research outputs through feedback. Therefore, collaborative learning should be understood as part of the broader management value of collaboration, not as a separate topic from research management.

However, the collaborative process was not without tension. Participation was not always equal because members had different levels of experience, confidence, availability, and familiarity with the project topic. In a team involving students, academic staff, and professional contributors, differences in expertise may also have influenced how freely some members expressed ideas or responded to feedback. This means that collaboration supported learning, but it also required careful facilitation to avoid unequal participation or over-reliance on more experienced members.

Overall, the collaborative process in the ToSMM project was interactive, developmental, and learning-oriented. Collaboration became stronger over time as members communicated more openly, gave and received feedback, supported one another, and learned from different expertise areas.

6.5 Leadership and Facilitation: Maintaining Workflow Under Disruption

The fourth collaborative governance category is leadership and facilitation which refers to the guidance, coordination, and management practices needed to support collaboration over time [2,4]. In this study, leadership and facilitation refer to the mechanisms that guided collaboration, maintained alignment, and helped the project continue under changing conditions.

The findings show that leadership and facilitation were important for workflow continuity. The ToSMM project faced external delays, especially in relation to field-related activities, stakeholder schedules, and company availability. However, the project did not stop during these delays. Instead, the team continued internal work such as guidebook drafting, reviewing theoretical sections, preparing materials, refining terminology, and integrating feedback.

This shows that workflow continuity was supported by adaptive coordination. The project began with a more structured waterfall-style workflow, where tasks and milestones were planned in sequence. During the guidebook development stage, the process became more iterative because the guidebook required repeated review, feedback, monitoring, and adjustment. Later, when the guidebook structure became more stable, the workflow returned to a more sequential process focused on final editing, review, and submission.

Leadership and facilitation were also visible in how meetings, feedback, and task adjustments were organized. Project leadership helped guide decisions, align tasks, and support progress. However, leadership also created pressure. Weekly coordination required members to report progress, respond to feedback, and adjust tasks within limited time. For some participants, this created accountability and direction. For others, it felt demanding when meetings overlapped with other academic, professional, or project-related responsibilities.

This indicates that collaborative leadership is not only enabling. It can also create tension between coordination efficiency and members' workload. The ToSMM case therefore shows that facilitation should not only focus on keeping the project moving, but also on balancing progress, participation, and realistic workload expectations.

Overall, leadership and facilitation helped sustain collaboration under uncertainty. They supported workflow continuity and task adjustment, but they also required careful management of time pressure and participation demands.

6.6 Outcomes: Collaboration as a Structured Research Management Process

The fifth category is outcomes. In this study, outcomes refer not only to final project outputs, but also to the effects of collaboration on research project implementation. The findings show that collaboration contributed to several important outcomes: workflow continuity, guidebook improvement, collaborative learning, team building, and knowledge integration.

First, collaboration supported workflow continuity. Even when some external activities were delayed, the team continued internal tasks and maintained progress. This shows that collaboration helped the project adjust rather than stop. The ability to continue work under disruption was one of the clearest practical outcomes of the collaborative approach.

Second, collaboration supported the improvement of the guidebook. Feedback, internal review, peer discussion, and stakeholder-related preparation helped improve the quality and practical relevance of the guidebook. The guidebook was not only produced through individual task completion, but through repeated collective review and improvement. This shows that collaboration directly contributed to research output development.

Third, collaboration supported learning across roles and expertise areas. This was one of the most important outcomes of the ToSMM project. The interviews indicate that members learned practical skills such as giving and receiving feedback, working with different personalities, communicating across roles, managing responsibilities, and understanding how individual tasks connect to a larger project goal. They also gained a clearer understanding of how academic research, guidebook development, stakeholder needs, and mining-sector practice can be connected within one project.

In this sense, collaborative learning was both an individual and collective outcome. At the individual level, members developed new knowledge, confidence, and soft skills. At the collective level, the team developed shared understanding, stronger coordination, and a more practical guidebook output. This finding strengthens the argument that the collaborative approach in

research management should not be evaluated only by whether the final output was completed, but also by what the team learned and how their capacity developed during the project.

Fourth, collaboration supported team building. The findings show that team atmosphere became stronger over time. Members became more comfortable communicating, asking questions, giving feedback, and supporting one another. This suggests that team building can develop through regular collaborative routines rather than through separate team-building activities alone.

Overall, the outcomes of collaboration in the ToSMM project show that the collaborative approach functioned as a structured research management process. It supported the project through formal tools, regular interaction, adaptive coordination, shared learning, and team development. Therefore, collaboration should not be understood only as a general positive condition, but as a practical management approach that shaped project implementation.

6.7 Theoretical Implications

The findings of this study have several theoretical implications for understanding collaborative research management. First, the study shows that collaborative governance theory can be applied not only to large public-sector or cross-sector partnerships, but also to a small, bounded, multidisciplinary research project team.

Second, the study demonstrates how collaborative governance can be operationalized into practical and observable dimensions within a project-level setting. The seven dimensions used in this thesis—communication, coordination, role clarity, participation and feedback, workflow continuity, mutual support, and collaborative learning—helped connect abstract theory with everyday project management practice.

Third, the ToSMM case shows that collaborative research management requires both formal structure and relational interaction. Formal tools such as the Project Charter, WBS, milestones, role allocation, and weekly meeting routines supported institutional design. However, these tools became meaningful only when they were activated through communication, feedback, monitoring, and shared problem-solving.

Fourth, the case also shows a limitation of collaborative governance theory when applied to small research teams. The theory explains institutional design, collaborative process, facilitation, and outcomes, but it gives less attention to micro-level tensions such as student confidence, academic

hierarchy, hidden coordination costs, time pressure, and uneven participation. Therefore, collaborative governance theory needs to be connected with everyday project management practice when applied to small research teams.

Finally, the theoretical contribution of this study is that collaboration is not treated only as a success factor. Instead, it is analyzed as a structured management mechanism that supports workflow continuity and learning under uncertainty while also creating tensions that must be actively managed.

6.8 Practical Implications

The findings also have practical implications for future multidisciplinary and multi-stakeholder research projects. First, future projects should establish clear roles and responsibilities from the beginning. The ToSMM case shows that protocol-based task allocation, WBS, and project planning helped participants understand their work and reduce confusion.

Second, regular meetings are important for communication and coordination. Weekly meetings helped the ToSMM team share updates, clarify tasks, receive feedback, and maintain progress. However, meetings should be structured carefully so that they support participation and do not become only reporting sessions.

Third, feedback should be treated as a normal part of the research management process. Some participants initially found feedback difficult, but later understood its value for improving the work. Future projects should create a supportive feedback culture where comments are understood as part of improvement rather than criticism.

Fourth, team building should begin early. The ToSMM case shows that team atmosphere became stronger over time, but some participants felt less comfortable at the beginning. Early team-building activities, informal introductions, and clear communication expectations could help members become more open earlier in the project.

Fifth, projects involving external stakeholders should prepare for delays. Field-related work and stakeholder coordination may not always follow the original timeline. Future projects should identify alternative internal tasks that can continue when external activities are delayed. This can help maintain workflow continuity.

Sixth, future projects should intentionally create opportunities for collaborative learning. This can be done through structured feedback sessions, short reflection discussions after major tasks, peer review between members, and opportunities for students, experts, and supervisors to explain their work to one another. In multidisciplinary teams, learning does not happen automatically. It needs to be supported through open communication, inclusive participation, and repeated opportunities to exchange knowledge.

Finally, multidisciplinary projects should actively use the diversity of team members. The ToSMM project showed that different educational backgrounds, professional experiences, and expertise areas can support collaborative learning and output quality. However, this diversity needs to be managed through communication, coordination, role clarity, and inclusive participation.

6.9 Summary of Discussion

This chapter interpreted the findings through the collaborative governance framework and project management theory. The discussion showed that collaboration in the ToSMM project was shaped by initial conditions, organized through institutional design, practiced through communication, feedback, mutual support, and learning, supported by leadership and facilitation, and reflected in outcomes such as workflow continuity, guidebook improvement, team building, and collaborative learning.

The main point of the discussion is that collaboration was not automatically smooth or problem-free. It supported coordination and learning, but it also created tensions such as time pressure, hidden coordination costs, uneven participation, and leadership-related pressure. These findings show that collaboration became effective because the team actively managed these tensions through structure, communication, feedback, and task adjustment. This discussion provides the basis for the conclusion and recommendations in the next chapter.

7. Conclusion and Recommendations

7.1 Conclusion

This thesis demonstrates that collaboration in small multidisciplinary research projects can function as a structured management mechanism that connects formal project design with adaptive implementation. In the ToSMM project, collaboration was not simply a positive team atmosphere. It operated through practical routines such as role allocation, weekly meetings, feedback discussions, internal review, task adjustment, and shared learning.

The main conclusion is that collaboration supported the ToSMM project because it combined structure and flexibility. Formal tools such as the Project Charter, Work Breakdown Structure, milestones, and role allocation helped organize the project and clarify responsibilities. At the same time, collaborative routines such as communication, feedback, mutual support, and adaptive coordination helped the team continue working when field-related activities, stakeholder schedules, and other external conditions created uncertainty.

The findings also show that collaboration was not problem-free. Weekly meetings supported coordination and accountability, but they also created pressure for some members who had to balance the project with other academic, professional, or project-related responsibilities. Communication became more open over time, but not all participants experienced openness equally from the beginning. Participation was generally positive, but differences in confidence, experience, role, and availability influenced how actively members contributed.

This positive and critical evidence shows that collaboration should not be understood as an automatic solution to project complexity. Instead, collaboration worked in the ToSMM project because tensions were actively managed through meetings, feedback, monitoring, and task adjustment. The project therefore shows that effective collaboration requires continuous facilitation, not only goodwill among team members.

One of the strongest outcomes was collaborative learning. Students learned from professors, academic supervisors, and professional experts through feedback and guidance. At the same time, professional and academic members recognized the effort, motivation, and responsibility of

student members. This shows that learning was not only one-directional, but reciprocal. Collaboration helped improve the project output while also developing the capacity of the team.

Overall, the ToSMM case shows that collaboration can help small multidisciplinary research teams manage complexity, maintain workflow continuity, and generate learning. The main lesson for future projects is that collaboration should be deliberately designed through clear roles, structured meetings, supportive feedback routines, inclusive participation, and flexible workflows for external delays.

7.2 Answer to the Research Questions

The main research question asked how collaborative management in the ToSMM project supported effective research project management and implementation. The study found that collaborative management supported the project by helping the team organize work, clarify responsibilities, coordinate tasks, exchange feedback, maintain progress, and learn across different areas of expertise. Collaboration helped connect individual protocol work, guidebook development, stakeholder-related activities, field-related planning, and internal review into one shared project process.

The first sub-question asked what formal and informal collaborative practices were used in the project. Formal practices included the Project Charter, Work Breakdown Structure, protocol-based task allocation, milestones, regular meetings, monitoring routines, internal review, progress reporting, and stakeholder communication. Informal practices included open discussion, peer feedback, mutual support, knowledge sharing, team learning, and problem-solving through repeated interaction.

The second sub-question asked how collaborative management supported participation, mutual learning, and knowledge exchange among students, experts, and academic supervisors. The findings show that weekly meetings, feedback discussions, internal review, and field-related interaction created repeated opportunities for members to share knowledge and learn from one another. Collaborative learning was the strongest survey dimension, showing that the project supported both individual learning and collective capacity development.

The third sub-question asked how collaborative practices influenced communication, coordination, role clarity, mutual support, and collaborative learning within the 12-member mixed project team. The findings show that weekly meetings supported communication and

coordination, protocol-based task allocation supported role clarity, repeated feedback supported participation, and regular interaction strengthened mutual support and collaborative learning. Some challenges remained, especially time coordination, online communication, differences in participation, and external dependency.

The fourth sub-question asked how the collaborative approach supported workflow continuity and task adjustment during external disruption. The findings show that the team continued internal work when field-related activities were delayed. This included guidebook drafting, internal review, terminology refinement, feedback integration, survey preparation, and document preparation. This demonstrates that collaboration supported adaptive coordination and helped the project maintain progress.

The fifth sub-question asked what lessons can be drawn for future multidisciplinary and multi-stakeholder research projects. The main lesson is that future projects should combine formal planning with active collaborative routines. Clear roles, regular meetings, structured feedback, early team building, inclusive participation, and preparation for external delays are important for maintaining project progress.

7.3 Recommendations

Based on the findings, the study makes the following recommendations for future multidisciplinary and multi-stakeholder research projects.

First, future projects should define roles and responsibilities clearly from the beginning. Clear role allocation helps reduce confusion and supports accountability. However, responsibilities should also be reviewed during implementation because roles may become clearer as the project develops.

Second, regular meetings should be used as a management tool, not only as reporting sessions. Meetings should support coordination, feedback, problem-solving, and shared learning. Clear agendas, progress updates, next steps, and meeting notes can help keep the team aligned.

Third, future projects should build a supportive feedback culture. Feedback should be introduced as part of collective improvement rather than personal criticism. This can help members improve their work and strengthen the quality of shared outputs.

Fourth, team building should begin early. In multidisciplinary teams, members may not know one another well at the beginning. Short introduction sessions, informal discussions, and early opportunities for collaboration can help members communicate more openly.

Fifth, projects involving external stakeholders should prepare alternative workflows. If fieldwork or stakeholder-related activities are delayed, internal tasks such as literature review, guidebook drafting, internal review, terminology refinement, and data organization should continue.

Sixth, collaborative learning should be intentionally supported. Future projects should include reflection discussions, peer review, knowledge-sharing sessions, and opportunities for students, experts, and supervisors to explain their work to one another.

Finally, diverse teams should use inclusive participation methods. Written feedback options, small group discussions, rotating speaking opportunities, and direct invitations to quieter members can help ensure that different voices are included.

7.4 Contribution, Limitations, and Future Research

This study contributes to the understanding of collaborative research management by showing how collaborative governance can be operationalized into practical and measurable dimensions within a small-scale research project. The study demonstrates that collaboration can be analyzed through communication, coordination, role clarity, participation and feedback, workflow continuity, mutual support, and collaborative learning. In doing so, it bridges the gap between abstract collaborative governance theory and day-to-day project management practice.

The study has several limitations. It is based on a single case, so the findings are not intended for statistical generalization. The survey was conducted with a small team, with 10 valid responses from 12 internal project members. The interview sample was also limited to five selected participants. In addition, the researcher was involved in the project, which provided contextual understanding but also required reflexive awareness.

Future research could compare several multidisciplinary research projects to examine whether similar collaboration patterns appear in different settings. Future studies could also examine how collaborative management changes across project stages or how feedback and team-building practices influence research project outcomes over time.

7.5 Final Statement

The ToSMM project shows that collaboration does not remove project difficulty; it helps teams manage it. In this case, collaboration supported progress despite scheduling challenges, external dependencies, uneven participation, and field-related delays.

The final lesson is that collaboration should be treated as an active management process, not as something that happens naturally. Future multidisciplinary research projects should therefore design collaboration deliberately through clear structure, regular interaction, feedback, facilitation, flexibility, and continuous adjustment.

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Appendices

Appendix A. Survey Questionnaire Structure

This appendix presents the structure of the survey questionnaire used in this study. The purpose of this appendix is to show how the survey instrument was organized. The survey findings are presented in Chapter 5 and are not repeated here.

Feature	Description
Purpose	**To collect descriptive data on how collaboration was experienced within the ToSMM project team.**
Target participants	**Internal members of the ToSMM project team.**
Distribution method	**Google Forms.**
Type of data collected	**Background information, Likert-scale responses, and open-ended responses.**
Main analytical basis	**Seven analytical dimensions of collaboration.**
Use in thesis	**Used to identify broad patterns and guide the interview stage.**

Confidentiality treatment	**Individual raw responses and respondent names are not included.**

Table A2. Survey Sections

Survey Section	Content
Background information	**Participant role, length of participation, and weekly meeting attendance.**
Scaled items	**Statements related to the seven analytical dimensions of collaboration.**
Additional items	**Leadership and overall collaboration effectiveness.**
Open-ended questions	**Questions about strengths, challenges, and future improvements.**

Table A3. Analytical Dimensions Covered in the Survey

Analytical Dimension	Item Focus

Communication	**Information sharing, meeting usefulness, and openness in discussion.**
Coordination	**Task alignment, project planning, and connection between members' work.**
Role clarity	**Understanding of individual and team responsibilities.**
Participation and feedback	**Opportunity to contribute, receive feedback, and take part in review.**
Workflow continuity	**Ability to continue work despite delays or external constraints.**
Mutual support	**Help, shared responsibility, and support among team members.**
Collaborative learning	**Learning from members with different roles, expertise, and experience.**

Table A4. Open-Ended Questions Included in the Survey

No.	Question

1	What were the strongest aspects of internal collaboration in the ToSMM project?
2	What was the main challenge related to collaboration?
3	What should be improved in future similar projects?

Table A5. Survey Data Protection

Data Type	Treatment
Respondent names	Not included.
Individual raw responses	Not included.
Google Forms raw file	Not reproduced in the thesis.
Aggregated findings	Presented only in Chapter 5.
Purpose of this appendix	To document the survey structure without repeating findings.

Appendix B. Semi-Structured Interview

This appendix presents the semi-structured interview guide used in the study. The purpose of the interviews was to explore the survey patterns in greater depth. The interview findings are presented in Chapter 5 and are not repeated here.

Table B1. Interview Guide Overview

Design Element	Description
Interview Type	Semi-structured interview (allowing for flexibility and probing).
Purpose	To capture in-depth qualitative insights on collaboration dynamics and **internal tensions**.
Number of Core Questions	10 questions (focused on mechanisms and challenges).
Main Focus	Seven collaboration dimensions, **hidden coordination costs, leadership pressures, and workflow disruptions**.
Use in Thesis	To triangulate survey data and provide "analytical generalization" of the case.
Confidentiality	Full transcripts are anonymized to protect participant privacy.

Table B2. Core Interview Questions

No.	Interview Question

1	What was your role in the ToSMM project, and how would you describe your overall experience of collaboration?
2	How did communication within the project team take place during the project?
3	How were project tasks coordinated among team members?
4	How clear were your role and responsibilities in the project?
5	To what extent were you able to participate in discussions, share ideas, and receive feedback?
6	How did feedback, internal review, or peer discussion influence the improvement of the guidebook or other project outputs?
7	How did the team continue working when field-related activities or stakeholder-dependent tasks were delayed?
8	How did team members support one another during the project?
9	What did you learn from working with people from different roles, expertise areas, or professional backgrounds?

10	What should be improved in future multidisciplinary or multi-stakeholder research projects?

Table B3. Follow-Up Areas

Follow-Up Area	Purpose
Weekly meetings	To understand how regular meetings supported or complicated collaboration.
Communication openness	To understand whether communication was open from the beginning or developed over time.
Role understanding	To understand whether responsibilities were clear and how they changed during implementation.
Feedback experience	To understand how participants gave, received, and used feedback.
External delays	To understand how the team adjusted work when external activities were delayed.
Team support	To understand how members helped one another during project work.

Collaborative learning	To understand what members learned from different expertise areas and roles.
Future improvement	To identify practical lessons for future research projects.

Table B4. Interview Data Protection

Data Type	Treatment
Participant names	Not included in the thesis.
Full transcripts	Not included.
Identifiable wording	Summarized or generalized.
Raw answers	Not reproduced.
Purpose of this appendix	To document the interview guide without repeating findings.

Appendix C. Survey Data Handling and Analysis Procedure

This appendix explains how the survey data were handled and used during the analysis. It does not repeat the survey results presented in Chapter 5.

Table C1. Survey Data Handling Procedure

Step	Description
Step 1. Distribution	The survey was distributed to internal ToSMM project team members through Google Forms.
Step 2. Response collection	Responses were collected electronically.
Step 3. Valid response check	Responses were reviewed to confirm that they were valid for analysis.
Step 4. Data organization	Survey items were grouped according to the seven analytical dimensions.
Step 5. Descriptive calculation	Average scores were calculated for each analytical dimension.
Step 6. Interpretation	The scores were interpreted descriptively, not statistically.
Step 7. Link to interviews	Survey patterns were used to guide the semi-structured interview stage.
Step 8. Triangulation	Survey findings were compared with interview data, project documents, and descriptive project evidence.

Table C2. Analytical Use of Survey Data

Analytical Use	Description
Descriptive overview	The survey provided an initial overview of collaboration across the project team.
Pattern identification	The survey helped identify dimensions that appeared strong, mixed, or in need of explanation.
Interview guidance	Survey patterns informed the areas explored through interviews.
Triangulation	Survey findings were compared with other sources of evidence.
Cautious interpretation	Results were interpreted carefully because the project team was small.

Table C3. Survey Data Confidentiality

Issue	Treatment
Raw survey file	Not included in the thesis.
Individual response sheets	Not included.

Respondent identity	Protected.
Aggregated results	Presented in Chapter 5 only.
Purpose of this appendix	To show how the survey data were handled without repeating the findings.

Appendix D. Anonymized Interview Evidence Records

This appendix documents how the interview evidence was organized and protected during the analysis. It does not repeat the interview findings presented in Chapter 5 and does not include full transcripts.

Participant Code	Role Category	Evidence Area Used in Analysis	Confidentiality Treatment
P1	Student member	Communication, feedback, coordination, mutual support, and learning.	Name removed; responses summarized; identifiable wording generalized.
P2	Student member	Role clarity, open communication, time coordination, feedback, and team building.	Name removed; responses summarized; identifiable wording generalized.

P3	Student member / design-related role	Design-related work, online communication, participation, feedback, and specialized support.	Name removed; role generalized; responses summarized.
P4	Professional / administrative contributor	Communication tools, planning, open management, on-site work, and team learning.	Name removed; role category used instead of specific identity.
P5	Academic participant	Role clarity, weekly feedback, time pressure, workflow continuity, and student responsibility.	Name removed; role category used instead of specific identity.

Table D2. Interview Evidence Handling

Evidence Type	Treatment
Full interview transcripts	Not included.
Participant names	Replaced with participant codes.
Specific personal details	Removed.
Identifiable wording	Summarized or generalized.

Sensitive comments	Excluded or paraphrased.
Role-specific information	Presented only in general role categories.
Use in thesis	Used to support thematic analysis and Chapter 5 findings.

Table D3. Use of Interview Evidence in Analysis

Use of Evidence	Description
Explaining survey patterns	Interview responses helped explain why participants experienced some collaboration dimensions positively or critically.
Identifying practical examples	Interview evidence helped identify examples of meetings, feedback, task adjustment, support, and learning.
Comparing experiences	Interview evidence helped show that collaboration was not experienced identically by all participants.
Supporting balanced analysis	Both positive and critical comments were considered during analysis.
Protecting confidentiality	Evidence was summarized instead of reproduced as full transcript data.

Table D4. Reason for Not Including Full Transcripts

Reason	Explanation
Small project team	Participants may be identifiable even if names are removed.
Role specificity	Some roles are unique and could reveal participant identity.
Ethical protection	The study protects participant confidentiality.
Analytical relevance	The thesis analyzes patterns and themes, not individual personal accounts.
Document length	Full transcripts would make the appendix unnecessarily long and repetitive.

Note. The original interview notes are retained by the researcher for academic verification if required, but they are not reproduced in the thesis document in order to protect participant confidentiality.

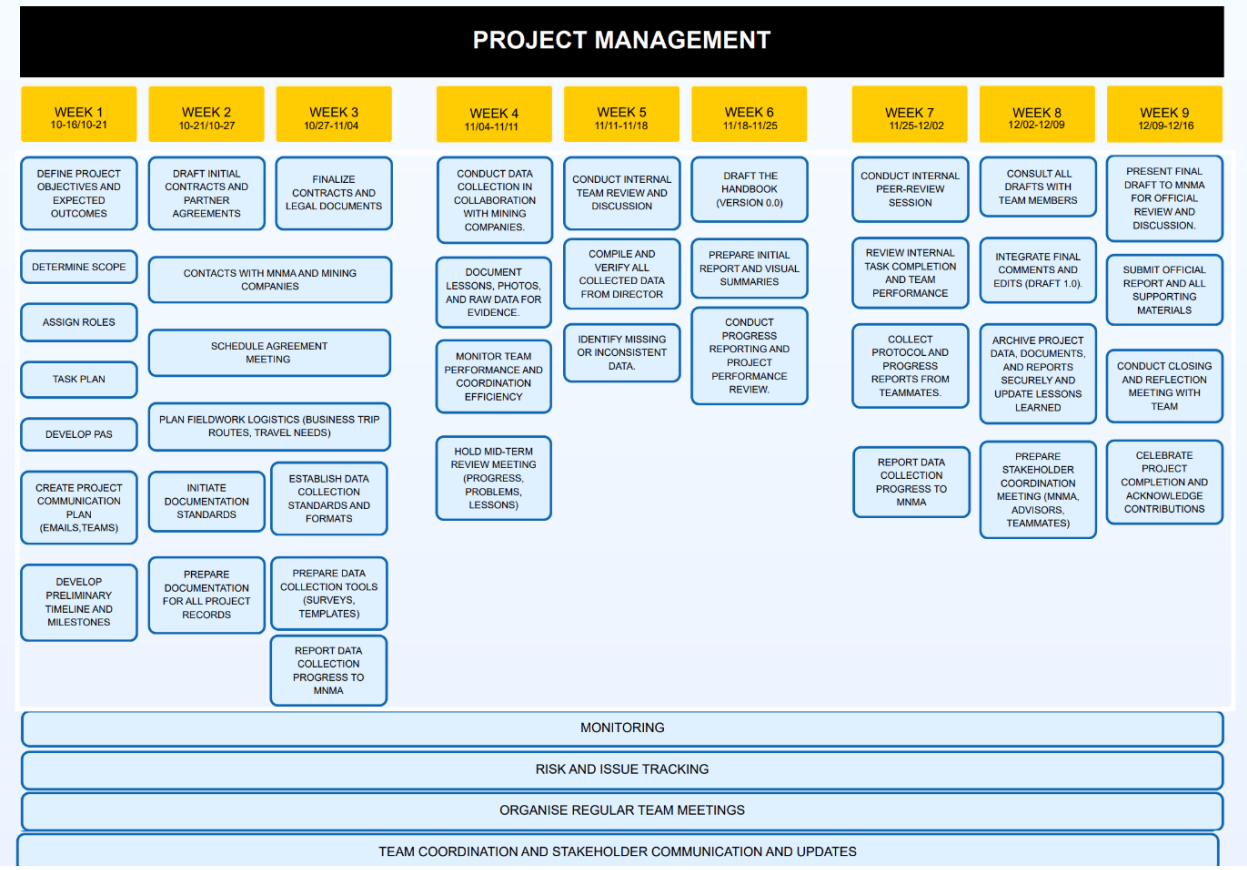
Appendix E. Project Documents and Supporting Evidence

This appendix lists the internal project documents reviewed as supporting evidence for this thesis. These materials were used for document review and triangulation, but they were not treated as public academic references.

Table E1. Internal Project Documents Reviewed

Internal Document	Use in Thesis
Project Charter	Used to understand the project goal, scope, deliverables, stakeholders, risks, constraints, and assumptions.
Work Breakdown Structure	Used to examine role allocation, task planning, communication routines, regular meetings, monitoring, internal review, and stakeholder coordination.
Interim Report	Used to support evidence of project progress, completed activities, guidebook development, stakeholder engagement, challenges, and next steps.
Bachelor Thesis Assignment Sheet	Used to understand the academic framing and thesis requirements.
Survey Questionnaire	Used to support the design of the survey questions.
Semi-Structured Interview Guide	Used to support the structure of the interview questions.

Figure E1. Work Breakdown Structure of the ToSMM Project



Note. The WBS is included as a visual supporting document because it shows the project management structure, including role allocation, communication planning, regular meetings, monitoring, risk tracking, stakeholder coordination, internal review, final reporting, and reflection activities.

Table E2. Redacted or Excluded Information

Information Type	Treatment
Personal contact information	**Excluded.**
Signatures	**Excluded.**
Detailed financial information	**Excluded or summarized.**
Individual survey responses	**Excluded.**
Full interview transcripts	**Excluded.**
Identifiable participant wording	**Summarized or generalized.**