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R&D MANAGEMENT PRACTICES IN A SUSTAINABILITY-ORIENTED PROJECT: AN ETHNOMETHODOLOGICAL AND PRACTICE-BASED STUDY

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Acceptance Page

This Thesis of **JEREMIAH G. NATIVIDAD** titled: **"R&D MANAGEMENT PRACTICES IN A SUSTAINABILITY-ORIENTED PROJECT: AN ETHNOMETHODOLOGICAL AND PRACTICE-BASED STUDY"** is hereby accepted by the Faculty of Management and Development Studies, U.P. Open University, in partial fulfillment of the requirements for the degree **Master of Research and Development Management**.

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Biographical Sketch

Jeremiah Garcia Natividad, PFT, is a Master of Research and Development Management graduate at the University of the Philippines Open University and a Professional Food Technologist with more than fifteen years of experience in quality assurance, food safety, applied microbiology, laboratory management, environmental management, and regulatory compliance within the food and beverage manufacturing industry.

He currently serves as Senior Microbiologist at San Miguel Brewery Inc., where he leads programs in quality assurance, food safety, product regulatory compliance, and environmental management. His professional responsibilities include establishment, implementation and continual improvement of food safety, environmental sustainability, laboratory and quality assurance systems, microbiological technologies, sanitation and hygiene programs, risk management, process optimization, and regulatory compliance. He also serves as the company's Qualified Person in Industry Regulatory Affairs (QPIRA) and a DENR-accredited Pollution Control Officer (PCO), providing leadership in food regulatory affairs, environmental governance, and sustainability compliance.

In addition to his industry role, he serves as a Technical Assessor and Technical Expert for the Philippine Accreditation Bureau, where he participates in the accreditation of laboratories, certification bodies, inspection bodies, proficiency testing providers, and other conformity assessment organizations against international standards. He is likewise a consultant and trainer in food safety management systems, laboratory accreditation, environmental management systems, auditing, and

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His professional contributions include leadership in the certification and maintenance of management systems such as FSSC 22000, ISO 22000, HACCP, ISO 14001, and ISO/IEC 17025, as well as extensive experience in auditing, accreditation, risk management, environmental stewardship, and organizational improvement. Throughout his career, he has remained committed to advancing scientific rigor, regulatory integrity, and sustainable business practices.

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Dedication

This work is lovingly dedicated to my family, whose constant love, prayers, patience, and encouragement sustained me throughout this journey.

It is also dedicated to my teachers, mentors, and advisers, whose guidance and wisdom helped shape both this study and my growth as a learner and professional.

Finally, I dedicate this thesis to all those who continue to pursue meaningful, responsible, and sustainability-oriented work in research and development.

Abstract

This study examined how sustainability-oriented research and development (R&D) management practices are accomplished through the elicitation, evaluation, and execution of projects within an organizational setting. While existing studies on R&D project selection and sustainability integration are often dominated by quantitative and model-driven approaches, relatively little attention has been given to the everyday practices through which sustainability is interpreted, justified, and enacted in organizational work. To address this gap, the study adopted a qualitative case study design grounded in a practice-based perspective and ethnomethodology, with conversation analysis informing the examination of organizational interactions and naturally occurring documents.

The study focused on a sustainability-oriented process improvement project within a beverage manufacturing organization. Data were drawn from naturally occurring organizational materials, including operations, product and process mapping documents; the Registry of Environmental Aspects and Impacts; Environmental Objectives; Environmental Plans and Programs; R&D trial protocols; and records of project evaluation, monitoring, and disposition. The analysis traced the project across eight organizational stages encompassing elicitation, evaluation, execution, and re-evaluation.

Findings showed that sustainability-oriented R&D management is accomplished through a sequence of interconnected organizational practices that render sustainability visible, discussable, measurable, and actionable. These practices include operational mapping, environmental categorization, target setting,

coordinated planning, trial design, deliberative evaluation, monitored execution, and institutional disposition.

The findings further revealed that these practices are shaped by underlying R&D management principles related to planning and foresight, human-centeredness, value orientation, performance, creativity and innovation, scientific processes, technology-society relations, and total quality management. Social sustainability, in particular, was found to be enacted through coordination, deliberation, justification, and accountability embedded within R&D management work itself.

The study contributes to R&D management research by demonstrating that sustainability is not merely a formal evaluation criterion but an organizational accomplishment produced through situated practices, documentary work, and social interaction. It also highlights the value of practice-based and ethnomethodological approaches in examining how sustainability governance is accomplished in everyday R&D management practices.

Keywords: Sustainability; R&D Management; Ethnomethodology; Organizational Practices; Sustainability Governance; Practice-Based Perspective; Qualitative Case Study

TABLE OF CONTENTS

Title Page i

University Permission Page ii

Acceptance Page iii

Biographical Sketch iv

Acknowledgment vi

Dedication viii

Abstract ix

Table of Contents xi

List of Tables xiii

List of Figures xiv

CHAPTER I RATIONALE FOR THE STUDY 1

- Sustainability as Organizational Accomplishment in R&D 1
- From Evaluation Models to Situated Practices in R&D Management 2
- Governing Sustainability in Everyday R&D Work 4

CHAPTER II REVIEW OF RELATED LITERATURE 7

- Empirical Studies on R&D Project Selection 8
- Sustainability Integration in R&D Management 10
- Organizational Decision-Making Practices 13
- Synthesis of Literature and Research Gap 16

CHAPTER III RESEARCH FRAMEWORK AND RESEARCH QUESTIONS 20

- Practice-Based Perspective 21
- Ethnomethodology 24
- Analytical Orientation of the Study 28
- Research Questions 32

CHAPTER IV METHODOLOGY 34

Conversation Analysis 34

Research Design 37

Study Site and Organizational Context 39

Selected R&D Project 43

Data Sources and Methodological Focus 46

Data Collection Procedures 50

Data Analysis and Interpretive Framework 52

Ethnomethodological Sensibilities: Indexicality, Reflexivity, and Accountability 55

Alignment of Methodology and Research Questions 57

Ethical Considerations 58

Ensuring Trustworthiness 58

Reflexivity and Researcher Position 60

CHAPTER V RESEARCH RESULTS 69

R&D Management Practices Involved in the Elicitation, Evaluation, and Execution of Sustainability-Oriented Projects 69

Analytical grouping of organizational stages by R&D management phase 74

Analytic strategy: Integrating inductive coding with practice-based and ethnomethodological analysis 77

Stage 1 – Operations, product, and process mapping 78

Stage 2 – Registry of Environmental Aspects & Impact Identification (RAI) 86

Stage 3 – Environmental Objectives (EO) 97

Stage 4 – Environmental Plans & Programs (EPP) 104

Stage 5 – Trial Protocol (TP) 115

Stage 6 – Evaluation & Approval 130

Stage 7 – Trial Execution and Monitoring 141

Stage 8 – Trial Evaluation and Disposition 159

Underlying Principles of Sustainability-Oriented R&D Management Practices 176

Stage 1 – Operations, Product & Process Mapping: Planning and Foresight as Foundational Sustainability Work 181

Stage 2 – Registry of Environmental Aspects & Impacts (RAI): Value-Orientation and Technology–Society as Sustainability Prioritization Work 184

Stage 3 – Environmental Objectives: Converting Sustainability Commitments into Measurable and Governable Targets 188

Stage 4 – Environmental Plans & Programs (EPP): Coordinating Sustainability Commitments into Governable Operational Action 192

Stage 5 – Trial Protocol (TP): Structuring Sustainability Innovation as Accountable and Measurable Experimentation 199

Stage 6 – Evaluation & Approval: Negotiated Governance of Sustainability Claims Through Cross-Functional Deliberation 207

Stage 7 – Trial Execution & Monitoring: Total Quality Management and Performance as Stabilization Work Under Operational Variability 214

Stage 8 – Trial Evaluation & Disposition: Scientific Process and Total Quality Management as Institutionalization Work 219

Interpretive Synthesis of RQ2 224

Integrative Synthesis of Findings 225

CHAPTER VI SUMMARY, CONCLUSION AND RECOMMENDATIONS 231

Summary 231

Conclusions 233

Recommendations 236

REFERENCES 238

LIST OF TABLES

Table 4.1 Selected project case, data sources, and methodological focus 45

Table 4.2 Organizational stages, routines, and methodological focus 48

Table 4.3 Alignment of methodology and research questions 57

Table 4.4 Selected reflexive log entries and analytic consequences for insider positionality management 62

Table 5.1 Analytical grouping of organizational stages by R&D management phase 75

Table 5.2 Coding consolidation: codes, sub-themes, and theme (Stage 1) 84

Table 5.3 Condensed version of the Registry of Environmental Aspects and Impact (RAI) 87

Table 5.4 Coding consolidation: codes, sub-themes, and theme (Stage 2) 95

Table 5.5 Environmental Objectives (EO) related to the bottle washing process 97

Table 5.6 Coding consolidation: codes, sub-themes, and theme (Stage 3) 103

Table 5.7 Condensed version of the environmental plans and programs (EPP) related to the bottle-washing process 105

Table 5.8 Coding consolidation: codes, sub-themes, and theme (Stage 4) 114

Table 5.9 Condensed version of the bottle washer trial protocol 116

Table 5.10 Coding consolidation: codes, sub-themes, and theme (Stage 5) 128

Table 5.11 Excerpt from Minutes of the Meeting for TP Evaluation & Approval 131

Table 5.12 Coding consolidation: codes, sub-themes, and theme (Stage 6) 139

Table 5.13 Condensed raw data summary of Trial Execution and Monitoring 143

Table 5.14 Excerpt from Minutes of the Meeting for Trial Execution & Monitoring Review 148

Table 5.15 Coding consolidation: codes, sub-themes, and theme (Stage 7) 156

Table 5.16 Excerpt from Minutes of the Meeting for Trial Evaluation and Disposition 162

Table 5.17 Coding consolidation: codes, sub-themes, and theme (Stage 8) 172

Table 5.18 Stage-linked integration of R&D management practices (RQ1) and underlying R&D management principles (RQ2), showing primary vs supporting principles and the role of each stage as ethnomethodological function 179

Table 6.1 Governance pattern of sustainability-oriented R&D management 234

LIST OF FIGURES

Figure 3.1. Analytical framework of the study. 31

Figure 4.1. R&D framework for the elicitation, evaluation, and execution of sustainability-oriented projects. 42

Figure 4.2. Alignment of research framework and data analysis. 55

Figure 5.1. Key stages of R&D project elicitation, evaluation and execution. 72

Figure 5.2. Operational logic of the bottle-washing process. 78

Figure 5.3. Flow of the Registry of Environmental Aspects and Impact. 92

Figure 5.4. Visual matrix figure for the environmental objectives. 100

Figure 5.5. Visual matrix figure for the environmental plans & programs. 110

Figure 5.6. Visual matrix figure for the translation of Environmental Objectives to Trial Protocol. 123

Figure 5.7. Governance process of sustainability-oriented R&D project management. 229

Chapter I

RATIONALE FOR THE STUDY

Sustainability as Organizational Accomplishment in R&D

Sustainability has become a central concern in organizational strategy, particularly in industries such as food and beverage manufacturing that are resource-intensive and highly visible in environmental and social debates (Kudratova et al., 2018; Ma, 2020). At the same time, organizations are under increasing pressure to justify R&D investments not only on the basis of financial return but also in terms of environmental and social contributions (Alyamani & Long, 2021). Yet, despite the growing prominence of sustainability at the policy and strategic levels, the challenge remains on how these ideals are translated into everyday practices of research and development (R&D) project elicitation, evaluation, and execution.

In this study, sustainability is understood in the triple bottom line framework: environmental sustainability is addressed through documented reductions in water, energy, and chemical use; economic sustainability through considerations of operational efficiency, cost, and feasibility embedded in project evaluation routines; and social sustainability through the R&D management and decision-making practices by which projects are coordinated, justified, and rendered accountable.

These developments point to a conceptual shift: sustainability in R&D is not only a matter of formal evaluation criteria or performance indicators, but also a matter of how organizational actors recognize, interpret, and operationalize sustainability concerns in the course of their everyday work. From this perspective, sustainability becomes visible in the practical reasoning and coordination practices through which

managers and technical staff make project decisions understandable, justifiable, and accountable within the organization.

This perspective raises an important question for research: if sustainability is not only defined through formal indicators but also accomplished through everyday organizational practices, how do managers and technical staff actually make sustainability consequential in the course of R&D work? Addressing this question requires moving beyond abstract evaluation models toward an examination of the situated practices through which sustainability considerations are interpreted and enacted in organizational decision-making.

While sustainability provides the empirical context of this study, the primary analytical focus is on R&D management practices. The study does not aim to develop or evaluate sustainability frameworks such as the triple bottom line; rather, it examines how sustainability concerns are handled, interpreted, and operationalized within R&D management work. In this sense, sustainability is treated as a situated organizational concern, while the core contribution of the study lies in revealing the practices and underlying principles of R&D management through which such concerns are addressed.

From Evaluation Models to Situated Practices in R&D Management

Research on R&D project elicitation, evaluation, and execution has been predominantly shaped by quantitative approaches such as Multi-Criteria Decision Making (MCDM), portfolio optimization, and fuzzy decision models (Türkmen &Topçu, 2021; de Souza et al., 2020; Ma, 2020). These approaches provide structured ways of defining evaluation criteria and prioritizing competing project alternatives. In sustainability-oriented R&D management, they often translate environmental and

social considerations into measurable indicators and weighted parameters intended to support rational decision-making.

While such models offer useful tools for structuring evaluation processes, they frequently abstract sustainability from the everyday organizational work through which it becomes meaningful, defensible, and actionable. In practice, sustainability commitments must be interpreted and balanced alongside operational efficiency, technical feasibility, and financial imperatives. Empirical studies suggest that organizational decision-making often involves negotiation, deliberation, and contextual judgment rather than strict adherence to formal evaluation outputs (Alyamani & Long, 2021; Gonzalez-Varona et al., 2024). This points to a persistent disjuncture between formal decision models and the lived realities of managerial practice.

In real organizational settings, strategic and R&D decisions are therefore not governed solely by the quantitative outputs of analytical models. Managers frequently rely on professional experience, collective deliberation, and locally situated reasoning when evaluating sustainability-oriented initiatives. Understanding sustainability-oriented R&D management thus requires moving beyond abstract evaluation metrics toward examining the everyday practices, interactions, and organizational routines through which sustainability considerations are interpreted and enacted.

From this perspective, an important theoretical gap emerges. Existing models explain how sustainability should be evaluated in project selection, but they offer limited insight into how sustainability is actually accomplished in the course of organizational work. The everyday work of R&D management involves interpreting policy goals, negotiating priorities, documenting decisions, and rendering those decisions accountable within institutional and operational constraints.

To address this limitation, the present study adopts a practice-based and ethnomethodological orientation. The practice-based perspective views organizations as systems of ongoing activity in which work is accomplished through situated practices involving people, tools, and documents (Chalmers & Shaw, 2017). Complementing this view, ethnomethodology examines the local methods through which organizational members produce recognizable and accountable forms of social order in their everyday activities (Garfinkel, 1967; Trace, 2016; Maynard, 2023). Together, these perspectives shift attention from abstract decision models to the practical reasoning and interactions through which organizational actors make sustainability consequential in their work.

Rather than treating sustainability as a purely technical evaluation criterion, this study approaches it as an accomplished organizational practice—something continuously produced through documentation, coordination, and situated reasoning in the course of R&D management. By examining how managers and technical staff interpret, justify, and align sustainability-oriented projects, the study highlights the organizational practices through which sustainability priorities become meaningful and actionable in decision-making.

A more detailed discussion of these theoretical foundations and their role in shaping the research framework is presented in Chapter III.

Governing Sustainability in Everyday R&D Work

The practical significance of this study lies in its potential to illuminate how sustainability-oriented R&D decisions are actually governed within organizational settings. In many industries, particularly resource-intensive sectors such as food and beverage manufacturing, sustainability commitments are increasingly embedded in

corporate strategies, regulatory expectations, and stakeholder demands (Kudratova et al., 2018; Alyamani & Long, 2021). However, translating these commitments into concrete project decisions remains a complex managerial task. Sustainability goals must be interpreted and reconciled with operational efficiency, technological feasibility, and financial considerations during the elicitation, evaluation, and execution of R&D projects.

Within organizations, these decisions are not made solely through formal evaluation models or policy frameworks. Rather, they are accomplished through everyday managerial practices involving proposals, evaluation templates, meetings, and documentation processes. These artifacts function as instruments through which actors coordinate activities, justify project priorities, and render decisions accountable to organizational stakeholders (Trace, 2016; Gonzalez-Varona et al., 2024). Examining these practices provides insight into how sustainability considerations are actually incorporated—or sometimes marginalized—in R&D management work.

By revealing the tacit rules, reasoning processes, and coordination practices that shape project elicitation, evaluation, and execution, this study can inform more transparent and consistent decision-making within organizations. Managers may use these insights to better align sustainability policies with operational practices, improve communication across organizational units, and strengthen the credibility of sustainability initiatives.

The study also contributes to organizational learning by highlighting how sustainability governance operates through everyday practices rather than through formal policies alone. Understanding how sustainability is negotiated, documented, and justified in routine R&D work can help organizations design governance

mechanisms that are grounded in actual managerial practices rather than relying solely on top-down directives or abstract decision models.

Methodologically, the study further demonstrates the value of qualitative approaches in a field traditionally dominated by quantitative models of R&D decision-making (Alyamani & Long, 2021; Kudratova et al., 2018). By applying ethnomethodology and conversation analysis to the study of R&D project elicitation, evaluation, and execution, the research highlights how naturally occurring organizational materials—such as documents, talk, and routines—can serve as rich sources of insight into sustainability governance in practice (Llewellyn & Hindmarsh, 2010; Raudaskoski, 2023; Ten Have, 2002).

More broadly, by examining how sustainability-oriented R&D projects are elicited, evaluated, and executed in practice, this study contributes to understanding how organizations can more effectively integrate sustainability considerations into everyday R&D management work.

This chapter has outlined the background, research questions, and purpose of the study, situating the investigation within a practice-based and ethnomethodological perspective.

The remainder of the thesis is organized as follows. Chapter II reviews relevant literature on R&D management, sustainability, and practice-based perspectives. Chapter III presents the research framework and analytical orientation. Chapter IV describes the methodology, including data sources and analytical procedures. Chapter V presents the findings, organized according to the research questions. Finally, Chapter VI provides the summary, conclusions, and recommendations of the study.

Chapter II

REVIEW OF RELATED LITERATURE

As discussed in Chapter I, sustainability has become an important consideration in R&D management, particularly in industries where resource use, environmental impact, and operational efficiency are closely intertwined. While organizations increasingly articulate sustainability commitments at the strategic level, translating these commitments into concrete R&D decisions remains complex. Understanding how sustainability influences project elicitation, evaluation, and execution therefore requires examining how prior research has studied R&D project decision-making and sustainability integration in organizational contexts.

This chapter reviews the existing empirical literature relevant to sustainability-oriented R&D management. Specifically, it examines three bodies of scholarship. The first concerns empirical studies on R&D project selection and portfolio decision-making, which largely employ quantitative and model-driven approaches. The second focuses on research examining how sustainability considerations are incorporated into R&D management and organizational strategy. The third explores empirical studies on organizational decision-making practices that reveal how managerial judgment, deliberation, and contextual reasoning shape project decisions in practice.

Through this review, the chapter identifies key contributions and limitations in existing research. In particular, it highlights how much of the literature emphasizes formal decision models and predefined evaluation criteria while offering limited insight into the everyday organizational practices through which sustainability considerations are interpreted, negotiated, and enacted. Identifying these limitations provides the basis for clarifying the research gap that motivates the present study.

Empirical Studies on R&D Project Selection

Research on R&D project elicitation, evaluation, and execution has traditionally been dominated by quantitative and model-driven approaches designed to improve the rationality and efficiency of organizational decision-making. These studies commonly employ analytical techniques such as portfolio optimization, multi-criteria decision-making (MCDM), and fuzzy decision models to structure project evaluation and prioritize competing investment alternatives. Within this literature, the central objective is to reduce managerial subjectivity by translating complex decision factors into measurable criteria and systematic ranking procedures.

A significant portion of empirical research in this area focuses on the development and testing of decision-support models intended to optimize R&D portfolio performance. For example, Türkmen and Topçu (2021) examine the use of multi-criteria decision-making frameworks to structure project prioritization processes, demonstrating how weighted evaluation criteria can help decision makers rank alternative R&D initiatives. Similarly, Ma (2020) proposes optimization models that account for uncertainty in project outcomes, enabling organizations to construct more robust R&D portfolios under conditions of technological and market unpredictability. Other studies have integrated fuzzy logic into decision models to manage ambiguity in expert judgments. De Souza et al. (2020), for instance, have developed hybrid fuzzy decision-making approaches that allow evaluators to incorporate qualitative assessments alongside quantitative indicators when selecting R&D projects.

Several studies have also attempted to incorporate sustainability considerations into these analytical models. Kudratova et al. (2018) demonstrate how sustainability-related parameters—such as environmental performance and long-term resource efficiency—can be integrated into portfolio reinvestment strategies. Through

such approaches, sustainability is operationalized as an additional set of criteria within decision models, allowing organizations to quantify trade-offs between financial performance, environmental impact, and strategic alignment. These efforts illustrate the analytical sophistication of contemporary R&D project selection research and highlight the growing recognition that sustainability should be incorporated into innovation decision-making.

Despite their methodological rigor, however, these model-driven approaches share a common limitation: the organizational decision-making process itself is largely treated as a “black box.” In most studies, inputs such as evaluation criteria and weighting schemes are mathematically combined to generate ranked project portfolios, but the actual practices through which these inputs are produced, interpreted, and applied within organizations remain largely unexplored. Activities such as proposal preparation, internal deliberation, evaluation meetings, and negotiation among decision makers are rarely examined in detail. As a result, the lived organizational processes through which sustainability considerations are interpreted and operationalized remain obscured.

Empirical research comparing theoretical decision models with real-world managerial practices further highlights this limitation. Alyamani and Long (2021), for example, observed that sustainability criteria emphasized in academic models are often applied inconsistently in practice, with decision makers frequently prioritizing operational feasibility, financial performance, or risk considerations over environmental objectives. Such findings suggest that the presence of sustainability criteria in formal evaluation models does not necessarily guarantee their influence on actual project decisions. Instead, the role of sustainability in R&D management

appears to be shaped by contextual organizational factors, managerial judgment, and negotiation among stakeholders.

Taken together, these empirical studies demonstrate that while quantitative decision models provide valuable tools for structuring R&D project selection, they offer only limited insight into how sustainability considerations are actually mobilized within organizational decision-making processes. By focusing primarily on analytical frameworks and evaluation criteria, many of the literature overlook the everyday organizational practices through which project proposals are formulated, evaluated, and justified. Understanding how sustainability-oriented R&D decisions unfold in practice therefore requires moving beyond model-based approaches to examine the organizational routines, documents, and interactions that shape project elicitation, evaluation, and execution.

This limitation provides an important motivation for the present study. Rather than focusing solely on formal decision models, this research investigates how sustainability considerations are interpreted and enacted through everyday R&D management practices. By examining organizational documents, meetings, and routines associated with project elicitation, evaluation, and execution, the study seeks to illuminate the practical methods through which sustainability becomes consequential in real-world decision-making contexts.

Sustainability Integration in R&D Management

Sustainability has increasingly become a strategic priority for organizations across many industries, particularly those with operations that depend heavily on natural resources or have significant environmental impacts. In response to regulatory

pressures, stakeholder expectations, and evolving corporate responsibility frameworks, many organizations now incorporate sustainability objectives into their innovation strategies and R&D agendas. Within the literature on R&D management, this shift is reflected in a growing body of research examining how environmental and social considerations can be integrated into project selection and innovation processes.

Empirical studies in this area often frame sustainability as an additional dimension of evaluation within R&D decision-making. Researchers have proposed various approaches for incorporating sustainability indicators—such as environmental impact, resource efficiency, or social responsibility—into project selection criteria and portfolio evaluation models. These studies emphasize the importance of aligning R&D investment decisions with broader sustainability goals, arguing that innovation plays a critical role in addressing environmental challenges while maintaining economic competitiveness (Kudratova et al., 2018; Ma, 2020). By embedding sustainability considerations into project evaluation frameworks, organizations are expected to identify and prioritize innovations that contribute to long-term environmental and economic performance.

Despite this growing attention, empirical research suggests that the integration of sustainability into R&D management remains uneven and often limited in practice. While sustainability criteria are frequently articulated in corporate strategies or formal evaluation frameworks, their influence on actual decision-making processes can be inconsistent. Alyamani and Long (2021), for example, report that sustainability-related criteria commonly appear in decision models and organizational policies. But, these criteria are often deprioritized during real project evaluations, where financial

feasibility, technological readiness, and operational constraints tend to dominate managerial deliberations.

Other studies similarly highlight tensions between sustainability aspirations and the practical realities of organizational decision-making. Gonzalez-Varona et al. (2024) observe that sustainability initiatives frequently encounter resistance when they are perceived as increasing costs, introducing uncertainty, or complicating established operational processes. In such situations, sustainability considerations may be acknowledged rhetorically yet sidelined in favor of more immediate organizational priorities. This discrepancy between stated sustainability commitments and actual decision outcomes has led some scholars to characterize the phenomenon as a "policy–practice gap," in which sustainability remains more visible in strategic discourse than in everyday organizational action.

The persistence of this gap reflects the complex nature of sustainability governance within organizations. R&D decisions are rarely determined by technical criteria alone; they are shaped by competing interests, organizational routines, and the interpretive work of managers who must balance environmental objectives with operational feasibility, financial performance, and institutional constraints. As a result, sustainability considerations are not simply applied as predefined evaluation metrics but must be interpreted, negotiated, and justified within specific organizational contexts.

These findings suggest that understanding sustainability integration in R&D management requires closer attention to the organizational processes through which project decisions are made. Rather than assuming that sustainability criteria directly determine project selection outcomes, researchers are increasingly recognizing the importance of examining how such criteria are mobilized, discussed, and evaluated

within the practical settings of organizational work. These include examining how managers interpret sustainability objectives, how evaluation templates are used in practice, and how sustainability concerns are raised, negotiated, or deferred during decision-making processes.

However, many of the existing literature continue to focus primarily on formal evaluation frameworks and strategic policies, offering limited insight into how sustainability considerations are enacted in everyday R&D management practices. Consequently, there remains relatively little empirical understanding of how sustainability is accomplished in the routine activities through which R&D projects are elicited, evaluated, and executed.

Addressing this limitation requires examining sustainability not only as a strategic objective but also as an organizational accomplishment produced through concrete practices, documents, and interactions. By focusing on how sustainability considerations are interpreted and operationalized in the everyday work of R&D management, research can provide deeper insight into how sustainability commitments are translated—or sometimes diluted—within organizational decision-making processes. This perspective motivates the present study, which investigates how sustainability-oriented R&D projects are elicited, evaluated, and executed in practice within an organizational setting.

Organizational Decision-Making Practices

While a large portion of the R&D management literature focuses on analytical models and evaluation frameworks, another stream of empirical research highlights the inherently social and contextual nature of organizational decision-making. Studies in organizational research have long emphasized that decisions are rarely the product

of purely technical calculations. Instead, they emerge through collective processes of interpretation, negotiation, and justification among organizational actors operating within specific institutional and operational contexts (March and Simon, 1958; Cyert and March, 1963).

Empirical investigations of managerial decision-making demonstrate that formal decision tools are often complemented, or even overridden, by experiential knowledge, professional judgment, and organizational routines. Managers frequently rely on discussions, deliberations, and informal exchanges to interpret evaluation criteria and reconcile competing priorities. In such settings, decision outcomes are shaped not only by formal analytical outputs but also by how participants frame problems, articulate concerns, and negotiate acceptable courses of action (Mintzberg, Raisinghani and Théorêt, 1976; Langley et al., 1995).

Within R&D management, these dynamics are particularly pronounced because innovation projects typically involve high levels of uncertainty, technical complexity, and strategic significance. Project proposals must therefore be evaluated not only in terms of quantitative indicators but also through collective deliberation among managers, engineers, and technical specialists who bring different perspectives and priorities to the decision process. As a result, the evaluation of R&D initiatives often unfolds through meetings, review discussions, and document exchanges that allow decision makers to interpret project implications, raise concerns, and justify recommendations (Cooper, Edgett and Kleinschmidt, 2001; Langley et al., 1995).

Empirical studies examining organizational interaction further illustrate how decisions are constructed through communicative and documentary practices. Organizational documents, such as proposals, evaluation reports, and formal records,

serve not merely as passive repositories of information but as active instruments through which decisions are structured and made accountable. These artifacts frame how problems are presented, how alternatives are compared, and how justifications are articulated. Similarly, meetings and discussions provide venues where participants collaboratively interpret evaluation criteria, question assumptions, and negotiate the legitimacy of proposed actions (Llewellyn and Hindmarsh, 2010; Suchman, 2007).

Research in organizational communication and interaction has shown that such processes are central to how institutional decisions gain legitimacy and coherence. Through talk, documentation, and routine procedures, organizational actors collectively produce shared understandings of problems and acceptable solutions. Decisions therefore become recognizable organizational outcomes not simply because they follow formal procedures but because they are rendered intelligible and defensible through these interactional and documentary practices (Llewellyn and Hindmarsh, 2010; Orlikowski, 2002).

These findings suggest that understanding R&D project decision-making requires examining the practical settings in which decisions are produced. Rather than viewing project selection as the mechanical application of evaluation models, it is necessary to consider how organizational members interpret criteria, mobilize evidence, and justify their judgments in the course of everyday work. This includes examining how project proposals are formulated, how evaluation templates are used, and how sustainability concerns are discussed and negotiated within decision forums (Nicolini, 2012; Gherardi, 2012).

Despite the growing recognition of these dynamics in organizational research, relatively few empirical studies have examined such practices in the context of sustainability-oriented R&D management. Much of the literature continues to

emphasize decision models or strategic frameworks while offering limited insight into the organizational activities through which sustainability considerations are practically interpreted and enacted (Adams et al., 2016; Silvius and Schipper, 2014). Consequently, there remains a need for research that examines how sustainability-related decisions are accomplished within the everyday routines, documents, and interactions that structure R&D management work.

Synthesis of Literature and Research Gap

The review of literature reveals several important insights regarding sustainability-oriented R&D management, while also exposing significant gaps that motivate the present study. Existing research has produced a growing body of knowledge on R&D project selection, sustainability integration, and organizational decision-making. However, these bodies of scholarship tend to approach the problem from different analytical angles, leaving critical aspects of sustainability-oriented decision-making insufficiently understood.

First, empirical studies on R&D project selection have largely focused on developing quantitative and model-driven decision frameworks. Techniques such as multi-criteria decision-making (MCDM), portfolio optimization, and fuzzy decision models are widely used to structure project evaluation and prioritize competing investment alternatives. These approaches offer valuable tools for organizing complex decision criteria and improving analytical rigor in R&D portfolio management (Türkmen & Topçu, 2021; Ma, 2020; de Souza, da Silva and Soma, 2020). Some studies have also attempted to incorporate sustainability indicators into these frameworks by integrating environmental and social considerations into evaluation models (Kudratova et al., 2018). While these contributions have advanced the analytical sophistication of

R&D decision-making, they generally treat the decision process itself as a technical problem to be solved through improved modeling techniques.

Second, research examining sustainability integration in R&D management highlights the growing recognition that innovation plays a critical role in addressing environmental and societal challenges. Many organizations now incorporate sustainability objectives into corporate strategies and innovation agendas, reflecting increasing regulatory pressures and stakeholder expectations. Nevertheless, empirical studies indicate that sustainability criteria often remain weakly embedded in actual project selection processes. Although sustainability may be formally included in evaluation frameworks or policy statements, decision-makers frequently prioritize financial feasibility, operational efficiency, and technological readiness during project evaluation (Alyamani & Long, 2021; Gonzalez-Varona et al., 2024). This discrepancy suggests the presence of a persistent policy–practice gap in which sustainability is strongly articulated at the strategic level but inconsistently enacted in everyday decision-making.

Third, studies on organizational decision-making emphasize that managerial decisions are rarely determined by analytical models alone. Instead, decisions are shaped through collective processes of interpretation, negotiation, and justification among organizational actors. Documents, meetings, and routine procedures play a crucial role in structuring how problems are framed, how alternatives are evaluated, and how decisions become organizationally legitimate. Through these communicative and documentary practices, managers interpret evaluation criteria, reconcile competing priorities, and produce decisions that are considered acceptable within their institutional context.

Taken together, these strands of literature reveal a critical limitation in current research. While analytical models explain how sustainability-oriented R&D projects should be evaluated, and organizational studies highlight the socially situated nature of decision-making, relatively little empirical work has examined how sustainability is actually accomplished within the everyday practices of R&D management. In particular, there remains limited understanding of how sustainability considerations are interpreted, negotiated, and operationalized through the organizational routines, documents, and interactions that structure project elicitation, evaluation, and execution.

This gap is especially evident in studies of sustainability-oriented R&D decision-making. Many of the existing literature focus on improving evaluation models or identifying appropriate sustainability indicators, yet comparatively little attention has been given to how such criteria are mobilized in real organizational settings. As a result, the practical mechanisms through which sustainability becomes consequential—or marginalized—in project decisions remain underexplored.

Addressing this limitation requires shifting analytical attention from abstract decision models toward the lived organizational processes through which project decisions are produced. Rather than assuming that sustainability criteria directly determine decision outcomes, it becomes necessary to examine how organizational actors interpret these criteria, how evaluation documents are used in practice, and how sustainability concerns are discussed and negotiated within decision forums.

The present study responds to this research gap by examining how sustainability-oriented R&D projects are elicited, evaluated, and executed within an organizational context. By focusing on naturally occurring organizational materials—including project proposals, evaluation templates, and meeting interactions—the study

investigates the practical methods through which sustainability considerations are rendered consequential in everyday R&D management work. Through this approach, the research seeks to contribute both empirically and conceptually to the literature by illuminating how sustainability is accomplished in practice rather than treated solely as an abstract evaluation criterion.

Building on the gaps identified in this chapter, the next chapter introduces the theoretical framework guiding the study. It outlines how a practice-based perspective and ethnomethodology provide conceptual tools for examining the organizational practices through which sustainability-oriented R&D decisions are produced.

Chapter III

RESEARCH FRAMEWORK AND RESEARCH QUESTIONS

The preceding chapter reviewed the literature on R&D project selection, sustainability integration in innovation management, and organizational decision-making practices. While existing research has produced sophisticated analytical models for evaluating R&D projects and emphasized the strategic importance of sustainability, the review also revealed a significant limitation. Many of the literature focus on decision criteria, evaluation models, and strategic policies while offering limited insight into how sustainability-oriented R&D decisions are actually produced within everyday organizational work.

Empirical studies have shown that sustainability considerations are often articulated in formal evaluation frameworks but inconsistently enacted during project selection and implementation. This suggests that sustainability-oriented decision-making cannot be fully understood through analytical models alone. Instead, it requires examining the practical organizational settings in which project proposals are formulated, evaluated, justified, and ultimately implemented. In these settings, decisions emerge through the coordinated activities of managers and technical staff who rely on documents, meetings, and routine procedures to interpret criteria, negotiate priorities, and render decisions accountable.

To examine these processes, this study adopts a qualitative research framework grounded in a practice-based perspective (PBP) and ethnomethodology (EM). These complementary traditions shift analytical attention from abstract decision structures toward the everyday practices through which organizational actors produce recognizable forms of order and meaning.

The practice-based perspective views organizations as systems of ongoing activity in which knowledge, coordination, and decision-making are accomplished through situated work practices. Ethnomethodology, in turn, focuses on the methods through which members make their actions intelligible and accountable within specific social settings.

Together, these frameworks provide a conceptual foundation for investigating how sustainability-oriented R&D projects are elicited, evaluated, and executed in practice. Rather than treating sustainability as a predefined criterion within evaluation models, the study approaches sustainability as something that is continuously produced through organizational practices such as documentation, deliberation, and procedural routines.

This chapter therefore outlines the theoretical framework guiding the study. It first introduces the practice-based perspective as a lens for examining organizational work as situated practice. It then discusses ethnomethodology as the foundational framework for analyzing how organizational actors produce accountable forms of action through everyday methods. Finally, the chapter presents the research questions that guide the empirical investigation of sustainability-oriented R&D management practices.

Practice-Based Perspective

The practice-based perspective (PBP) provides an important theoretical lens for examining how organizational activities are accomplished in everyday work (Schatzki, 2002; Nicolini, 2012). Rather than viewing organizations primarily as formal structures composed of roles, hierarchies, and decision rules, practice-based research

conceptualizes organizations as ongoing systems of situated activity (Schatzki, 2002; Gherardi, 2012).

From this perspective, organizational outcomes, including decisions, innovations, and policies, are produced through the recurrent practices of organizational members as they carry out their work (Orlikowski, 2002; Nicolini, 2012). Practice-based scholarship emphasizes that knowledge, coordination, and meaning emerge through action and participation in situated work practices (Orlikowski, 2002; Gherardi, 2012).

Organizational actors rely on shared routines, tools, documents, and interactional practices to accomplish tasks and maintain organizational order (Nicolini, 2012; Schatzki, 2002). Consequently, understanding organizational phenomena requires examining the concrete practices through which work is performed rather than focusing solely on formal structures or decision models (Schatzki, 2002; Orlikowski, 2002).

Within management and organizational studies, the practice-based perspective has gained increasing attention as a way of studying complex organizational processes that cannot be adequately explained through structural or purely cognitive approaches. Chalmers and Shaw (2017), for example, argue that organizations should be understood as configurations of practices in which actors draw upon shared repertoires of routines, tools, and interpretive resources to accomplish their work. In this view, practices are the fundamental units through which organizational life unfolds. They encompass both material elements—such as documents, technologies, and physical artifacts—and social elements, including interactions, interpretive judgments, and collective understandings.

This perspective is particularly relevant for studying R&D management processes. Innovation activities typically involve high levels of uncertainty, interdependence, and coordination among multiple organizational actors. Decisions about R&D projects therefore emerge through complex organizational practices that include proposal development, technical evaluation, managerial deliberation, and procedural documentation. These practices structure how projects are identified, how alternatives are compared, and how decisions are justified within the organization.

From a practice-based perspective, project elicitation, evaluation, and execution can thus be understood as sets of interconnected practices through which organizations organize innovation activities. For example, project proposals, evaluation templates, and procedural guidelines function as practical tools that guide how actors formulate ideas, assess feasibility, and communicate recommendations. Meetings and review discussions provide settings where participants interpret project implications, raise concerns, and negotiate acceptable courses of action. Through these practices, organizations transform abstract innovation goals—such as sustainability—into operational decisions and coordinated actions.

An important implication of the practice-based perspective is that organizational context is not merely a background condition shaping action; rather, context is continuously produced and reproduced through practice. As actors engage with documents, procedures, and each other, they simultaneously enact the organizational environment within which decisions are made. In this sense, practices both shape and are shaped by the institutional arrangements of the organization. This dynamic understanding of context allows researchers to examine how organizational priorities—including sustainability considerations—become embedded within everyday work activities.

Applying a practice-based perspective to sustainability-oriented R&D management shifts analytical attention away from abstract evaluation models toward the lived practices through which sustainability considerations are operationalized in organizational settings. Rather than assuming that sustainability criteria directly guide project decisions, this perspective encourages investigation of how such criteria are interpreted, mobilized, and negotiated within the practical routines of R&D management. Documents, evaluation procedures, and meetings become key sites where sustainability concerns are translated into actionable organizational decisions.

While the practice-based perspective provides a valuable lens for examining organizational activities as situated practices, it does not by itself fully explain how actors produce shared understandings and recognizable forms of order within those practices. For this reason, the present study complements the practice-based perspective with ethnomethodology, which focuses on the methods through which members make their actions intelligible and accountable within specific social settings. The following section therefore introduces ethnomethodology as the foundational framework for analyzing how sustainability-oriented R&D practices are accomplished in everyday organizational work.

Ethnomethodology

Ethnomethodology (EM), originally developed by Garfinkel (1967), provides the foundational theoretical framework for examining how social order is produced through the everyday activities of organizational members. Rather than treating social structures as fixed external forces shaping human behavior, ethnomethodology investigates the practical methods through which individuals make their actions understandable and accountable within specific social contexts. From this perspective,

social order is not simply imposed by formal rules or institutional structures but is continuously accomplished through the routine practices of members as they interact with one another and with the artifacts of organizational life.

Central to ethnomethodology is the idea that actors rely on shared methods to render their actions intelligible to others. These methods include ways of describing situations, interpreting events, and justifying decisions in ways that appear reasonable and appropriate within the local context. Such practices are not typically explicit or formally articulated; instead, they are embedded in the everyday routines, documents, and interactions through which organizational activities are carried out. Ethnomethodological research therefore seeks to uncover the implicit methods that actors use to produce recognizable forms of action and organizational order.

A key concept within ethnomethodology is indexicality, which refers to the context-dependent nature of meaning. Actions, statements, and documents derive their meaning from the specific situations in which they occur. Organizational artifacts—such as project proposals, evaluation forms, or procedural documents—do not possess fixed meanings independent of their use. Instead, their significance emerges through the ways organizational members interpret and apply them within particular decision-making contexts. Understanding organizational practices therefore requires examining how actors use such materials to make sense of situations and coordinate their activities.

Another important concept is reflexivity, which describes how actions simultaneously describe and constitute the social settings in which they occur. Organizational records, reports, and evaluation documents are not merely representations of organizational activity; they actively contribute to the production of that activity by shaping how situations are understood and acted upon. Through

documentation and procedural routines, actors create accounts that both explain and organize their actions. These accounts allow organizational practices to appear coherent, rational, and legitimate to participants and observers.

Ethnomethodology also emphasizes accountability, referring to the ways actors make their actions observable and reportable to others. In organizational contexts, accountability is achieved through the use of recognizable procedures, standardized documents, and communicative practices that enable participants to justify their decisions and demonstrate that actions conform to accepted organizational norms. For example, evaluation templates, project reports, and meeting minutes function as practical mechanisms through which decisions become visible, reviewable, and defensible within the organization.

Taken together, these concepts highlight that organizational order is an ongoing accomplishment produced through members' practical methods. Rather than assuming that decision-making follows predetermined rules or formal evaluation criteria, ethnomethodology directs attention to how organizational actors actively construct recognizable and legitimate decisions through their everyday work practices.

This perspective is particularly relevant for studying sustainability-oriented R&D management. Decisions about innovation projects often involve complex trade-offs among environmental objectives, operational feasibility, and economic considerations. While formal frameworks may define evaluation criteria, the practical significance of these criteria depends on how managers and technical staff interpret them within specific organizational situations. Through discussions, documentation, and procedural routines, actors collaboratively determine how sustainability concerns are recognized, prioritized, or deferred during project evaluation and implementation.

By adopting an ethnomethodological perspective, the present study investigates how sustainability-oriented R&D decisions are accomplished in practice through the methods organizational members use to interpret, justify, and coordinate their actions. Organizational documents such as trial protocols, environmental objectives, and evaluation reports are treated as members' methods—practical resources through which actors produce accountable accounts of project decisions. Similarly, meetings and interactions are examined as sites where participants negotiate meanings, articulate concerns, and align interpretations of sustainability within decision-making processes.

In this way, ethnomethodology provides a framework for examining the organizational practices through which sustainability becomes consequential in R&D management. Rather than viewing sustainability as a predefined criterion within evaluation models, the study approaches sustainability as an accomplishment emerging from the situated activities of organizational members as they carry out their work. This orientation allows the research to uncover the implicit rules, logics, and interpretive practices that shape sustainability-oriented R&D project elicitation, evaluation, and execution.

Ethnomethodology is particularly suited to this study because it enables the analysis of how organizational order is achieved within each stage of R&D management, rather than assuming that stages operate as predefined or deterministic processes. Instead of treating elicitation, evaluation, and execution as fixed procedural steps, the study examines how these stages are actively constituted through members' methods, including documentation, interaction, and justification practices.

Analytical Orientation of the Study

Building on the practice-based perspective and ethnomethodology discussed in the preceding sections, this study develops an analytical orientation for examining how sustainability-oriented R&D management practices are accomplished within organizational contexts. While the practice-based perspective foregrounds the importance of examining organizational work as situated practice, ethnomethodology provides tools for analyzing how actors produce recognizable and accountable forms of action within those practices. By integrating these perspectives, the study approaches sustainability-oriented R&D management not as a purely technical decision process but as an organizational accomplishment produced through everyday activities.

From a practice-based perspective, R&D project elicitation, evaluation, and execution are understood as interconnected sets of organizational practices through which innovation activities are coordinated. These practices include the preparation of project proposals, the use of evaluation templates, the conduct of review meetings, and the documentation of project outcomes. Such practices provide the material and interactional infrastructure through which organizations structure innovation work and translate strategic objectives into operational decisions.

Ethnomethodology complements this perspective by directing attention to the practical methods through which organizational members make these activities intelligible and accountable. Rather than assuming that documents, procedures, or evaluation criteria automatically determine decisions, the ethnomethodological approach examines how actors interpret and mobilize these resources in the course of their work. Through discussions, documentation, and procedural routines,

managers and technical staff produce accounts that justify decisions, align interpretations, and maintain organizational coherence.

Within this analytical orientation, organizational documents are treated as active components of organizational practice rather than neutral records of activity. Artifacts such as trial protocols, environmental objectives, evaluation reports, and meeting minutes are understood as members' methods—practical resources that actors use to frame problems, organize evaluations, and justify decisions. These documents structure how sustainability concerns are articulated, how alternatives are compared, and how project outcomes are rendered legitimate within the organization.

Similarly, organizational interactions—particularly meetings and review discussions—are treated as important sites where sustainability considerations are interpreted and negotiated. During these interactions, participants draw upon documents, technical knowledge, and organizational procedures to construct shared understandings of project proposals and their implications. Through such interactional processes, actors determine how sustainability objectives are balanced with operational feasibility, financial considerations, and technological constraints.

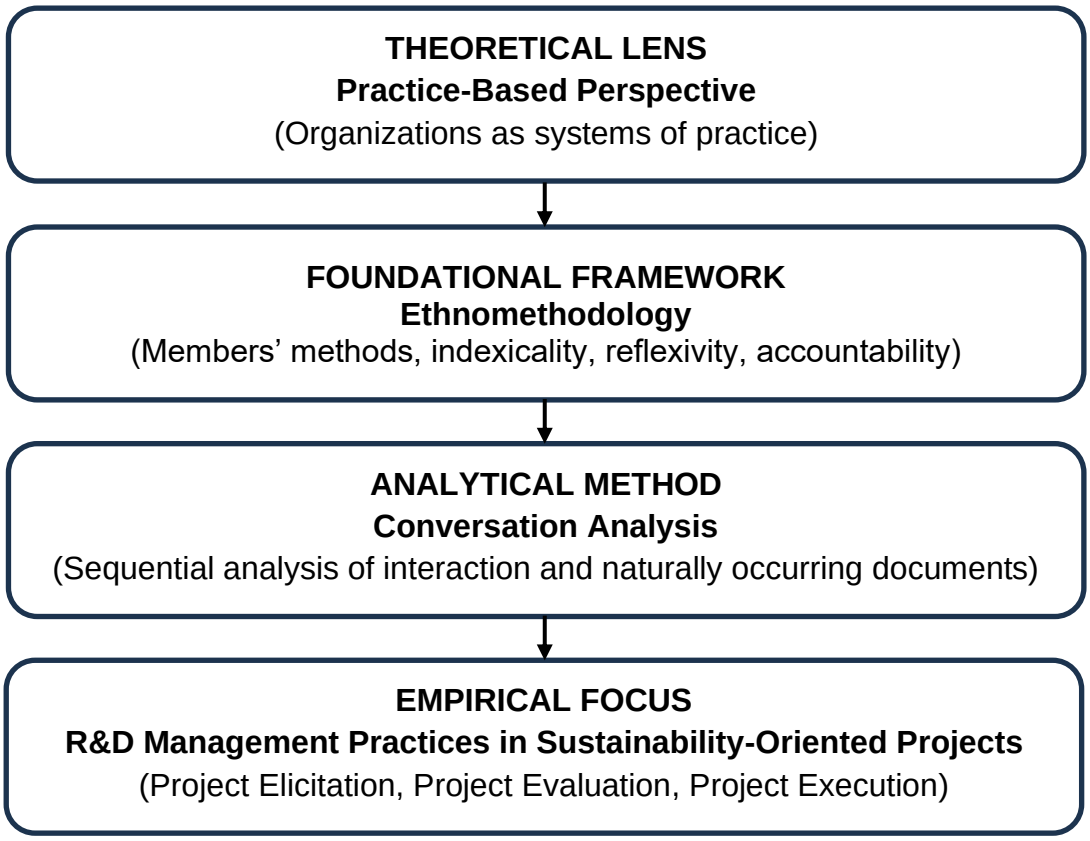
This analytical orientation therefore shifts the focus of investigation from formal evaluation models toward the practical activities through which R&D decisions are accomplished. Instead of treating sustainability as a fixed evaluation criterion, the study examines how sustainability concerns are made relevant within the everyday work of R&D management. Attention is directed toward how actors formulate project proposals, interpret evaluation criteria, and justify decisions in ways that render sustainability consequential—or sometimes secondary—within organizational processes.

By examining documents, routines, and interactions associated with project elicitation, evaluation, and execution, the study seeks to uncover the practical logics and interpretive practices that shape sustainability-oriented R&D management. Through this approach, the analysis reveals how organizational actors construct meanings, coordinate actions, and maintain accountability in the course of managing innovation projects.

Guided by this analytical orientation, the study investigates how sustainability-oriented R&D projects are accomplished in practice within an organizational setting. The next section presents the research questions that structure this investigation and guide the empirical analysis conducted in the subsequent chapters.

The analytical orientation of the study integrates the practice-based perspective and ethnomethodology as complementary theoretical foundations, while conversation analysis serves as the methodological approach for examining organizational interaction and documentation. The relationship among these components and the empirical focus of the study is illustrated in Figure 3.1.

Figure 3.1. Analytical framework of the study.



The study integrates a practice-based perspective and ethnomethodology to examine how sustainability-oriented R&D management practices are accomplished in organizational contexts. Conversation analysis serves as the analytic approach for examining interaction and naturally occurring organizational materials associated with project elicitation, evaluation, and execution.

As shown in Figure 3.1., the study conceptualizes sustainability-oriented R&D management practices as emerging from the interaction of theoretical perspectives and methodological analysis.

Research Questions

Guided by the analytical orientation outlined above, this study examines how sustainability-oriented R&D management is accomplished through the everyday practices of organizational actors. Rather than focusing solely on formal decision models or predefined evaluation criteria, the study investigates the practical activities through which R&D projects are elicited, evaluated, and executed within an organizational setting. By examining naturally occurring organizational materials such as project documents, evaluation templates, and meeting interactions, the research seeks to uncover how sustainability considerations are interpreted, negotiated, and operationalized in the course of R&D management work.

The study is structured around two central research questions that reflect both the empirical focus of the investigation and the conceptual framework introduced in this chapter. The first question examines the observable R&D management practices through which sustainability-oriented projects are elicited, evaluated, and executed in practice. The second question explores the underlying principles and logics that shape these practices, revealing how organizational actors justify, coordinate, and render their decisions accountable within the institutional context of the organization.

Accordingly, the study addresses the following research questions:

RQ1. *What R&D management practices are involved in the elicitation, evaluation, and execution of sustainability-oriented projects?*

RQ2. *What underlying principles shape these R&D management practices?*

Together, these research questions guide the empirical investigation presented in the subsequent chapters. The methodological approach used to examine naturally

occurring organizational materials is described in Chapter IV, while Chapter V presents the findings organized according to these research questions.

Chapter IV

METHODOLOGY

This chapter describes the methodological approach adopted in the study to examine how sustainability-oriented R&D projects are elicited, evaluated, and executed in organizational practice. Guided by the theoretical framework presented in Chapter III, the study applies conversation analysis within an ethnomethodological and practice-based orientation to analyze naturally occurring organizational materials and interactions.

The chapter begins by introducing conversation analysis as the primary analytic approach used to examine organizational interaction. It then describes the research design, study context, data sources, and data collection procedures. The chapter also outlines the analytical framework used to interpret the data, including the ethnomethodological sensibilities guiding the analysis. Finally, it discusses ethical considerations, strategies for ensuring trustworthiness, the researcher's reflexive position, and the limitations of the study.

Conversation Analysis

Conversation Analysis (CA) is an analytic approach developed within the tradition of ethnomethodology to examine how social interaction is organized in naturally occurring settings. Originally developed by Harvey Sacks, Emanuel Schegloff, and Gail Jefferson during the late 1960s and early 1970s, conversation analysis investigates the sequential organization of talk and the methods through which participants produce meaningful and recognizable actions in interaction (Sacks, Schegloff and Jefferson, 1974). Rather than treating communication as the

transmission of information, CA focuses on how participants collaboratively construct social order through the detailed organization of interaction.

A central premise of conversation analysis is that talk-in-interaction is systematically organized. Participants rely on shared interactional practices—such as turn-taking, repair mechanisms, and sequential structures—to produce actions that are intelligible to others. These interactional patterns enable participants to coordinate activities, negotiate interpretations, and maintain mutual understanding within social encounters. Through careful examination of interactional sequences, conversation analysis reveals how participants accomplish actions such as proposing ideas, questioning decisions, expressing agreement or disagreement, and justifying positions.

Conversation analysis has been widely applied in studies of institutional and organizational interaction. In organizational settings, meetings, deliberations, and collaborative discussions are key sites where decisions are formulated and negotiated. CA allows researchers to examine how participants use talk to construct problems, evaluate alternatives, and justify actions within these institutional contexts. Through this lens, interaction is understood not merely as communication but as a practical activity through which organizational processes are accomplished.

Within management and organizational research, conversation analysis has been used to investigate decision-making processes, professional coordination, and the enactment of organizational routines (Llewellyn & Hindmarsh, 2010; Raudaskoski, 2023). These studies demonstrate that organizational outcomes often emerge through the sequential organization of interaction, where participants collaboratively construct shared interpretations of problems and acceptable solutions.

In the context of R&D management, meetings and review discussions play a crucial role in evaluating project proposals, interpreting evaluation criteria, and negotiating decisions regarding project implementation. Through interaction, managers and technical staff articulate concerns, justify recommendations, and align interpretations of project objectives and constraints. Conversation analysis provides a systematic method for examining how such interactions unfold and how participants collaboratively produce organizational decisions.

In this study, conversation analysis is used as an analytic tool for examining naturally occurring organizational interactions associated with sustainability-oriented R&D management. Meeting records, documented discussions, and interactional exchanges related to project evaluation and monitoring are analyzed to identify how participants interpret sustainability considerations, mobilize technical knowledge, and justify decisions within the context of organizational procedures. By examining the sequential organization of interaction, the analysis reveals how sustainability concerns are raised, negotiated, or deferred during R&D decision-making processes.

While conversation analysis traditionally focuses on detailed transcripts of naturally occurring talk, its application in this study is adapted to the nature of the available corpus, which includes both interactional data (e.g., meeting discussions) and documentary records (e.g., minutes of meetings).

For interactional segments, CA techniques such as sequential analysis and turn-taking are applied. For documentary records, analysis focuses on how interactions are summarized, formalized, and rendered accountable, acknowledging that these representations differ from verbatim conversational data.

In this study, conversation analysis is applied to Minutes of the Meeting (MoM) rather than to verbatim audio or video recordings. As such, the analysis focuses on documented interactional sequences, categorizations, and justifications as they are rendered institutionally visible, rather than on micro-interactional features such as pauses, intonation, overlap, or repair. While this constrains the level of interactional granularity typically associated with fine-grained CA, it aligns with the ethnomethodological emphasis on members' documentary methods and organizational accountability practices.

Through its focus on naturally occurring interaction, conversation analysis complements the ethnomethodological orientation of the study. While ethnomethodology provides the theoretical framework for examining how social order is accomplished through members' methods, conversation analysis offers methodological tools for analyzing the interactional practices through which organizational actors coordinate their activities and produce accountable forms of action.

Research Design

This study adopts a qualitative research design to examine how sustainability-oriented R&D projects are elicited, evaluated, and executed within an organizational setting. Qualitative research is particularly appropriate for investigating complex organizational processes where meanings, interpretations, and interactions play a central role in shaping decision-making practices. Rather than seeking to measure predefined variables, the study focuses on understanding how organizational actors interpret situations, coordinate actions, and produce accountable decisions in the course of their everyday work.

The research is conducted as an in-depth organizational case study. Case study research is widely used in organizational and management studies when the objective is to examine contemporary processes within their real-life context. By focusing on a specific organizational setting, the case study approach enables detailed examination of the routines, documents, and interactions through which organizational practices are carried out. This approach allows the researcher to capture the contextual conditions that shape how sustainability considerations are interpreted and operationalized within R&D management processes.

Within this case study design, the study analyzes a sustainability-oriented R&D project conducted within a manufacturing organization. The selected project provides a concrete setting in which the practices of project elicitation, evaluation, and execution can be observed through naturally occurring organizational materials. These materials include project proposals, evaluation templates, environmental management documents, and meeting records that are routinely produced during the management of R&D initiatives.

A key feature of the research design is the use of naturally occurring data. In ethnomethodological and conversation analytic research, naturally occurring materials are preferred because they capture organizational activities as they are performed in practice rather than as they are retrospectively described by participants. Documents and interactions produced during organizational work provide direct evidence of how actors formulate problems, interpret evaluation criteria, and justify decisions. By examining such materials, the study seeks to uncover the practical reasoning and interpretive practices through which sustainability-oriented R&D decisions are accomplished.

The qualitative case study design therefore provides an appropriate framework for investigating the situated practices of R&D management. It enables the study to analyze how sustainability concerns are interpreted and negotiated within the organizational processes that govern project selection, evaluation, and implementation. Through this design, the research aims to illuminate the practical activities through which sustainability becomes consequential within everyday R&D management work.

The following sections describe the organizational context of the study, the selected R&D project examined, and the sources of data used to analyze the practices associated with sustainability-oriented project elicitation, evaluation, and execution.

The following sections elaborate the methodological components of the study. Section 4.3 describes the organizational context in which the study is situated, followed by Section 4.4 which introduces the selected R&D project examined. Section 4.5 outlines the sources of data used in the study, while Section 4.6 explains the procedures for data collection. Section 4.7 details the analytical approach adopted in interpreting the data. The subsequent sections discuss the ethnomethodological sensibilities guiding the analysis, the alignment of methodology and research questions, and the ethical and methodological considerations relevant to the study.

Study Site and Organizational Context

The study was conducted within a manufacturing organization operating in the food and beverage sector. The organization operates within a resource-intensive production environment where operational efficiency, environmental stewardship, and product quality are critical considerations in day-to-day operations. As part of its sustainability commitments, the organization maintains structured environmental

management and operational monitoring systems designed to track resource consumption, environmental impacts, and process performance.

Within this organizational setting, sustainability initiatives are integrated into operational and managerial routines through established management systems and procedural documentation. Environmental management practices are supported by mechanisms such as environmental aspect identification, environmental objectives, and operational programs that guide the organization's efforts to reduce environmental impacts and improve resource efficiency. These mechanisms provide the institutional framework through which sustainability considerations are incorporated into operational decision-making and innovation activities.

Research and development activities within the organization are closely linked to operational improvement initiatives. R&D projects are often initiated to address technical challenges, enhance process efficiency, improve environmental performance, or support compliance with regulatory and sustainability requirements. Such projects typically undergo a structured process of proposal development, evaluation, approval, implementation, and monitoring.

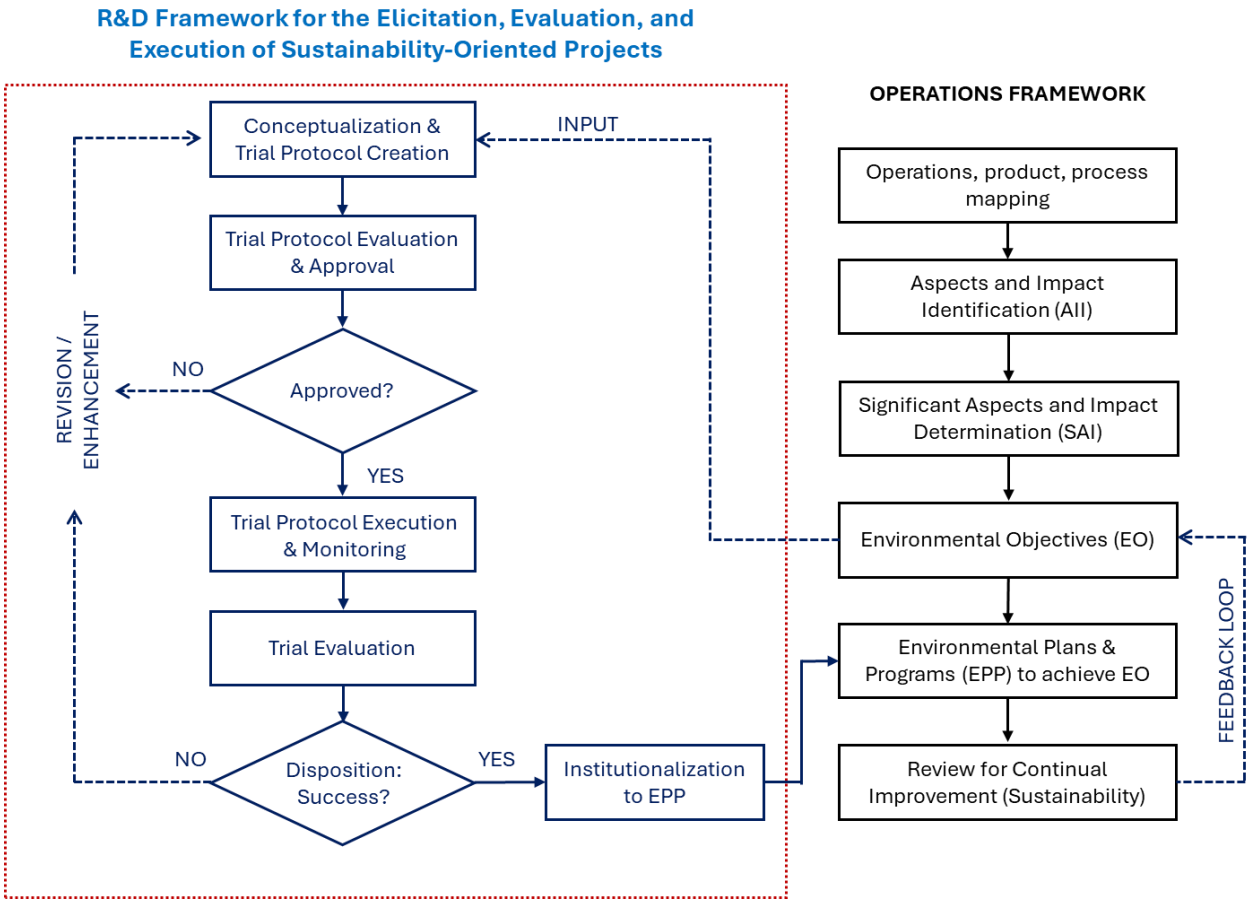
The processes through which R&D initiatives are proposed and evaluated involve multiple organizational actors, including managers, technical specialists, and operational personnel. These actors interact through formal documentation and organizational meetings to assess project feasibility, resource requirements, and expected operational outcomes. Documents such as trial protocols, environmental objective records, and project evaluation reports function as key artifacts in these processes, providing structured formats for presenting project proposals and documenting decision rationales.

This organizational context provides an appropriate setting for examining sustainability-oriented R&D management practices. The presence of formal sustainability commitments, structured operational processes, and documented R&D initiatives creates a rich environment for analyzing how sustainability considerations are interpreted and operationalized within everyday organizational work.

Within this context, the study focuses on a specific R&D initiative that illustrates how sustainability-oriented projects are elicited, evaluated, and executed in practice. The following section introduces the selected R&D project examined in the study and explains its relevance to the research objectives.

Within the organization, sustainability-oriented R&D initiatives are embedded in a structured process that links operational mapping, environmental management practices, and project development. These processes provide the institutional context through which sustainability concerns are translated into specific R&D initiatives. The stages through which sustainability-oriented projects are elicited, evaluated, and executed within the organization are summarized in Figure 4.1.

Figure 4.1. R&D framework for the elicitation, evaluation, and execution of sustainability-oriented projects.



The framework illustrates the organizational process through which sustainability-oriented R&D initiatives are identified, evaluated, implemented, and monitored. It highlights the integration of operational mapping, environmental management practices, and project development activities that collectively guide the elicitation, evaluation, and execution of sustainability-oriented projects within the organization.

As illustrated above, sustainability-oriented R&D initiatives emerge from the interaction of operational processes, environmental management practices, and

organizational decision-making routines that structure project development within the organization.

Within this context, the study focuses on a specific R&D initiative that illustrates how sustainability-oriented projects are elicited, evaluated, and executed in practice. The following section introduces the selected R&D project examined in the study and explains its relevance to the research objectives.

Selected R&D Project

Within the organizational context described above, this study focuses on the Bottle Washer Equipment Upgrade project, an R&D initiative undertaken to improve operational efficiency and environmental performance in the bottle washing stage of the production process. Bottle washing is a resource-intensive operation within beverage manufacturing, involving significant consumption of water, energy, and cleaning chemicals. Improvements in this process therefore present opportunities to enhance both operational efficiency and environmental sustainability.

The Bottle Washer Equipment Upgrade project was selected as the focal case of the study because it exemplifies how sustainability-oriented initiatives are translated into concrete R&D activities within the organization. The project involved multiple stages of proposal development, technical evaluation, implementation, and monitoring, thereby providing a comprehensive illustration of the organizational routines associated with R&D project elicitation, evaluation, and execution. Through these stages, the project generated a range of naturally occurring organizational materials that document how sustainability considerations were articulated, evaluated, and operationalized.

From an analytical perspective, the project offers a valuable opportunity to examine the interaction between environmental management practices and R&D management processes. Sustainability-oriented initiatives frequently emerge from operational challenges, environmental objectives, or regulatory requirements that require technical innovation to address. In the case of the Bottle Washer Equipment Upgrade project, improvements in equipment design and operational parameters were explored as potential means of enhancing resource efficiency while maintaining production performance and product quality.

The project also involved the participation of multiple organizational actors, including technical personnel, managers, and operational staff, who contributed to the proposal, evaluation, and execution of the initiative. Their interactions were mediated through organizational documents, technical reports, and formal meetings that structured the process of project development and decision-making.

As a result, the Bottle Washer Equipment Upgrade project provides a suitable empirical case through which the study can investigate how sustainability-oriented R&D management practices are accomplished in practice. By examining the documents, routines, and interactions associated with this project, the study seeks to uncover the practical reasoning, organizational rules, and interpretive processes that shape the elicitation, evaluation, and execution of sustainability-oriented initiatives. Table 4.1 summarizes the selected project examined in the study together with the primary sources of data and the methodological focus guiding the analysis.

Table 4.1

Selected Project Case, Data Sources, and Methodological Focus

Project Case	Key Sustainability Goal	Data Sources (Corpus)	Methodological Focus
Bottle Washer Equipment Upgrade	Major: To reduce environmental impact through optimization/reduction in water and energy consumption Minor: Reduce chemical consumption and wastewater generation.	• Operations, Product, and Process Mapping • Registry of Environmental Aspects and Impact • Environmental Objectives and Plans • R&D Trial Protocols • Evaluation and Approval Records • Execution and Monitoring Records • Evaluation and Disposition Records	**PBP:** Sustainability framed as efficiency, cost-saving, and innovation **EM:** Protocols and registries as socially organized accounts of compliance, justification, and innovation **CA:** Talk revealing how sustainability claims are negotiated, prioritized, or sidelined in collective decision-making

Collectively, these data sources capture the full cycle of sustainability-oriented R&D project management, from project proposal and evaluation to implementation and eventual institutionalization. The combination of documentary records and interactional materials provides complementary perspectives on organizational practice. Documents reveal how sustainability objectives are formalized, structured, and rendered accountable within organizational procedures, while meetings and discussions illustrate how sustainability claims are interpreted, negotiated, and prioritized in practice. This integrated corpus enables the study to address both research questions: identifying the practices through which sustainability-oriented

projects are elicited, evaluated, and executed (RQ1), and uncovering the underlying principles—such as compliance, innovation, and efficiency—that shape these practices (RQ2).

Data Sources and Methodological Focus

This study draws on a corpus of naturally occurring organizational materials generated during the lifecycle of the selected R&D project. In ethnomethodological and conversation-analytic research, naturally occurring data are particularly valuable because they capture organizational practices as they unfold in real settings rather than through retrospective accounts or researcher-generated responses (Garfinkel, 1967; Trace, 2016; Maynard, 2023). Consistent with this orientation, the study analyzes documents and interactional records produced as part of the organization's routine processes for developing, evaluating, implementing, and reviewing sustainability-oriented R&D initiatives.

The primary data sources consist of internal organizational documents and records associated with the Bottle Washer Equipment Upgrade project. These materials include operations, product, and process mapping documents; environmental management records such as the Registry of Environmental Aspects and Impacts (RAI), Environmental Objectives (EO), and Environmental Plans and Programs (EPP); the R&D Trial Protocol; and records of project evaluation, monitoring, and final disposition. Collectively, these materials make visible how sustainability concerns are identified, formalized, tested, reviewed, and eventually embedded into organizational routines.

At the documentary level, the corpus captures a progression of organizational work across the project lifecycle. Operations, Product, and Process Mapping

documents provide structured representations of workflows, inputs, utilities, and outputs within the bottle-washing process, thereby making visible the operational context from which sustainability-related issues and improvement opportunities are identified. The Registry of Environmental Aspects and Impacts (RAI) translates these operational conditions into formal categories of environmental significance, rendering sustainability-related concerns visible, comparable, and actionable within organizational routines. Environmental Objectives (EO) and Environmental Plans and Programs (EPP), in turn, formalize these concerns into measurable commitments and coordinated improvement pathways, showing how environmental intent is operationalized through planning, scheduling, and interdepartmental responsibility. The R&D Trial Protocol extends this sequence by translating sustainability commitments into a testable project design that specifies rationale, objectives, parameters, responsibilities, data requirements, and success criteria for implementation.

The corpus also includes interactional and deliberative records in the form of minutes of meetings related to trial protocol evaluation and approval, trial execution and monitoring review, and trial evaluation and disposition. These records are analytically important because they capture how project proposals, trial performance, and final outcomes are collectively interpreted, justified, and negotiated within formal organizational settings. Although they do not reproduce the full granularity of naturally occurring talk, they provide structured accounts of deliberation through which feasibility, compliance, quality, sustainability, and financial considerations are rendered discussable, reviewable, and institutionally accountable.

Taken together, these documentary and interactional materials provide a coherent empirical basis for tracing how sustainability-oriented R&D projects are

elicited, evaluated, executed, monitored, and institutionalized in practice. From a methodological perspective, the corpus enables analysis from complementary angles. The Practice-Based Perspective (PBP) focuses on how organizational actors accomplish work through tools, documents, routines, and coordinated activity. Ethnomethodology (EM) examines how these materials function as members' methods for producing recognizable and accountable forms of organizational order. Conversation Analysis (CA), applied to meeting records and interactional exchanges, helps illuminate how sustainability-related claims, proposals, and evaluations are articulated, negotiated, and aligned in collective decision-making. In this way, the corpus is not treated merely as a repository of information but as a set of organizational accomplishments through which sustainability becomes visible and consequential in R&D management practice.

To clarify the relationship between organizational stages, documentary materials, and methodological analysis, Table 4.2 summarizes the key organizational routines examined in the study together with their associated data sources and analytical focus.

Table 4.2

Organizational Stages, Routines, and Methodological Focus

Organizational Stage	**Key Routine / Document**	**Data Source**	**Methodological Focus**
Operations, Product, and Process Mapping	Baseline operational mapping	Mapping documents, process diagrams	PBP: framing sustainability opportunities through operational analysis

Organizational Stage	Key Routine / Document	Data Source	Methodological Focus
Registry of Environmental Aspects and Impacts	Environmental impact identification	Environmental registry documents	EM: documenting accountability and compliance
Environmental Objectives	Sustainability goal formulation	Environmental objective records	EM: formal articulation of sustainability priorities
Environmental Plans and Programs	Operationalization of environmental objectives	Environmental plans, program documentation	PBP: translating sustainability goals into actionable initiatives
R&D Trial Protocol	Project proposal development	Trial protocol documents	PBP: translating sustainability objectives into innovation proposals
Evaluation and Approval	Project evaluation and authorization	Evaluation templates, meeting discussions	CA: interactional negotiation of project justification
Trial Execution and Monitoring	Implementation and performance tracking	Monitoring reports, technical records	PBP: enactment of sustainability practices
Evaluation and Disposition	Institutionalization or termination	Final evaluation reports	EM: retrospective accountability and organizational learning

Table 4.2 illustrates how the organizational processes associated with sustainability-oriented R&D projects generate a sequence of documentary and interactional materials that can be examined analytically. Each stage of the project lifecycle produces artifacts that reflect the practical reasoning of organizational actors

as they identify environmental aspects, define sustainability objectives, translate these objectives into operational plans and programs, and subsequently develop R&D project proposals. The later stages of evaluation, implementation, and project disposition further generate records that document how sustainability initiatives are assessed, executed, and institutionalized within the organization.

By examining these materials through the combined lenses of practice-based perspectives, ethnomethodology, and conversation analysis, the study seeks to uncover the organizational practices and underlying principles that shape sustainability-oriented R&D project management.

The social dimension of sustainability examined in this study is intentionally bounded to internal organizational stakeholders. The analysis focuses on how managers and technical staff coordinate, justify, and render sustainability-oriented R&D decisions accountable within the organization. External stakeholders (e.g., customers, suppliers, regulators, or communities) are not directly included in the analytic corpus. Consequently, the findings illuminate sustainability as an internally accomplished organizational practice rather than as an externally evaluated social outcome.

Data Collection Procedures

Data for the study were collected from organizational materials generated during the development and implementation of the Bottle Washer Equipment Upgrade project. Consistent with the ethnomethodological orientation of the research, the study relied primarily on naturally occurring data—documents and interactional records produced as part of the organization's routine processes rather than materials generated specifically for research purposes (Garfinkel, 1967; Trace, 2016). This

approach allows the analysis to focus on how sustainability-oriented R&D practices are accomplished in real organizational settings.

Access to the relevant materials was obtained through the researcher's professional role within the organization, which provided legitimate access to internal documents and records associated with R&D project development and environmental management processes. The materials were selected based on their relevance to the lifecycle of the Bottle Washer Equipment Upgrade project and their capacity to illustrate the organizational practices through which sustainability-oriented initiatives are proposed, evaluated, and implemented.

The data collection process involved identifying and compiling documents associated with each stage of the organizational workflow described earlier in the chapter. In parallel with document collection, reflexive log entries were recorded to capture methodological decisions, emerging observations, and moments where professional familiarity became analytically relevant. These materials included operational mapping documents, environmental management records, R&D trial protocols, evaluation and approval templates, monitoring reports, and project disposition records. Together, these documents form a corpus that captures the progression of the project from the identification of environmental improvement opportunities to the evaluation and institutionalization of the initiative.

In addition to documentary materials, the study also considered interactional exchanges occurring during project evaluation and decision-making processes. Meetings and discussions among managers, technical personnel, and operational staff provided opportunities to observe how sustainability-related proposals were articulated, interpreted, and negotiated within the organization. These interactional

contexts reveal how formal sustainability objectives are discussed and prioritized in collective decision-making settings.

To maintain analytical coherence, materials included in the corpus were selected based on three criteria: (1) direct relevance to the Bottle Washer Equipment Upgrade project, (2) documentation of organizational practices associated with project elicitation, evaluation, or execution, and (3) the presence of explicit or implicit references to sustainability considerations such as resource efficiency, environmental compliance, or operational improvement. These criteria ensured that the data corpus captured both the procedural and interactional dimensions of sustainability-oriented R&D management.

All collected materials were organized chronologically according to the stages of the organizational process presented earlier in the chapter. This chronological organization allowed the analysis to trace how sustainability-oriented initiatives emerge, evolve, and are evaluated across successive stages of project development. By examining these materials sequentially, the study is able to reconstruct the practical reasoning and organizational routines that shape sustainability-oriented R&D project management.

Data Analysis and Interpretive Framework

This study applies two primary analytic strategies, informed by the practice-based and ethnomethodological orientation of the research framework.

Documentary Method of Interpretation (Ethnomethodology)

Proposals, registries, and protocols are examined as accounts that construct sustainability, rather than as neutral records. Analysis focuses on how sustainability is

framed, justified, and rendered accountable through these documents (Trace, 2016). Particular attention is given to the reflexive character of documents: for example, when a Trial Protocol frames “energy efficiency” as compliance with corporate policy, this is treated as a situated accomplishment rather than a neutral entry.

Conversation Analysis (CA)

Evaluation and monitoring sessions are transcribed at the level of interactional detail, focusing on turn-taking, interruptions, and categorizations. The analysis examines how sustainability issues are raised, negotiated, or downgraded in sequential talk (Llewellyn & Hindmarsh, 2010; Raudaskoski, 2023). Recurrent patterns are identified, such as when sustainability is mentioned but overshadowed by ROI concerns or reframed as a compliance requirement.

These dual strategies align with Raudaskoski’s (2023) emphasis on studying documents and talk together as intertwined practices. In organizational life, documents gain meaning through the ways participants reference and contest them in interaction, while talk is often anchored in documents, such as when managers cite evaluation forms or trial protocols to justify their claims. By combining documentary analysis (EM) and interactional analysis (CA), the study captures the reflexive relationship between written records and spoken exchanges, showing how sustainability criteria are not only inscribed but also invoked, negotiated, and institutionalized in practice.

Inductive Coding Procedure

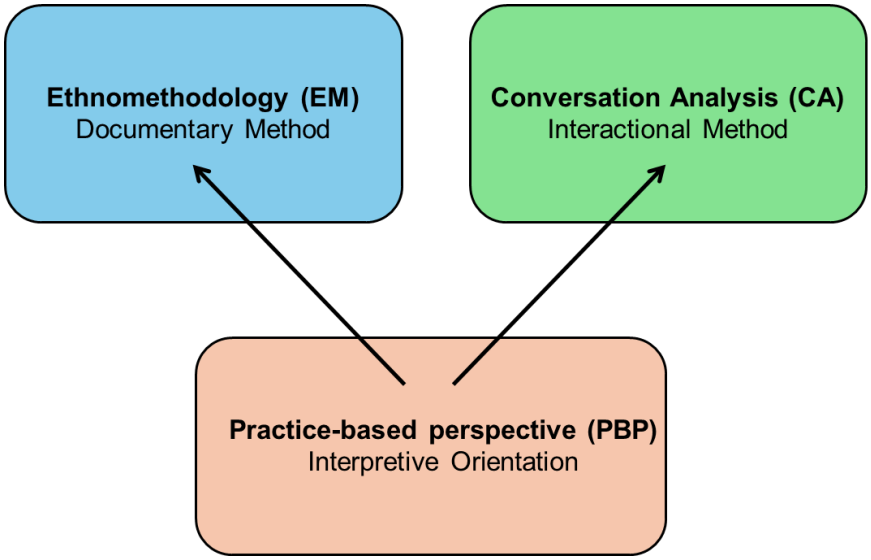
To support the analysis of documentary and interactional materials, an inductive coding process was conducted. Relevant excerpts from organizational documents, records, and meeting interactions were initially coded based on recurring actions, practices, categorizations, and forms of organizational reasoning evident in

the data. Through iterative comparison, similar codes were grouped into sub-themes and broader themes to identify patterned R&D management practices and recurring organizational principles (Braun and Clarke, 2006).

Coding was employed as an analytic consolidation strategy rather than as a standalone thematic method. The resulting codes, sub-themes, and themes served as organizational and interpretive aids for examining patterns across the project lifecycle. Interpretation remained grounded in the Practice-Based Perspective (PBP), Ethnomethodology (EM), and Conversation Analysis (CA), with the coded patterns subsequently analyzed in relation to organizational practices, accountability mechanisms, interactional processes, and underlying R&D management principles.

Importantly, the *practice-based perspective (PBP)* provides the overarching interpretive orientation. PBP highlights that sustainability is not a static category but is continually reconstituted in practice depending on the stage of the R&D process (Chalmers and Shaw, 2017). Thus, while EM and CA provide the methodological tools for analyzing documents and interactions, PBP ensures that these findings are situated within the everyday routines of R&D management.

Figure 4.2. Alignment of research framework and data analysis.



As depicted in Figure 4.2., Ethnomethodology (EM) and Conversation Analysis (CA) provide the primary analytic strategies—documentary and interactional methods—while the Practice-Based Perspective (PBP) serves as the interpretive orientation. This alignment ensures that documents and talk are examined in detail, but always situated within the broader practices through which sustainability is enacted in R&D.

Ethnomethodological Sensibilities: Indexicality, Reflexivity, and Accountability

Consistent with ethnomethodological commitments, the analysis draws on three interrelated concepts—indexicality, reflexivity, and accountability—as points of orientation in interpreting the data (Garfinkel, 1967; Trace, 2016; Maynard, 2023):

Indexicality: The plausibility of actions and statements is examined as context dependent. For instance, a manager's reference to "efficiency" may signify cost reduction in one meeting but environmental stewardship in another. Rather than

treating such terms as fixed, the analysis attends to how contextual cues and organizational settings shape their meaning.

Reflexivity: The study considers how participants' actions and statements both reflect and shape the organizational order. Trial protocols and evaluation reports are not just outcomes of sustainability practices but are themselves constitutive of what counts as credible sustainability. Similarly, meeting talk does not simply mirror decision-making; it actively produces and legitimizes sustainability judgments in situ.

Accountability: Particular attention is given to how participants justify, explain, and defend their decisions during evaluations and discussions. For example, managers render their claims accountable by invoking corporate policy, regulatory requirements, or cost–benefit projections. These justifications are treated not as background context but as practices through which sustainability is made observable, arguable, and institutionally consequential.

To support the systematic application of these analytic strategies, an analytic guide was developed to identify and code ethnomethodological sensibilities within both documentary and interactional data. The guide focuses on key concepts such as indexicality, reflexivity, and accountability, enabling a structured examination of how organizational actors produce, interpret, and justify sustainability-related decisions in context. Rather than functioning as a rigid coding scheme, the guide served as a flexible interpretive resource, supporting the iterative analysis of documents and meeting records and allowing patterns of practice to emerge from the data.

Indexicality is particularly relevant to **RQ1**, as it reveals how practices are shaped by shifting, context-dependent meanings of sustainability. Reflexivity and accountability are central to **RQ2**, since they highlight how participants' justifications

and explanations make explicit the principles guiding R&D decision-making. By orienting analysis to these sensibilities, the study ensures that both the practical methods and underlying principles of sustainability-oriented R&D management are made visible.

Together, these sensibilities ensure that the analysis does not reduce sustainability to a predefined category, but instead traces how it is locally produced, recognized, and stabilized within R&D practices.

Alignment of Methodology and Research Questions

To ensure methodological coherence, Table 4.3 maps the analytic approaches to the study's research questions. Ethnomethodology, the practice-based perspective, and conversation analysis each contribute distinct insights, while their integration provides a comprehensive account of how sustainability is accomplished and how underlying R&D management principles are enacted in practice.

Table 4.3

Alignment of Methodology and Research Questions

Methodological Approach	Contribution to Research Questions
Practice-Based Perspective (PBP)	**RQ2:** Explains how sustainability-related principles are locally constructed, negotiated, and embedded in everyday R&D management practice.
Ethnomethodology (EM)	**RQ1:** Reveals how sustainability is accomplished in proposals and forms. **RQ2:** Identifies tacit principles shaping sustainability judgments.

Methodological Approach	Contribution to Research Questions
Conversation Analysis (CA)	**RQ1:** Shows how sustainability is interactionally produced, negotiated, or sidelined in meetings. **RQ2:** Reveals principles enacted through interactional sequences.
Integration of PBP, EM, and CA	**RQ1 & RQ2:** Provides a comprehensive account of both practices and principles in sustainability-oriented R&D project management.

Ethical Considerations

In line with ethical standards in qualitative research, the study adhered to principles of responsible access, confidentiality, and respect for participants. Access and authorization were limited strictly to materials within the researcher's professional scope, and no confidential or higher-level corporate documents were included.

To protect organizational and individual privacy, project name, personnel, and other sensitive identifiers were anonymized or paraphrased. Data were stored securely and used solely for academic purposes.

Finally, in accordance with ethnomethodological and conversation analytic norms, the findings are presented as analyses of practices rather than evaluations of individual performance (Lardizabal, 2023).

Ensuring Trustworthiness

Credibility and rigor were enhanced through:

Triangulation of materials

Triangulation was achieved by systematically comparing evidence across three data sources: proposals, evaluation forms, and meeting talk. For instance, if sustainability is emphasized in a Trial Protocol but downplayed in approval meetings, this divergence becomes an analytic finding about how sustainability is handled differently across organizational practices. Convergence (e.g., sustainability consistently framed as “cost saving”) strengthens the credibility of the analysis. Triangulation thus guards against one-sided interpretations and shows how sustainability is (or is not) consistently enacted across multiple routines.

Thick description

Thick description was pursued by presenting extended excerpts from documents and transcripts, with contextual detail about who produced them, under what circumstances, and how they were used.

For example, instead of simply quoting a line from a Trial Protocol, the excerpt is shown alongside the organizational stage (e.g., evaluation vs. monitoring) and linked to how managers later discussed it. Following Okada (2024), who demonstrated the value of including contextualized transcripts, this study embedded fragments within rich contextual accounts to make practices intelligible to both scholars and practitioners.

Member sensitivity

Member sensitivity means ensuring that interpretations remain faithful to the reasoning methods of participants themselves. Following Maynard (2023), the analysis foregrounded how managers and staff categorized, justified, and explained sustainability in their own terms, rather than imposing external frameworks.

For example, if participants consistently framed sustainability in terms of “compliance” rather than “innovation,” the analysis presented this as their accomplishment, not as a researcher’s critique. This approach increases both validity and organizational recognition of the findings.

Reflexivity

Reflexivity was achieved by documenting the dual role of the researcher as both practitioner and analyst. Insider ethnomethodological fieldwork carries risks of bias, but also offers privileged access to naturally occurring data (Hinds, 2024). To mitigate risks, a reflexive log was maintained, noting how professional involvement may shape interpretations. Instances where insider knowledge influenced selection or interpretation of data were explicitly acknowledged, ensuring transparency.

Reflexivity and Researcher Position

I occupy an insider position within the organizational context studied as I am a researcher who is professionally involved in environmental and R&D management and is directly engaged in the routines, documentation, and decision processes under investigation. This insider positionality provides privileged access to naturally occurring data and an in-depth, practical understanding of organizational routines and practices. But, this also introduces the risk of taken-for-granted interpretations.

To address this, I adopted a reflexive stance in the dual role of both practitioner and analyst, recognizing how professional involvement may shape analytic attention and interpretation. Reflexivity was operationalized not as a general statement of awareness, but as an active methodological procedure through systematic bracketing and reflexive logging.

I explicitly treated documents, decisions, and interactions as members' methods rather than as evaluations of individual performance. Analytic claims are grounded in observable practices—how sustainability is documented, justified, and negotiated—rather than in personal intentions or motivations.

A reflexive log was maintained throughout the study to document moments where professional familiarity informed data selection, interpretation, or analytic emphasis. Entries were used to record instances where insider knowledge appeared to shape the reading of documents, the recognition of patterns, or the weighting of particular interpretations. Rather than being treated as a separate supplementary record, the reflexive log formed part of the study's methodological procedure for sustaining transparency and analytic accountability in relation to the researcher's dual role.

To make this reflexive procedure more transparent, selected entries from the reflexive log are summarized in Table 4.4. These entries illustrate how insider familiarity was identified, bracketed, and analytically reworked during the interpretation of documents and meeting records.

Table 4.4

Selected Reflexive Log Entries and Analytic Consequences for Insider Positionality Management

Study Phase	Chapter/ Section	Material / Interaction	Trigger	Insider Assumption Identified	Reflexive Action Taken	Analytic Consequence
During initial analysis phase	Operations, Product & Process Mapping	Operations, Product & Process Mapping Report	The mapping document appeared routine and administratively standard to me as QA / R&D personnel.	Because this format is required under ISO 14001 documentation, I initially regarded it as compliance documentation / paperwork rather than analytically rich material.	I deliberately re-read the document as an accountability device and asked: *What does this format allow the organization to claim?*	The mapping was analyzed as performing elicitation work (diagnostic surfacing of sustainability concerns) rather than merely describing operations.
During RAI coding	Registry of Environmental Aspects & Impacts (RAI)	RAI Masterfile excerpt	I immediately interpreted “Significant” impact ratings as automatic R&D priority signals.	In practice, significant ratings often lead to budget or retrofit proposals; I “knew” how these are	I bracketed this managerial expectation and returned to observable documentary categories (likelihood ×	The RAI was interpreted as a diagnostic sense-making system rather than as implicit decision-making or budgeting logic.

Study Phase	Chapter/ Section	Material / Interaction	Trigger	Insider Assumption Identified	Reflexive Action Taken	Analytic Consequence
				operationalized internally.	severity, regulatory references, improvement pathway column).	
During EO analysis	Environmental Objectives (EO)	Energy and water KPIs (≤ 0.153 kWh/case; ≤ 0.173 hL/case)	The numerical targets appeared familiar and self-evident due to prior involvement in KPI setting.	I knew the negotiation history behind these numbers and the compromises embedded in them.	I excluded background negotiation knowledge from analysis and focused strictly on how the targets functioned as measurable commitments in documentary form.	The EOs were analyzed as legitimating devices and organizational promises, not as outcomes of managerial bargaining.
During EPP interpretation	Environmental Plans & Programs (EPP)	Energy and Water Program coordination entries	I perceived joint audits and scheduling coordination as “ordinary	My familiarity risked normalizing coordination routines and	I re-examined the entries through EM sensibilities (indexicality, reflexivity,	The EPPs were interpreted as coordination achievements that embed

Study Phase	Chapter/ Section	Material / Interaction	Trigger	Insider Assumption Identified	Reflexive Action Taken	Analytic Consequence
			operational practice.”	underplaying their sustainability significance.	accountability) to identify how coordination performs stewardship.	sustainability into routine production work.
During Trial Protocol review	Trial Protocol (TP)	Bottle washer trial protocol	I authored portions of the protocol and was aware of strategic wording adjustments for approval.	I knew sustainability language had been strengthened to anticipate evaluation concerns.	I retained multiple document iterations and analyzed language shifts as reflexive reshaping rather than hidden intention.	The protocol was treated as a justificatory organizational account that performs legitimacy in advance of experimentation.
During transcript analysis	Evaluation & Approval Meeting	Minutes of meeting	I anticipated financial caution influencing approval due to familiarity with budget cycles.	I “knew” that cost exposure concerns often shape tone and sequencing of approval discussions.	I bracketed inferred motives and analyzed only observable turn-taking, category work, and documented justifications.	Approval was interpreted as an interactional accomplishment (CA lens), not as predetermined by budgetary constraints.

Study Phase	Chapter/ Section	Material / Interaction	Trigger	Insider Assumption Identified	Reflexive Action Taken	Analytic Consequence
During monitoring review	Trial Execution & Monitoring	Minutes of meeting and 10-day trial performance data	Micro-biological exceedance on Day 5 (150 CFU/bottle)	As R&D with great familiarity with QA, I was immediately confident that the deviation was calibration-related and recoverable. Based on operational experience, such fluctuations during equipment optimization are often temporary and mechanically traceable.	I bracketed my expectation of recovery and re-examined the discussion transcript to focus on how members categorized the deviation (e.g., “optimization phase,” “gating condition,” “traceable cause”) rather than assuming its outcome. I analyzed the sequential organization of explanation → diagnosis → corrective	The monitoring meeting was interpreted as an interactional accomplishment of conditional continuation, rather than as a routine technical correction. Sustainability was analyzed as stabilized through documented accountability work, not through presumed operational competence.

Study Phase	Chapter/ Section	Material / Interaction	Trigger	Insider Assumption Identified	Reflexive Action Taken	Analytic Consequence
					articulation → authorization, instead of treating restoration as inevitable.	
During final evaluation and disposition	Trial Evaluation & Disposition	Minutes of meeting and consolidated 10-day performance summary	Confirmation that all nine success criteria were met	Given the positive metrics and my prior involvement in sustainability initiatives, I expected adoption and replication to follow. I was predisposed to interpret the outcome as "obviously successful."	I bracketed the presumption of success and analyzed how "success" was interactionally produced. I examined how performance thresholds were validated, how endorsement was sequenced, and how executive authorization transformed metrics into	Institutionalization was interpreted not as a natural consequence of good results, but as a collectively constructed accomplishment. Adoption emerged through documentary confirmation, cross-functional endorsement, and executive synthesis—demonstrating

Study Phase	Chapter/ Section	Material / Interaction	Trigger	Insider Assumption Identified	Reflexive Action Taken	Analytic Consequence
					institutional commitment.	sustainability as governance work rather than outcome celebration.
During institutional embedding analysis	Trial Evaluation & Disposition	Discussion on phased replication to other plants	Proposal to integrate the upgrade into Environmental Plans & Programs (EPP) and replicate to other breweries	I perceived replication as a strategic win for sustainability targets and corporate positioning, influenced by my prior experience with EMS program rollouts.	I suspended strategic enthusiasm and analyzed how replication was framed interactionally—as phased, monitored, and subject to management review—rather than automatic scaling.	Replication was interpreted as structured institutional embedding, revealing sustainability as recursive governance rather than expansionist momentum.

Taken together, the methodological framework outlined in this chapter establishes the foundation for examining how sustainability-oriented R&D projects are accomplished in practice. By combining a practice-based perspective, ethnomethodology, and conversation analysis, the study analyzes naturally occurring organizational materials—including documents, routines, and interaction—to uncover the practical reasoning and organizational methods through which project elicitation, evaluation, and execution are carried out.

Building on this methodological foundation, the next chapter presents the research results, organized according to the study's research questions and examining how sustainability-oriented R&D management practices unfold *in situ* within the organizational context.

Chapter V

RESEARCH RESULTS

This chapter presents the research findings on sustainability-oriented R&D management practices within the organizational context examined in this study. Guided by the analytical orientation developed in the previous chapters, the analysis investigates how sustainability-oriented projects are elicited, evaluated, and executed in practice.

The presentation of findings follows the structure of the study's research questions. The first section examines the organizational practices through which sustainability-oriented R&D projects are elicited, evaluated, and executed. The second section identifies the underlying principles that shape these practices and guide decision-making within the organization. The chapter concludes with a synthesis of findings that integrates the insights derived from the analysis.

R&D Management Practices in the Elicitation, Evaluation, and Execution of Sustainability-Oriented Projects

Drawing on the analytical orientation established in the previous chapters, the analysis focuses on how organizational actors accomplish R&D management work through the use of documents, routines, and interaction. Rather than treating project selection and implementation as purely technical processes, the study examines how these activities are carried out in practice through everyday organizational methods.

This study primarily captures the social dimension of sustainability from the perspective of internal organizational actors, including R&D, QA, and management personnel. External stakeholders—such as customers, suppliers, and community

actors—are not directly represented in the dataset. As such, the findings reflect how sustainability is constructed and negotiated within organizational boundaries, and do not fully capture broader stakeholder engagement processes emphasized in sustainability literature.

The findings reveal that sustainability-oriented R&D initiatives are not introduced as isolated decisions but emerge through a sequence of interconnected organizational practices that structure the development and evaluation of projects. These practices form an institutionalized process that links environmental management routines with R&D project development. Through this process, sustainability concerns—such as reductions in water, energy, and chemical consumption—are translated into concrete project proposals, evaluated against operational and technical criteria, and subsequently implemented and assessed within the organization.

Analysis of the empirical materials associated with the Bottle Washer Equipment Upgrade project shows that the elicitation, evaluation, and execution of sustainability-oriented initiatives unfold through a series of organizational stages. These stages provide the procedural infrastructure through which sustainability considerations are identified, translated into project proposals, evaluated, and eventually implemented. Each stage involves the production and use of specific documents and organizational interactions that render project decisions intelligible and accountable within the organization.

From a practice-based perspective, these stages represent the situated practices through which innovation work is organized and coordinated. Documents such as operational maps, environmental registries, project protocols, and evaluation templates serve as practical resources that structure how sustainability concerns are

articulated and addressed in the course of R&D management activities. At the same time, organizational interactions—particularly meetings and review discussions—provide important sites where these documents are interpreted, negotiated, and used to justify decisions.

Ethnomethodologically, these materials and interactions can be understood as members' methods for producing recognizable and accountable forms of organizational action. Through documentation, discussion, and procedural routines, organizational actors construct shared understandings of project proposals and their implications. Sustainability considerations are therefore not simply applied as predefined criteria; rather, they are interpreted and made consequential through the practical reasoning of managers and technical staff engaged in project work.

The analysis identifies eight key stages through which sustainability-oriented R&D projects are developed and managed within the organization. These stages reflect the integration of environmental management processes with R&D project development and together constitute the organizational framework through which sustainability-related initiatives are translated into operational practice.

The stages below are presented and analyzed in the following subsections:

1. Operations, Product, and Process Mapping
2. Registry of Environmental Aspects and Impacts
3. Environmental Objectives
4. Environmental Plans and Programs
5. R&D Trial Protocol
6. Evaluation and Approval
7. Trial Execution and Monitoring

8. Trial Evaluation and Disposition

The stages presented in this study are not intended to represent a formal or universal R&D lifecycle model. Rather, they are empirically grounded organizational stages observed in the case, which are subsequently analytically grouped into broader R&D management phases (elicitation, evaluation, execution). This distinction is important: the stages originate from actual organizational routines and documents, while their grouping reflects an interpretive effort to make visible the structure of R&D management practice.

Figure 5.1. Key stages of R&D project elicitation, evaluation and execution.



The study traced the Bottle Washer Equipment Upgrade project across eight organizational stages, beginning with operations mapping and culminating in trial

disposition and institutionalization. These stages represent the procedural infrastructure through which sustainability-oriented initiatives are identified, translated into project proposals, evaluated, and ultimately integrated into operational practice.

Each stage produced documents and interactional records (e.g., mapping reports, environmental registries, objectives, protocols, minutes of meetings, monitoring reports). These artifacts were analyzed using Practice-Based Perspective (PBP), Ethnomethodology (EM), and Conversation Analysis (CA), allowing sustainability to be traced not as an abstract principle but as a lived organizational practice.

Each subsection examines how documents, routines, and interaction contribute to the accomplishment of R&D project management work. By tracing these stages, the analysis reveals how sustainability-oriented initiatives are progressively formulated, justified, implemented, and institutionalized within everyday organizational practice.

In this study, the social dimension of sustainability is approached not as an external stakeholder outcome but as an internal organizational accomplishment. It examines how R&D management work—through coordination, deliberation, and accountability—sustains the continuity, legitimacy, and governability of sustainability-oriented projects.

Results demonstrate how sustainability was elicited, evaluated, executed, monitored, and finally institutionalized. The analysis also highlights how innovation-driven logics (efficiency, competitiveness) intersect with compliance-driven logics (QA standards, ROI, regulations), and how sustainability becomes embedded into organizational routines and Environmental Plans & Programs (EPPs).

Analytical grouping of organizational stages by R&D management phase

To guide interpretation, the eight organizational stages identified in the analysis are analytically grouped into three major R&D management phases: elicitation, evaluation, and execution with re-evaluation. This analytical grouping reflects the sequential structure through which sustainability-oriented initiatives are developed within the organization and aligns with Research Question 1 (RQ1), which examines how R&D management practices are enacted across the full project life cycle.

Elicitation refers to the formative sequence in which sustainability concerns are diagnosed, defined, and structured into potential R&D initiatives. These stages include the Operations, Product & Process Mapping, Registry of Environmental Aspects & Impact Identification (RAI), Environmental Objectives (EOs), and Environmental Plans & Programs (EPPs)—where sustainability is successively mapped, codified, formalized, and coordinated.

This phase culminates with the Trial Protocol, which bridges elicitation and evaluation by translating commitments into testable hypotheses and parameters. It completes the diagnostic arc by defining what will be tested, how evidence will be gathered, and what success will mean before any actual trial is conducted.

Evaluation encompasses the formal and interactional processes through which proposed interventions are assessed, interpreted, and validated for feasibility, compliance, and organizational alignment. This includes the Evaluation & Approval stage, where results of the trial are discussed, interpreted, and negotiated among R&D, QA, and management—transforming empirical evidence into institutional decision-making.

Execution and re-evaluation comprise the actual conduct of the approved trial, its monitoring, and its eventual normalization into operational standards. In this phase, R&D management practices revolve around coordination, documentation, and feedback integration. Sustainability becomes embedded in everyday routines through continuous learning, re-calibration, and the codification of trial outcomes into standard operating procedures and policy reference points.

Table 5.1 summarizes how the eight organizational stages correspond to these three analytic phases. Each subsequent subsection elaborates how sustainability is accomplished through the situated practices, documents, and interactions characteristic of each phase.

Table 5.1

Analytical Grouping of Organizational Stages by R&D Management Phase

R&D Management Phase	Organizational Stage	Core Analytical Function
Elicitation	1. Operations, Product & Process Mapping	Surfacing and describing operational realities; defining production context
	2. Registry of Environmental Aspects & Impact Identification (RAI)	Diagnosing environmental dependencies and framing sustainability concerns
	3. Environmental Objectives (EOs)	Formalizing sustainability intentions into measurable commitments

R&D Management Phase	Organizational Stage	Core Analytical Function
	4. Environmental Plans & Programs (EPPs)	Coordinating and anticipating improvement pathways across departments
	5. R&D Trial Protocol	Translating commitments into testable hypotheses, parameters, and success criteria (bridge to evaluation)
Evaluation	6. Evaluation and Approval	Interpreting trial data and negotiating managerial decisions; validating evidence and feasibility
Execution and Re-evaluation	7. Trial Execution and Monitoring	Conducting approved trials; observing, recording, and adjusting performance under operational conditions
	8. Trial Evaluation and Disposition	Integrating validated practices into SOPs and long-term organizational learning

Table 5.1 summarizes how the eight organizational stages correspond to the three analytic phases of sustainability-oriented R&D management. The elicitation phase encompasses the early diagnostic and planning activities through which sustainability concerns are identified, formalized, and translated into project proposals. The evaluation phase involves the interpretation and validation of proposed interventions through organizational review and decision-making processes. Finally, the execution and re-evaluation phase captures the implementation of approved trials and the subsequent integration of validated practices into operational routines.

Together, these phases illustrate how sustainability initiatives move from conceptualization to institutionalization within everyday R&D management work.

Analytic strategy: Integrating inductive coding with practice-based and ethnomethodological analysis

While the findings are presented according to the organizational stages of the R&D cycle, the analysis also incorporated inductive coding to identify recurring patterns across documents and interactions. Excerpts from mapping records, environmental registries, trial protocols, evaluation discussions, and monitoring reports were systematically coded and clustered into sub-themes and broader themes.

Coding was employed as an analytic consolidation device rather than as a standalone thematic method. Interpretation remained grounded in the Practice-Based Perspective (PBP), Ethnomethodology (EM), and Conversation Analysis (CA) outlined in Chapter IV. Themes are therefore understood not as abstract categories imposed on the data but as conceptual articulations of patterned organizational practices as they were accomplished in situ.

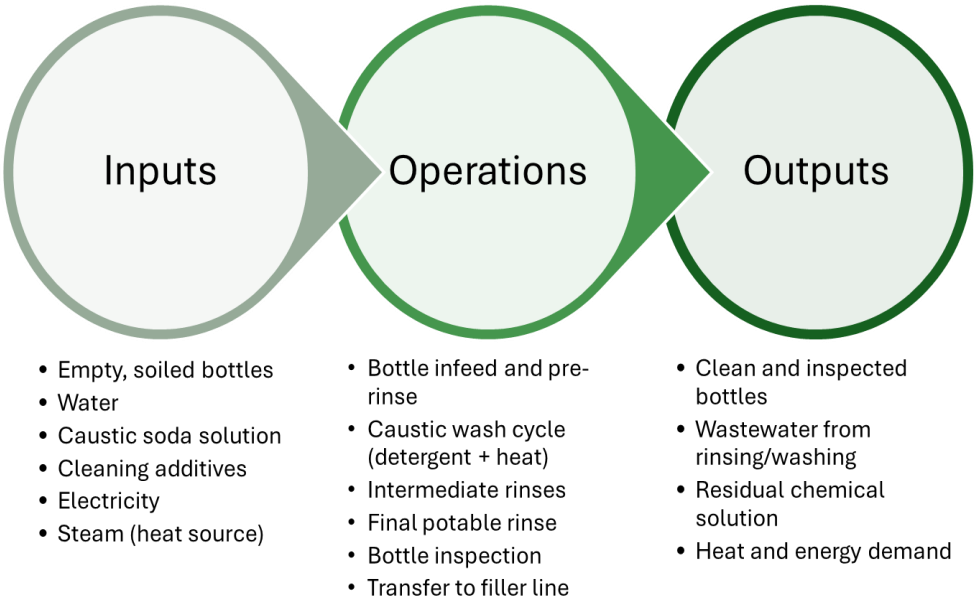
Accordingly, Chapter V maintains a stage-based presentation aligned with the R&D project life cycle while integrating inductively derived thematic patterns to clarify how sustainability-oriented R&D management practices unfold and what principles underlie them.

The following subsections examine each organizational stage in detail, illustrating how sustainability considerations are progressively articulated, evaluated, and embedded within the everyday practices of R&D management.

Stage 1 – Operations, product, and process mapping

The first stage in the development of sustainability-oriented R&D initiatives involves operations, product, and process mapping. This stage provides the diagnostic foundation for identifying potential sustainability concerns within production processes. Thus, one of the primary documents collected for this study was the Operations, Product, and Process Mapping Report prepared by Plant QA (2005) for the returnable glass bottle (RGB) washing line. This document is a routine account that sets out the inputs, operations, and outputs of the bottle washing process as illustrated in Figure 5.2. It provides insight into how production realities are described, how operational order is made intelligible, and how quality and efficiency are expressed in organizational records.

Figure 5.2. Operational logic of the bottle-washing process.



This sequence displays the intended function of the process: to ensure bottles are sanitized, quality-checked, and prepared for high-speed filling.

The analysis of the Operations, Product, and Process Mapping document for the Bottle Washer Equipment Upgrade project is situated within a combined Practice-Based Perspective (PBP) and Ethnomethodology (EM) orientation.

1.1. Analytic Result

PBP: Operational Order and Quality Assurance

From a practice-based perspective, the mapping illustrates how the washer line is organized as a disciplined sequence. Each stage has a defined operational purpose — from gross soil removal to microbial safety — thereby ensuring that bottles meet filling and QA standards.

PBP draws attention to how resource dependencies (e.g., water, steam, electricity, chemical dosing) are interwoven with production realities, showing that concerns about efficiency, sustainability, and product integrity are not separate categories but are accomplished together in the routine of bottle washing.

The arrangement of stages reflects planning foresight in resource allocation and scientific process in methodical treatment, with inspection identified as a later checkpoint. In practice, these stages embody R&D management principles of foresight, quality, and adherence to standards.

EM: Documentation as Organizational Work

The mapping is not merely descriptive; the document itself is treated as an account—a situated description that makes the bottle-washing process visible, reportable, and intelligible to organizational audiences. Its format (listing inputs, operations, and outputs) embodies the organizational need to render processes observable and accountable, particularly in relation to standards of cleanliness, safety, and reliability.

The document therefore does not just describe the washer; it does organizational work by providing a version of the process that is recognizable to QA, production, and management actors. As an accountability device, the mapping stabilizes a version of the process that can be audited, referenced in meetings, and updated across trials, ensuring continuity between documentation and practice.

1.2. Ethnomethodological Sensibilities

Building on the methodological framework discussed in Chapter IV, the analysis of the Operations, Product, and Process Mapping document is guided by three ethnomethodological sensibilities: indexicality, reflexivity, and accountability (Garfinkel, 1967; Trace, 2016; Maynard, 2023). These sensibilities serve as interpretive lenses for uncovering how members' ordinary documentary work makes sustainability observable and reportable within organizational settings.

Applied to this stage, they illuminate how R&D management practices—particularly those of planning, sequencing, and quality assurance—are accomplished through textual and procedural order. The next subsections describe how each sensibility manifests in the mapping document and how it contributes to answering the study's research questions.

Indexicality

The meaning of "inputs," "operations," and "outputs" is context-specific and cannot be detached from the practical setting of the bottle washing line. For instance, "wastewater" in this document is not an abstract environmental category but a concrete outcome of rinsing stages, meaningful within plant QA and operational monitoring. Indexicality directs attention to how such terms gain sense from their placement within production routines.

Reflexivity

The mapping does not only describe the process; it reflexively enacts and reproduces organizational values of cleanliness, quality, and efficiency. By documenting sequential stages, the report itself reaffirms that bottle washing is a controlled, inspectable, and auditable process. Reflexivity here shows how organizational order is displayed and stabilized through the very act of reporting.

Accountability

The mapping makes the washer process accountable by producing a version that others in the organization can inspect, challenge, or rely upon. Its structured format renders the process transparent to management, auditors, and operators, while also aligning with broader discourses of efficiency and resource management. Thus, accountability is accomplished through the very document under analysis.

1.3. Synthesis

Rather than serving as abstract concepts, these sensibilities operate as analytic orientations that sensitize the researcher to the contextual, reflexive, and accountable character of documentary practices. Through them, sustainability is understood not as a policy label but as an accomplished form of writing and reporting—a product of how organizational members render their work intelligible, auditable, and aligned with R&D management principles.

1.4. Sustainability as an Elicited R&D Management Practice

From a practice-based perspective, the act of mapping is itself a form of planning with foresight: it anticipates the inputs, operations, and outputs that will become focal points of R&D intervention. The structured depiction of resource flows translates technical performance into accountable categories, thereby enacting the

scientific process principle (systematic observation and documentation) and the Total Quality Management principle (control and verification of standards).

Viewed ethnomethodologically, the mapping is a situated method through which sustainability becomes observable and actionable within organizational work. By listing “wastewater,” “residual chemicals,” and “energy demand,” the document accomplishes the Technology–Society principle in practice—rendering environmental effects as legitimate organizational concerns rather than externalities. These traces show that sustainability is not merely a policy aspiration but an elicited management practice: it emerges as engineers and QA staff produce documents that make efficiency, resource stewardship, and compliance accountable to future R&D decisions.

In this sense, the mapping does not simply describe operations; it performs the elicitation stage of R&D management by organizing knowledge, defining controllable parameters, and aligning operational realities with sustainability objectives that will guide subsequent project formulation.

1.5. Illustrative Excerpts and Interpretation

To further demonstrate how sustainability is elicited and made consequential through documentary practices, the following excerpts are drawn directly from the Operations, Product, and Process Mapping report. Each fragment is analyzed as a situated accomplishment — showing how routine descriptions of inputs, operations, and outputs perform R&D management work. Through these textual details, one can observe how planning foresight, scientific process adherence, and accountability for resource use are enacted in practice. The accompanying interpretations connect these excerpts to the study’s analytic orientation of sustainability as an elicited R&D practice,

thereby grounding the conceptual discussion in naturally occurring organizational data.

Excerpt 1: *"Wastewater from rinsing and washing stages."*

Interpretation: This phrase treats wastewater as a normal operational output, yet by naming it, the mapping document already elicits sustainability as an area of concern. What appears as a simple description becomes an anticipatory signal: it frames water consumption and effluent management as issues to be monitored and improved in later project stages. The act of writing "wastewater" is thus an early move in making sustainability discussable within the R&D process.

Excerpt 2: *"Cleaned and inspected bottles, suitable for filling."*

Interpretation: This statement embeds QA standards within production outputs, connecting operational success to consumer safety and product reliability. By foregrounding inspection and suitability, it elicits the Human-Centered and Performance Principles, showing that the assurance of quality and safety is foundational to sustainability. Sustainability here is not post hoc—it is elicited in the way "clean" and "inspected" are rendered as organizational achievements.

Excerpt 3: *"Residual chemical solution requiring neutralization/disposal."*

Interpretation: Though presented as a routine by-product, this entry subtly invokes accountability for chemical management. The mention of "neutralization/disposal" calls forth both technical and ethical dimensions of operation, transforming waste handling into a site for sustainability-oriented reflection. The mapping thereby elicits the Technology–Society Principle by linking process maintenance to environmental responsibility.

Collectively, these excerpts illustrate that elicitation is not a separate planning stage, but an everyday practice enacted through organizational documentation. By naming, sequencing, and describing material flows, the mapping anticipates the future R&D work of evaluation and improvement. In this way, sustainability is not introduced from outside—it is elicited from within the practical routines of documenting production itself.

1.6. Coding Consolidation: Codes, Sub-Themes, and Theme

Across these excerpts, a patterned form of operational visibility work becomes apparent.

Table 5.2

Coding consolidation: codes, sub-themes, and theme (Stage 1)

Excerpt Pattern	Code	Sub-theme	Theme
Mapping of water, steam, chemical flows	Resource visibility through process mapping	Operational visibility work	Anticipating operational sustainability needs
Identification of wastewater and energy hotspots	Environmental problematization of inefficiencies		
Mapping conducted prior to project idea generation	Structured pre-project scanning	Systematic pre-elicitation structuring	

The codes relating to resource visibility and environmental problematization converge under the sub-theme of Operational Visibility Work. Together with systematic pre-elicitation structuring, these sub-themes synthesize into the broader theme of

Planning with Operational Foresight as Foundational Sustainability Work. At this stage, sustainability is not yet an innovation project but an outcome of structured operational observation. Mapping routines render water, energy, and chemical flows visible and therefore actionable.

This demonstrates that sustainability-oriented R&D elicitation is grounded in disciplined foresight practices embedded within routine operational governance. Rather than emerging from abstract environmental commitment, project ideas arise from documented visibility of inefficiencies and environmental burdens. In this sense, sustainability is accomplished through systematic pre-project scanning.

From an ethnomethodological perspective, mapping does not merely describe operations; it constitutes the method by which environmental issues are made observable, categorizable, and accountable. The patterned reliance on structured observation reflects the Planning and Foresight Principle and the Scientific Process Principle, anchoring innovation in documented operational reality.

1.7. Analytic Linkage to Research Questions

RQ1: What R&D management practices are enacted during the elicitation, evaluation, and execution of a sustainability-oriented project?

Elicitation: The Operations, Product, and Process Mapping document demonstrates how sustainability work begins through deliberate anticipation of inputs, utilities, and QA checkpoints. By tracing material flows and equipment dependencies, R&D practitioners coordinate foresight across departments—projecting operational requirements and identifying potential constraints before production begins. These mapping activities show sustainability as something performed through planning and coordination, rather than merely stated in policy.

1.8. Synthesis of RQ1

Across these stages, R&D management is seen as a procedural system that anticipates variability, structures control and enables adaptation. Sustainability is enacted through coordinated documentation and disciplined routines that bind planning, verification, and performance into a continuous cycle of organizational learning.

Stage 2 – Registry of Environmental Aspects & Impact Identification (RAI)

Registry of Environmental Aspects and Impact (RAI) is a formal document that categorizes the resource dependencies, emissions, and waste streams of the bottle washing operation. It systematically links each operational activity to its potential environmental effect and aligns them with relevant regulatory instruments and internal norms. In doing so, the registry renders the environmental consequences of production legible to the organization, transforming everyday operations into auditable categories of compliance and improvement.

The analysis of the RAI for the Bottle Washer Equipment Upgrade project is situated within a combined Practice-Based Perspective (PBP) and Ethnomethodology (EM) orientation. Table 5.3 presents a condensed version of the RAI to illustrate its structure and orientation.

Table 5.3

Condensed version of the Registry of Environmental Aspects and Impact (RAI)

Operational Aspect	Observed Dependency	Potential Impact	Reference / Internal Note	Impact Rating	Impact Category	Current Organizational Response	Improvement Pathway / Priority Signal
Use of electricity	Powers conveyors, pumps, and caustic heating cycles	Resource draw from grid (coal-dependent supply)	RA 11285 (Energy Efficiency Act); SO: ≤ 0.153 KwH/case	20	Significant	Energy conservation programs	Signals project priority for energy recovery retrofits
Use of water	Pre-rinse, soak, and final rinse stages	Resource depletion; localized water stress	PD 1067 (Water Code); SO: ≤ 0.173 hL/case	15	Significant	Water conservation initiatives	Opportunity for reuse/recycling system development
Use of chemicals	Caustic soda and additives in wash cycles	Handling require-ments; chemical depletion	PKG SO: dosing norms	5	Acceptable	Process optimization programs	Suggests R&D priority on alternative chemistries or dosing controls

Operational Aspect	Observed Dependency	Potential Impact	Reference / Internal Note	Impact Rating	Impact Category	Current Organizational Response	Improvement Pathway / Priority Signal
Waste generation (cullets)	Broken glass from handling	Solid waste accumu-lation	RA 9003 (Solid Waste Act)	5	Acceptable	Recovery & recycling	May trigger packaging R&D (lightweight design, breakage reduction)
Wastewater generation	Effluent with caustic residues, organic load	Water pollution risk	RA 9275 (Clean Water Act)	5	Acceptable	On-site treatment, Wastewater treatment facility	Encourages effluent treatment upgrades and monitoring

The registry demonstrates how operational data are re-contextualized into categories of “aspects” and “impacts.” Each row displays a translation: what begins as a material dependency (water, energy, chemical) is reframed into a codified environmental significance that can be tracked, audited, and improved. This transformation represents the moment where sustainability moves from process description (as in the mapping document) to compliance-oriented codification.

2.1. Analytic Result

PBP: Compliance as a Shaper of Future Projects

From a practice-based perspective, the registry shows how compliance routines do not merely constrain but actively shape innovation trajectories. By linking energy consumption to RA 11285, or wastewater generation to RA 9275, the document implicitly signals where R&D efforts should focus—on energy recovery, water reuse, or process optimization. Compliance, therefore, is not the end point but a generator of organizational foresight: it defines what counts as *improvable* and *innovable* in daily operations.

The RAI materializes this link between regulation and imagination. It embeds the logic of improvement into the organization’s daily monitoring, shaping both present accountability and future project formulation.

EM: Categorization as Organizational Practice

From an ethnomethodological standpoint, the RAI reveals how *significance* is practically accomplished. Entries such as “resource depletion” or “solid waste accumulation” are not self-evident truths; they are produced through documentary work that aligns operational measurements (e.g., 0.173 hL/case water use) with legal and organizational frames (e.g., PD 1067). The act of classifying operational data into

“aspects” and “impacts” makes environmental consequences visible, intelligible, and actionable.

Thus, the registry functions as an *accountability device*—a situated method by which members render their production processes transparent to auditors, regulators, and managers. Through this, the organization accomplishes accountability by producing categories that others can inspect, verify, and use for decision-making.

2.2. Ethnomethodological Sensibilities

Building on the methodological orientation outlined in Chapter IV, the analysis of the RAI draws on three ethnomethodological sensibilities—indexicality, reflexivity, and accountability (Garfinkel, 1967; Trace, 2016; Maynard, 2023). These sensibilities guide attention to how members make environmental significance observable and reportable through documentation. In the context of the registry, they illuminate how sustainability is not a fixed attribute of operations but an accomplished outcome of everyday evaluative practices—how meaning, responsibility, and order are continuously produced through the act of recording, classifying, and referencing.

Indexicality

Terms such as “resource depletion,” “cullet recovery,” or “localized water stress” derive their meaning from the specific operational and regulatory setting of the bottle-washing line. A metric like *0.173 hL/case water use* is not simply numerical—it indexes a situated performance benchmark against both internal norms and external expectations of conservation.

Reflexivity

The registry both describes and reproduces organizational order. By documenting resource dependencies as “significant aspects,” the organization

reflexively enacts its environmental responsibility. The very act of filling in the registry reinforces the legitimacy of ongoing efficiency programs and embeds sustainability within everyday documentation.

Accountability

Through structured categories, legal citations, and numerical references, the registry renders environmental performance auditable. Accountability operates at two levels—externally (to regulators under the Clean Water Act, Energy Efficiency Act, etc.) and internally (to QA, Production, and R&D). The document thereby makes environmental performance calculable, reportable, and governable.

2.3. Synthesis

The RAI transforms operational dependencies into formalized categories of significance, where sustainability is codified through the language of compliance and improvement. EM reveals how this codification is achieved through members' routine documentation work—writing, referencing, and benchmarking that render impacts accountable. PBP, in turn, shows how these same registers shape project imagination: every compliance entry doubles as a potential R&D cue, pointing toward future retrofits or efficiency innovations. Together, they demonstrate how the registry is both a mirror of current operations and a map for future sustainability action.

Figure 5.3. Flow of the registry of environmental aspects and impact.

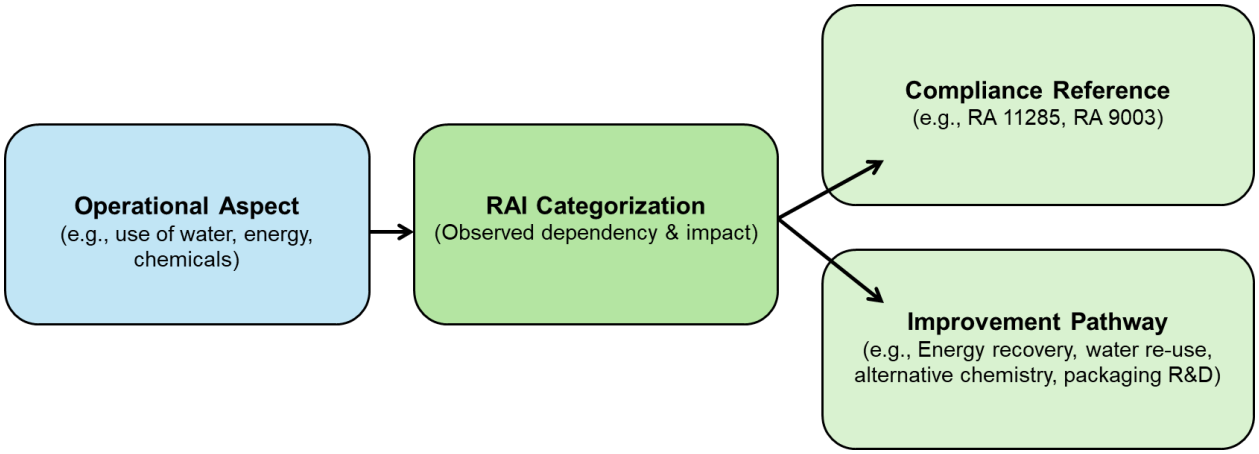


Figure 5.3. illustrates how the RAI functions as both an operational and organizational device. From a PBP perspective, it depicts the translation from *operations → aspects → impacts → improvement pathways*. This sequence demonstrates how regulatory categories mobilize the organization toward projective innovation. From an EM perspective, the figure highlights how *significance* is achieved through categorization, referencing, and documentation formats, rendering everyday operations visible, accountable, and auditable. Thus, the registry does not merely record impacts—it organizes the movement from operational practice to compliance recognition and onward to innovation.

2.4. Sustainability as a Diagnostic Logic in R&D Management Practice

While the registry is formally structured around compliance and organizational response, it functions in practice as a diagnostic mechanism that embeds sustainability into the everyday work of R&D management. Through its systematic listing of dependencies—such as power, water, and chemicals—the registry translates operational realities into traceable categories of environmental significance. Each

entry represents a practical diagnosis: what counts as an “aspect,” what constitutes an “impact,” and which among these signal opportunities for improvement.

From an ethnomethodological standpoint, this evaluative work is a situated accomplishment. Members make sustainability visible and reportable through the ordinary acts of listing, benchmarking, and classifying. The registry performs accountability by transforming practical activities into auditable traces that can be referenced, verified, and acted upon within the organization.

From a practice-based perspective, the RAI converts compliance data into developmental insight. As each category is linked to an “improvement pathway,” the registry turns documentation into a medium for organizational learning—where environmental performance becomes both a diagnostic record and a prompt for future innovation. In this sense, sustainability is not an external advocacy but an accomplished routine, achieved as members continuously interpret, compare, and refine their operations through documentary practice.

By institutionalizing these diagnostic routines, the RAI situates sustainability within the logic of R&D management—bridging operational monitoring with the elicitation of prospective projects and technical solutions. This analytical moment thus lays the groundwork for understanding how organizational accountability becomes a source of actionable innovation.

2.5. Illustrative Excerpts and Interpretation

The following excerpts from the Registry of Environmental Aspects and Impacts demonstrate how sustainability is diagnosed through documentation. Each entry is not merely a record of consumption or compliance but an organizational reasoning device—a way of interpreting operational realities and projecting future improvements.

Excerpt 1: *"Water consumed in pre-rinse, soaking, and final rinse stages … localized water stress."*

Interpretation: This fragment exemplifies how a routine process parameter becomes a diagnostic statement. The registry recontextualizes water use (0.173 hL/case) from a production metric into an environmental concern, thereby transforming ordinary monitoring data into evidence for sustainability intervention. Through this translation, the R&D team identifies potential reuse initiatives and infrastructure upgrades, enacting sustainability through the diagnostic act itself.

Excerpt 2: *"Signals project priority for energy recovery retrofits in washer design."*

Interpretation: Here, compliance data under RA 11285 are mobilized as a rationale for innovation. The entry performs diagnostic work by converting a regulatory observation into a design signal—defining energy efficiency not just as a compliance requirement but as a prospective R&D opportunity. Diagnosis, thus, becomes a generative practice: it produces directions for technological improvement.

Excerpt 3: "May trigger packaging R&D (lightweight design, breakage reduction)."

Interpretation: In this statement, waste (cullets) is reframed as a productive cue for innovation. What begins as a record of material loss is turned into an argument for design improvement, linking production data to packaging research. This shows how the registry performs cross-functional evaluation—connecting operational data, environmental management, and product development under the same sustainability logic.

Together, these excerpts illustrate how the registry, as a diagnostic document, performs the dual task of making sustainability visible and transforming it into organizational action. Diagnosis, in this sense, is both a measurement and a method for imagining what the organization can do next.

2.6. Coding Consolidation: Codes, Sub-Themes, and Theme

Across these records, a patterned practice of institutional classification and prioritization becomes visible.

Table 5.4

Coding Consolidation: Codes, Sub-Themes, and Theme (Stage 2)

Excerpt Pattern	Code	Sub-theme	Theme
Use of significance matrix scoring	Categorization of environmental risk	Risk categorization practices	Classifying priorities and directing sustainability efforts
Assignment of 'significant' label	Institutional threshold invocation		
Impacts linked to regulatory compliance	Regulatory anchoring	Compliance anchoring	

The codes under risk categorization practices and compliance anchoring merge into the theme of Institutional Classification as a Mechanism for Sustainability Prioritization. Through significance scoring and threshold labeling, environmental concerns are transformed into ranked organizational priorities. Sustainability here is not simply identified but institutionally structured.

This stage demonstrates that sustainability-oriented R&D does not proceed from generic environmental awareness but from formally classified “significant

aspects.” The registry operates as a decision-filtering device, determining which issues warrant strategic attention and potential innovation.

Through an EM lens, the significance matrix functions as a practical reasoning tool: it stabilizes what counts as important and legitimizes resource allocation. The patterned use of scoring systems reflects the Total Quality Management Principle and the Value-Orientation Principle, embedding sustainability within institutionalized evaluation routines.

2.7. Analytic Linkage to Research Questions

RQ1: What R&D management practices are enacted during the elicitation, evaluation, and execution of a sustainability-oriented project?

Elicitation: The Registry of Environmental Aspects and Impacts (RAI) operationalizes foresight by identifying where resource dependencies, consumption trends, and waste streams signal the need for improvement. Through this diagnostic mapping, managers and technical staff surface the practical sites of environmental concern, making potential sustainability initiatives traceable within production data. The act of registry filling itself is a collaborative accomplishment—where production realities are transformed into documented signals for R&D attention.

2.8. Synthesis of RQ1

Across these stages, sustainability-oriented R&D management emerges as an iterative documentation system: elicited through diagnostic mapping. The RAI thus performs sustainability not as a separate agenda but as an organizing practice of observation, classification, and responsive action.

Stage 3 – Environmental Objectives (EO)

The Environmental Objectives document specifies operational goals related to energy and water efficiency in the bottle-washing process. Unlike abstract corporate statements, these objectives are formulated in plant-specific terms while remaining aligned with broader sustainability frameworks. They express how sustainability aspirations are translated into measurable and auditable commitments within everyday operations.

The Environmental Objectives (EOs) related to the bottle washing process were analyzed through the dual lens of Practice-Based Perspective (PBP) and Ethnomethodology (EM).

Table 5.5 presents the excerpt of the Environmental Objectives (EO) related to the bottle washing process.

Table 5.5

Environmental Objectives (EO) Related to the Bottle Washing Process

Local Objective	Operational Target	Alignment & Framing
Ensure efficient energy use in bottle washing and utilities	Achieve ≤ 0.153 kwh/case power consumption	Anchored in corporate energy efficiency programs (RA 11285) and local conservation efforts; emphasizes balancing operational stability with continuous optimization
Improve water stewardship in cleaning and process cycles	Achieve ≤ 0.173 hL/case water consumption	Connected to corporate water sustainability commitments and national frameworks (PD 1067); locally, addresses groundwater stress and operational reuse initiatives

These objectives frame sustainability as locally constructed commitments—grounded in the material realities of plant operations while reflexively aligned with corporate and policy expectations. Table 5.5 highlights operational ownership, quantitative accountability, and strategic alignment, showing how environmental goals function simultaneously as technical targets and organizational promises.

3.1. Analytic Result

PBP: Local Construction with Corporate Alignment

The objectives are locally situated, tied to the bottle-washing and utility cycles, yet they gain legitimacy by aligning with corporate programs and national policy mandates. From a PBP lens, sustainability concerns are enacted through operational routines that translate corporate discourse into measurable practice. Commitments to energy efficiency (≤ 0.153 kWh/case) and water stewardship (≤ 0.173 hL/case) illustrate how production realities—resource inputs, cleaning cycles, utilities—are converted into performance indicators that both express and stabilize sustainability within everyday work.

EM: Objectives as Legitimation Devices

From an EM perspective, the objectives operate as documented accounts that perform organizational work by legitimizing future R&D and operational projects. The quantified targets transform abstract intentions into recognizable, reportable, and auditable commitments. They reflexively create the grounds on which managers can justify new interventions—such as water-reuse systems or energy-recovery retrofits—thus functioning as both descriptive statements and performative instruments of accountability.

3.2. Ethnomethodological Sensibilities

Building on the methodological orientation outlined in Chapter IV, the analysis of the EO draws on three ethnomethodological sensibilities—indexicality, reflexivity, and accountability (Garfinkel, 1967; Trace, 2016; Maynard, 2023). These sensibilities illuminate how members make sustainability observable, reportable, and actionable through documentation.

Indexicality

Terms like “efficient energy use” and “water stewardship” acquire meaning within the local operational and regulatory context. The figure “≤ 0.173 hL/case” indexes a situated benchmark derived from QA experience, production constraints, and environmental scarcity.

Reflexivity

By prescribing numerical targets, the EO does not merely describe expectations—it reproduces the organizational value that sustainability must be quantified and demonstrable. Each revision or monitoring cycle reflexively re-affirms that commitment.

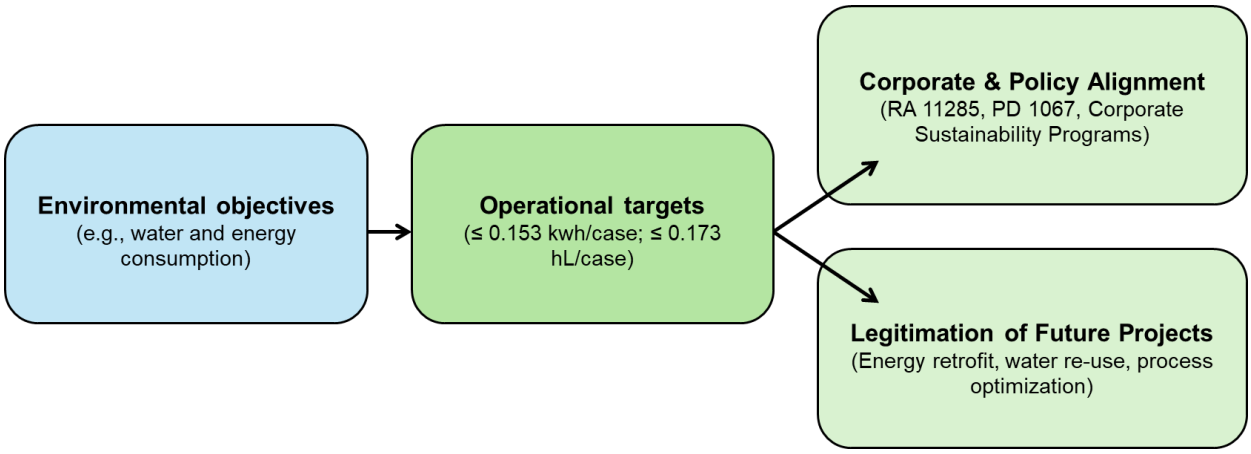
Accountability

The EO situates plant practices within corporate programs and national regulations, making performance traceable and auditable to internal and external audiences. Accountability is enacted through the document’s very form—its tables, metrics, and sign-offs.

3.3. Synthesis

Through these sensibilities, the Environmental Objectives appear not as static targets but as organizational accomplishments: documents through which sustainability is continually produced, validated, and governed in practice.

Figure 5.4. Visual matrix figure for the environmental objectives.



The matrix illustrates how objectives originate in local operational concerns and are translated into measurable targets that reflexively align with corporate and policy frames. It visualizes how objectives simultaneously anchor local practice, connect to external frameworks, and project organizational trajectories.

3.4. Sustainability as a Formalized R&D Commitment

The phrasing of the objectives—such as “energy use in bottle washing” and “water stewardship in cleaning cycles”—illustrates how sustainability is not treated as an external mandate but as an integral planning logic. Through this phrasing, sustainability becomes formalized: it is rendered tangible and actionable within the same managerial vocabulary of efficiency, precision, and continuous improvement that organizes QA and R&D work. This integration demonstrates how sustainability is

anticipated and framed through practice—it is not merely declared but enacted in the everyday disciplines of target-setting, benchmarking, and prospective compliance.

3.5. Illustrative Excerpts and Interpretation

The following excerpts exemplify how the document transforms sustainability aspirations into quantifiable and accountable forms of organizational work. Each entry shows how a local production goal is simultaneously framed as an ethical and corporate sustainability commitment.

Excerpt 1: *"Achieve ≤ 0.153 kwh/case power consumption."*

Interpretation: This KPI localizes the abstract concept of energy conservation into a precise operational benchmark for the bottle-washing process. The metric anchors sustainability within production control routines, where deviations are tracked, and corrective actions are standard practice. It also mirrors national and corporate sustainability frameworks such as RA 11285 (Energy Efficiency and Conservation Act), translating regulatory intent into measurable R&D performance.

In this sense, energy reduction is not only a technical goal but a practice of sustainability accounting—a way of making environmental responsibility observable, auditable, and improvable within plant operations. The target thus embodies both the Performance Principle (ensuring process efficiency) and the Technology–Society Principle (linking technological optimization to public resource conservation).

Excerpt 2: *"Improve water stewardship in cleaning and process cycles … addresses groundwater stress."*

Interpretation: The term "water stewardship" reframes a production necessity—water for bottle washing—into a sustainability commitment tied to local ecological conditions. By referencing "groundwater stress," the document situates

operational efficiency within a broader socio-environmental discourse. It signals that every incremental improvement in water use is simultaneously a corporate, community, and ecological contribution. The objective legitimizes investments in reuse and recycling technologies by transforming environmental constraints into R&D opportunities. This exemplifies the Planning and Foresight Principle (anticipating long-term sustainability trajectories) and the Human-Centered Principle (acknowledging responsibility toward shared water resources).

Taken together, these excerpts demonstrate how sustainability in R&D management is accomplished through documentation. The Environmental Objectives convert resource concerns into measurable duties that tie the technical (efficiency), the managerial (performance), and the accountability (stewardship) dimensions of organizational life. From a Practice-Based Perspective, they show how R&D work links innovation to regulatory and societal expectations; from an Ethnomethodological view, they reveal how sustainability becomes accountable—made visible, calculable, and actionable through the very documents that guide operational practice.

3.6. Coding Consolidation: Codes, Sub-Themes, and Theme

Across these EO formulations, a patterned practice of quantified sustainability commitment becomes evident.

Table 5.6

Coding Consolidation: Codes, Sub-Themes, and Theme (Stage 3)

Excerpt Pattern	Code	Sub-theme	Theme
Quantified reduction targets (e.g., % reduction)	Measurable sustainability target setting	Quantified target construction	Formalizing sustainability targets
Alignment with corporate environmental policy	Policy alignment invocation	Policy-embedded legitimization	
Objectives derived from significant aspects	Traceable derivation logic	Traceable objective derivation	

Codes relating to quantified target construction, policy-embedded legitimization, and traceable objective derivation merge into the theme of Strategic Formalization of Sustainability Commitments Through Quantified Targets. Environmental issues identified in prior stages are translated into measurable institutional commitments.

This shift marks a transformation from prioritized concern to documented expectation. Sustainability becomes numerically expressed, strategically aligned, and formally recorded, thereby creating normative grounds for subsequent managerial and technical action.

The reliance on quantification reflects the Performance Principle, while alignment with corporate policy reflects the Value-Orientation Principle. From a practice-based perspective, objectives stabilize sustainability by embedding it into the organization’s strategic planning architecture.

3.7. Analytic Linkage to Research Questions

RQ1: What R&D management practices are enacted during the elicitation, evaluation, and execution of a sustainability-oriented project?

Elicitation: The Environmental Objectives (EOs) anticipate operational improvements by identifying where efficiency and resource stewardship hold the greatest impact. Through this anticipatory framing, objectives shift organizational focus from reactive compliance to proactive enhancement. They formalize managerial foresight by defining the direction of improvement—translating emerging operational issues into structured sustainability commitments.

3.8. Synthesis of RQ1

Across these stages, the Environmental Objectives demonstrate how sustainability is enacted through quantification and coordination. Foresight, measurement, and monitoring turn environmental intent into structured organizational action, allowing sustainability to circulate as a shared managerial routine rather than a stand-alone initiative.

Stage 4 – Environmental Plans & Programs (EPP)

The Environmental Plans and Programs (EPP) translate objectives into anticipated operational pathways. Each program represents a locally constructed improvement pathway derived from the Environmental Aspects and Impact Registry (RAI) and the Environmental Objectives (EO). In practice, these plans are not presented as sustainability projects per se but as evolving operational routines—embedded in plant procedures, QA systems, and inter-departmental coordination. They demonstrate how energy and water stewardship are performed through the

everyday disciplines of efficiency, maintenance, and scheduling, consistent with corporate and policy frames yet grounded in local production realities.

Table 5.7

Condensed Version of the Environmental Plans and Programs (EPP) Related to the Bottle-Washing Process

Program	Local Objective	Operational Target	Key Operationalized Activities	Subtle Signal / Focus
2023 Energy Program – Bottle Washing & Utilities	Ensure efficient energy use in bottle washing and utilities	≤ 0.153 kWh/case	SOP integration into PAWIM; coordination with production planning; joint packaging–engineering utilities audits; collaboration with R&D on energy-recovery retrofits	Energy efficiency framed as an embedded operational discipline guiding planning, scheduling, and maintenance optimization
2023 Water Program – Bottle Washer & Cleaning Cycles	Improve water stewardship in cleaning and process cycles	≤ 0.173 hL/case	SOP integration into PAWIM; joint packaging–engineering leak audits; optimized production scheduling; washer adjustment to balance caustic concentration; collaboration with R&D on reuse and recycling system development	Water conservation presented as an adaptive operational concern continually recalibrated to chemical dosing, cleaning cycles, and process demands

Table 5.7 shows how these plans translate environmental objectives into *structured* operational responses. Each program represents a locally constructed improvement pathway derived from the Environmental Aspects and Impact Registry (RAI) and the Environmental Objectives (EO). The initiatives are situated within the

daily disciplines of QA, Engineering, and Production—embedded in SOPs, audits, and scheduling routines rather than framed as separate sustainability projects.

Together, the two programs demonstrate how energy and water stewardship are accomplished through the procedural logics of efficiency, coordination, and preventive maintenance. They also illustrate how the plant operationalizes its environmental commitments as traceable, measurable, and auditable actions, ensuring that improvement remains both technically grounded and organizationally accountable.

The detailed Environmental Plans and Programs outline the plant's operational initiatives for energy and water management. These include routine activities such as SOP integration, joint audits, production scheduling, and preventive maintenance, which together embody how environmental objectives are enacted in daily work. Rather than isolated compliance tools, the plans function as living documents that guide coordination and sustain improvement pathways across departments.

4.1. Analytic Result

PBP: Contextualizing Priorities through Operational Coordination

From a Practice-Based Perspective, the Environmental Plans and Programs (EPP) demonstrate how sustainability priorities—such as energy conservation, water stewardship, and resource efficiency—are contextualized, recalibrated, and anticipated and structured through everyday production coordination. The programs reflect how operational realities continually shape what sustainability means in practice. For instance, energy efficiency is not treated as a stand-alone initiative but as part of production planning and machine scheduling, while water conservation is intertwined with QA routines, caustic dosing, and cleaning-in-place cycles.

This perspective reveals that the EPPs are situated practices rather than fixed policy instruments. Their content changes as production conditions shift—when caustic concentration increases, or when maintenance cycles tighten, the meaning of "optimization" and "stewardship" changes with them. Thus, the plans materialize sustainability as an adaptive organizational routine where improvement arises from coordination, not prescription. In this way, the EPPs exemplify how R&D management sustains alignment between technical efficiency and environmental responsibility through locally meaningful practices.

EM: Plans as Organizational Accounts and Commitments

From an Ethnomethodological perspective, the EPPs function as organizational accounts that formalize commitment and accountability. They do not simply list tasks or targets; they describe the organization's own methods for making environmental responsibility observable, reportable, and auditable. Each entry—whether an SOP integration, a joint audit, or a scheduling adjustment—represents a member's method for demonstrating stewardship through documentation.

In this sense, the EPPs accomplish accountability on two levels. First, they distribute responsibility across functional groups (Packaging, Engineering, QA, and Planning), creating shared ownership of environmental outcomes. Second, their written form establishes the grounds for internal and external verification—aligning local operations with corporate programs (e.g., Enercon, Water Stewardship) and national policies (RA 11285, PD 1067). These documents thus do double work: they direct practical coordination while legitimizing that coordination within the organization's accountability structure.

Viewed through both lenses, the Environmental Plans and Programs show how sustainability is not imposed as a top-down directive but framed through coordination, documentation, and adjustment. The plans render environmental performance actionable in the same language that governs production—efficiency, reliability, and control. Through these routinized acts of planning and reporting, sustainability becomes part of the plant's ordinary operational logic, sustaining the dual aim of compliance and innovation that defines R&D management practice.

4.2. Ethnomethodological Sensibilities

Building on the methodological orientation outlined in Chapter IV, the analysis of the Environmental Plans and Programs (EPP) draws on three ethnomethodological sensibilities—indexicality, reflexivity, and accountability (Garfinkel, 1967; Trace, 2016; Maynard, 2023). These sensibilities guide attention to how organizational members make sustainability observable, reportable, and actionable through their routine documentation and coordination work. In the EPPs, energy and water programs are not abstract commitments but practically accomplished forms of order—the ways through which sustainability is done and demonstrated in everyday operations.

Indexicality

The meaning of terms such as "optimization," "stewardship," or "abnormalities" depends on the specific operational setting of the bottle-washing line. For example, a metric like "≤ 0.173 hL/case" is not a detached conservation figure; it indexes a performance standard shaped by washer throughput, caustic dosing, and local groundwater limitations. Similarly, an instruction like "joint utilities audits" carries a locally recognized meaning of collaboration, referring to a coordinated practice between Packaging and Engineering that ensures accountability through co-

observation. Thus, the language of the plans derives sense from the situated contexts in which these activities are performed.

Reflexivity

The EPPs do not simply describe coordination—they enact it. By specifying programs, assigning departments, and integrating SOPs into PAWIM, the documents reproduce the very organizational order they appear to record. Every line item—such as scheduling coordination or water-use adjustment—reaffirms the institutional expectation that environmental performance must be visible, measurable, and proceduralized. In this way, the plans reflexively sustain the corporate value that efficiency and stewardship are inseparable dimensions of good operational practice. The act of documentation thus becomes a reflexive performance of order: sustainability exists because it is continually written, monitored, and re-written into procedures.

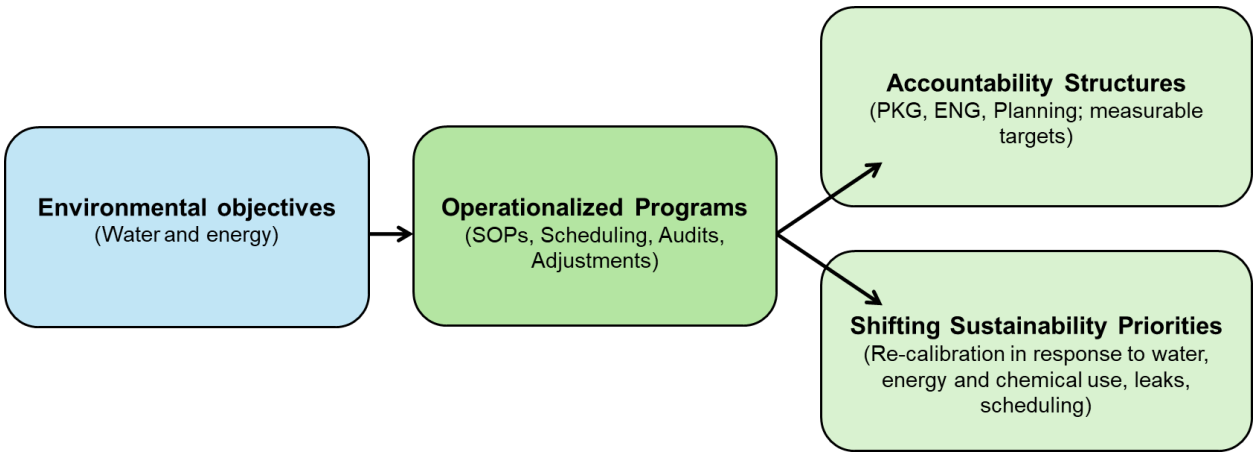
Accountability

The EPPs make environmental responsibility auditable and governable. By linking each action to corporate programs (Enercon, Water Conservation) and national regulations (RA 11285, PD 1067), the plans transform local routines into reportable outcomes. Accountability operates both horizontally—across departments through joint audits, co-signatures, and inter-departmental reporting—and vertically—through alignment with corporate and regulatory frameworks. The written form itself, with its structure of objectives, operational targets, and improvement pathways, ensures that responsibility is not just assigned but made observable and reviewable in organizational discourse.

4.3. Synthesis

Through these sensibilities, the Environmental Plans and Programs emerge as organizational accomplishments rather than administrative outputs. They show how sustainability is continually produced through documentation, coordination, and monitoring—how members create a sense of order and accountability through everyday paperwork. From an ethnomethodological standpoint, the EPPs transform efficiency routines into moral accounts of care; from a practice-based view, they link operational stability with continuous learning. Together, they illustrate how R&D management practices transform environmental objectives into living systems of coordination that sustain improvement over time.

Figure 5.5. Visual matrix figure for the environmental plans and programs.



The matrix illustrates how environmental objectives are translated into operationalized programs and accountability structures. From a PBP view, shifting priorities—energy, water, efficiency—are contextualized into SOP cascades, audits, and scheduling. From an EM view, these programs are formalized commitments that

make sustainability priorities visible and re-calibratable as operational realities change.

4.4. Sustainability as a Coordinated R&D Management Practice

Sustainability within the Environmental Plans and Programs is not presented as an independent agenda; rather, it is coordinated into the daily organization of work. The programs show how energy and water priorities are embedded within production planning, utilities management, and QA routines. In this sense, sustainability is performed through coordination—it is enacted as part of the same managerial logic that governs efficiency, reliability, and performance improvement. The EPPs thus materialize R&D management practices that convert environmental objectives into measurable, actionable, and legitimate forms of operational work.

From a Practice-Based Perspective (PBP), these programs represent how improvement is accomplished through joint routines and practical adjustments rather than through formal sustainability rhetoric. From an Ethnomethodological (EM) view, they serve as organizational accounts—documents that make environmental responsibility both visible and discussable in the language of production, metrics, and maintenance. In this way, sustainability is rendered not as an aspirational statement but as an ongoing coordination achievement.

4.5. Illustrative Excerpts and Interpretation

The following excerpts from the Environmental Plans and Programs illustrate how coordination, recalibration, and accountability transform sustainability commitments into ordinary operational practice.

Excerpt 1: *"Joint utilities audits (Packaging + Engineering) to detect and immediately correct abnormalities and other areas for improvement."*

Interpretation: This entry exemplifies how environmental performance is achieved through collaborative diagnostics. Energy and water efficiency are enacted not by policy enforcement but by collective observation and shared accountability. The phrase "joint audits" signals an established coordination practice that integrates QA verification, engineering maintenance, and packaging oversight. This joint activity translates the abstract ideal of stewardship into a concrete operational rhythm—an iterative cycle of detection, correction, and documentation. It embodies the Performance and Total Quality Management (TQM) Principles of R&D management, showing how sustainability is institutionalized through cross-functional problem solving rather than isolated initiatives.

Excerpt 2: "Adjustment of washer water use to balance increased caustic concentration with conservation targets."

Interpretation: This phrase highlights the dynamic negotiation of competing priorities within production: cleaning efficacy versus water conservation. The act of "balancing" reflects how operators and QA personnel continuously recalibrate process parameters to sustain both quality and resource targets. Such recalibration demonstrates the Scientific Process Principle—applying systematic monitoring and controlled experimentation to achieve optimal results—and the Technology–Society Principle, which aligns plant-level efficiency with environmental responsibility. The excerpt shows sustainability not as static compliance but as a responsive mode of management, where each technical adjustment embodies ethical and ecological awareness.

Excerpt 3: “Coordinate with production planning to minimize changeovers and idle gaps.”

Interpretation: Here, sustainability is enacted through temporal coordination. Energy reduction is achieved by synchronizing production schedules rather than by adding new technology. The phrase reflects the Planning and Foresight Principle, demonstrating that efficient scheduling serves as a preventive sustainability mechanism—reducing energy spikes and resource waste before they occur. It shows how time management itself becomes an environmental practice, reinforcing that sustainability is woven into the ordinary flow of R&D and production coordination.

Across these examples, sustainability appears as an emergent property of coordination. The Environmental Plans and Programs translate environmental goals into everyday operational reasoning: scheduling decisions, parameter adjustments, and inter-departmental audits. From a PBP stance, they show how improvement and adaptation arise from ongoing collaboration between departments. From an EM stance, they illustrate how documentation serves as a reflexive tool that both records and sustains organizational order. In summary, sustainability in R&D management is accomplished through practices of alignment—where efficiency, accountability, and environmental care converge within the plant’s ordinary routines.

4.6. Coding Consolidation: Codes, Sub-Themes, and Theme

Across these programs and assignments, a patterned mode of distributed sustainability coordination becomes visible.

Table 5.8

Coding Consolidation: Codes, Sub-Themes, and Theme (Stage 4)

Excerpt Pattern	Code	Sub-theme	Theme
Enercon and water reuse initiatives	Operationalization of objectives	Operational embedding	Stabilizing sustainability programs
Assignment of program ownership	Distributed responsibility allocation	Distributed responsibility	
Attachment of measurable monitoring indicators	Program measurability	Monitoring Governance	

The sub-themes of operational embedding, distributed responsibility, and monitoring governance synthesize into the theme of Programmatic Stabilization of Sustainability Through Structured Implementation. At this stage, sustainability commitments are translated into routinized programs, assigned ownership, and measurable indicators.

This demonstrates that sustainability is enacted not merely through aspiration but through structured role allocation and ongoing monitoring. Responsibility is distributed across organizational actors, making sustainability a collective performance rather than a centralized directive.

Through EM, the attachment of indicators functions as an accountability mechanism: performance becomes reportable, comparable, and correctable. The patterned structuring of implementation reflects the Human-Centered Principle and the Total Quality Management Principle, reinforcing sustainability as coordinated managerial work.

4.7. Analytic Linkage to Research Questions

RQ1: What R&D management practices are enacted during the elicitation, evaluation, and execution of a sustainability-oriented project?

Elicitation: The Environmental Plans and Programs (EPPs) demonstrate organizational foresight by identifying and prioritizing operational areas for improvement—particularly those involving energy and water efficiency. Through plant-level audits, performance monitoring, and interdepartmental coordination meetings, the EPPs transform environmental objectives into specific operational strategies. These practices show sustainability as planned coordination: the deliberate anticipation of constraints and alignment of resources to pre-empt inefficiency.

4.8. Synthesis of RQ1

Across these practices, the EPPs illustrate how sustainability is enacted as coordinated routine work—where planning, measurement, and interdepartmental collaboration transform environmental intent into operational improvement. Sustainability is therefore performed not as a separate initiative but as an embedded management cycle of foresight, verification, and adaptation.

Stage 5 – Trial Protocol (TP)

The Trial Protocol represents the pivotal translation of sustainability commitments into experimental practice. Planned improvements will be tested under operational reality—linking R&D inquiry, technical coordination, and organizational accountability.

In this study, these materials are treated as Trial Protocols to foreground their situated, procedural, and method-oriented character within R&D practice. The term reflects how these documents are used *in situ*—as working instructions that organize

tasks, specify parameters, and render trial activities accountable to standards of quality and efficiency. At the same time, they also exhibit a proposal character: they articulate rationales, resource needs, and anticipated gains, thereby legitimizing the trial within broader logics of innovation, compliance, and sustainability. They are thus analyzed as organizationally produced accounts that are both instructive and justificatory—practically adequate descriptions through which R&D work becomes visible, reportable, and actionable.

Table 5.9

Condensed Version of the Bottle Washer Trial Protocol

Component	Description	Key Operationalized Elements	Signal / Focus
Project Rationale	Declining washer performance; high water (17.9 L/case), energy, and caustic use	Links resource inefficiency to quality and cost	Efficiency framed as strategic renewal
Objectives / Targets	Reduce water ≥ 25 %; caustic ≥ 20 %; energy ≥ 15 %; ensure microbiological quality; ROI ≤ 5 years	Quantitative, auditable goals	Sustainability rendered empirical and comparable
Trial Design	Ten-day operating run per product type; modular washer with heat-recovery system	Defined parameters, calibration, data capture	Experimentation as routine coordination
Roles / Responsibilities	QA – bottle quality & microbiology; Packaging – utilities data; Engineering – reliability; Supplier – technical support; R&D – analysis & recommendation	Cross-functional data flow	Collaboration institutionalized

Success Criteria	≥ 98 % washing efficiency, no microbial non-compliance, scale reduction, cost improvement	Linked to quantitative baselines	Verification as collective performance

Table 5.9 presents a condensed version of the Bottle Washer Trial Protocol, which operationalizes the plant's sustainability objectives through structured experimentation. The document delineates how improvement commitments—previously articulated within the Environmental Plans and Programs (EPP)—are tested and validated under real production conditions. Each component translates planning foresight into procedural instruction: defining objectives, specifying data parameters, assigning departmental responsibilities, and setting measurable success criteria. In this way, the trial functions as the organization's method for transforming environmental intent into verifiable performance outcomes. Rather than a one-time experiment, it represents an institutionalized mode of learning—where sustainability is enacted through evidence, coordination, and iterative verification.

Together, the components of the protocol demonstrate how R&D management integrates innovation with accountability. The trial links technical evaluation with managerial discipline, showing that experimentation is not simply a technical test but an organizational performance of stewardship—making improvement calculable, comparable, and auditable across functions.

The Trial Protocol provides the procedural document for the Bottle Washer Equipment Upgrade. It includes the full set of objectives, parameters, data-collection methods, and inter-departmental responsibilities that governed the ten-day evaluation. As with the preceding Environmental Plans and Programs, the protocol functions as a

living document—guiding coordination, stabilizing accountability, and sustaining the link between environmental improvement and everyday operational practice.

5.1. Analytic Result

PBP: Coordinating Trial Design and Evidence Generation

From a Practice-Based Perspective, the Trial Protocol illustrates how experimentation is a collective form of work rather than an isolated technical exercise. Each step—calibration, data recording, inspection—is distributed across departments and suppliers, transforming the bottle-washing line into a shared laboratory of improvement. Trials are staged within production time, not apart from it; operators, QA, and engineers coordinates schedules, sampling frequencies, and tolerances so that testing coexists with daily output.

Through this cooperative composition, R&D management appears as a performative practice of coordination—where sustainability emerges through disciplined interdependence. The plant learns by doing, and that learning is inscribed through data sheets, signatures, and trial memos. In this sense, the trial enacts the Human-Centered, Creativity and Innovativeness, and Performance principles: innovation thrives in participation, discovery arises from routine, and performance is collectively owned.

Viewed beyond its technical design, the Trial Protocol organizes not only experimental testing but also the social coordination of responsibility across R&D, QA, Engineering, Production, and supplier actors. Through the explicit allocation of roles, parameters, and reporting obligations, the protocol stabilizes who is accountable for what during the trial, thereby aligning technical experimentation with organizational order.

EM: Trial Protocol as Organizational Accounts of Experimentation

From an Ethnomethodological standpoint, the Trial Protocol functions simultaneously as script, method, and account. Its ordered sections—objectives, methodology, roles, success criteria—constitute the grammar through which members make the experiment recognizable as legitimate work. To complete a table, sign a line, or record a parameter is to perform accountability.

These textual actions demonstrate the Value-Orientation and Planning and Foresight principles: they embed organizational morality expectations (safety, stewardship, precision) into procedural form. The protocol thereby materializes the organization's social order of responsibility. Each reading, photo log, and sampling note doubles as evidence that sustainability is being practiced properly.

Seen in this light, the protocol does not merely document the trial—it constitutes it. The experiment exists because it is continually written, monitored, and signed into being.

Together, these perspectives reveal that the Trial Protocol is both a technical instrument and an accountability artifact: it coordinates empirical work while displaying the organization's commitment to rational, responsible experimentation.

5.2. Ethnomethodological Sensibilities

Building on the methodological orientation established in Chapter IV, the analysis of the Trial Protocol draws on three core ethnomethodological sensibilities—indexicality, reflexivity, and accountability (Garfinkel, 1967; Trace, 2016; Maynard, 2023). These sensibilities shift attention from what the document contains to what it does in practice: how organizational members make experimentation observable, reportable, and actionable through documentation and coordination.

The Trial Protocol is not a neutral technical script; it is an instrument through which members collectively perform the order of science in industry. Its tables, targets, and sign-offs make “sustainability testing” recognizable as proper R&D work—an organized way of doing, describing, and justifying improvement. Through these sensibilities, the trial emerges not as a mere experiment but as a lived method of accountability that integrates technical precision, managerial discipline, and organizational responsibility.

Indexicality

In ethnomethodological terms, the meanings of the Trial Protocol’s categories—such as “BWE ≥ 98 %,” “soaker-cleanable bottles,” or “EBI rejection rate”—are not fixed scientific constants but indexical expressions whose sense depends on the practical contexts of their use.

Within the daily world of QA and Packaging, “98 %” does not stand as a purely mathematical value; it represents a locally stabilized achievement of cleanliness and throughput, negotiated through shared experience, mutual calibration, and the plant’s operational rhythms. When technicians record a bottle-washing efficiency or a defect count, they are not merely collecting data—they are displaying competent membership in a community that recognizes what counts as “clean,” “efficient,” or “acceptable.”

Similarly, terms like “soaker-cleanable” or “abnormality” carry specific situated meanings that can only be understood within the plant’s embodied routines—soaking times, caustic concentration, inspection protocols, and machine behavior. These categories are indexical to local practice; they derive intelligibility from the lived scenes of coordination in which they are used. The Trial Protocol thus operates as a linguistic bridge between management discourse and workshop reality: it translates technical performance into recognizable social achievement.

Reflexivity

The Trial Protocol does not simply describe the experimental order—it reflexively enacts it. Each section, from objectives to methodology to sign-off, constitutes a practical demonstration that "proper experimentation" is being carried out. By listing roles, enumerating parameters, and specifying success criteria, the document reproduces the corporate expectation that good R&D is measurable, documented, and auditable. Every act of compliance—checking a box, writing "within spec," noting "no abnormality observed"—is a reflexive performance of organizational rationality.

Through this reflexivity, the Trial Protocol becomes a self-validating artifact: it both defines and fulfills the conditions of credible experimentation. The plant's technicians, engineers, and QA personnel enact reliability not as an abstract value but as a recurrent textual performance. Each measurement reinforces the institutional belief that transparency, traceability, and repeatability define legitimate knowledge. The Trial Protocol thus reveals how reflexivity sustains order: the process is scientific because it is documented as such, and it is documented as such because that is what counts as science in the organization.

Accountability

In the Trial Protocol, accountability extends far beyond the act of signature—it is woven into every procedural layer of the document. The stepwise instructions, data logs, and distribution lists create an infrastructure of mutual visibility among departments.

QA monitors microbiological results, Engineering validates utilities data, Packaging confirms mechanical reliability, and R&D consolidates findings into reports.

These cross-references ensure that each action is observable and verifiable by others, transforming isolated acts of testing into collective accountability.

Vertically, accountability ascends the hierarchy through formal review—trial outcomes are submitted to R&D and National Manufacturing, linking local observation to corporate assurance. Horizontally, it circulates through shared forms, reports, and email loops that sustain interdepartmental trust. The Trial Protocol thus materializes what Garfinkel would call an accountable order of work: experimentation becomes legitimate not through authority alone but through its capacity to be inspected, referenced, and narrated across institutional levels.

In this light, accountability is not a constraint but a resource for coordination. It allows members to manage uncertainty, negotiate meaning, and sustain legitimacy. The act of “writing up” the trial is the act of “making good” on the organizational promise of responsible innovation.

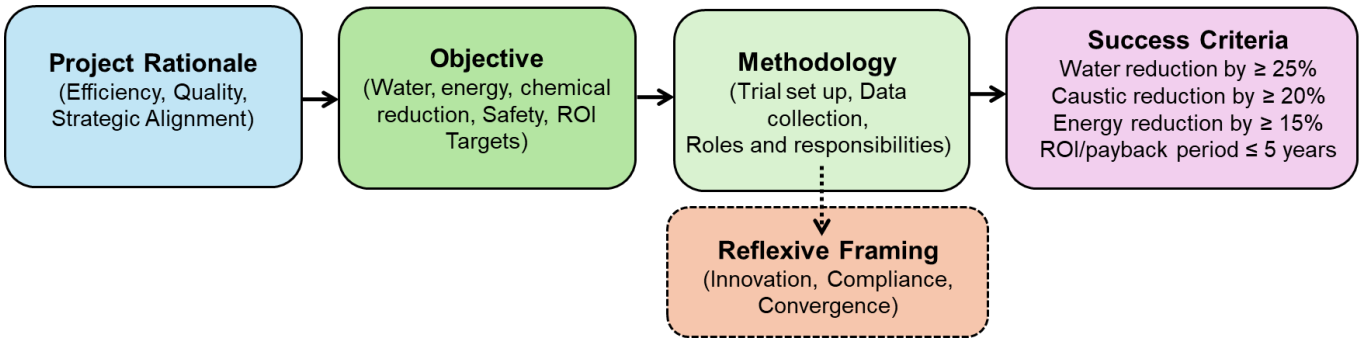
5.3. Synthesis

Taken together, these sensibilities show that the Trial Protocol is not merely a technical plan but an organizational accomplishment—a site where experimental, managerial, technical and social orders converge. The document’s power lies in its dual function: it instructs what should be done while demonstrating that it is being done properly. Through indexicality, it anchors meaning in the situated practices of technicians and engineers; through reflexivity, it reproduces the very logic of credible experimentation; and through accountability, it transforms testing into a distributed performance of care.

In this sense, the Trial Protocol converts the scientific method into organizational morality: to measure, document, and verify is to act responsibly. The

plant demonstrates stewardship not through rhetoric but through the practical labor of inscription—writing, checking, and signing sustainability into existence. Experimentation thus becomes a communicative act of care, where every recorded metric and observation stands as both technical evidence and accountability testimony of the organization's commitment to responsible innovation.

Figure 5.6. Visual matrix figure for the translation of Environmental Objectives to Trial Protocol.



The matrix visualizes how environmental objectives are translated into experimental routines and accountability relations. From a PBP lens, the figure traces the framework link among QA, Packaging, Engineering, Supplier, and R&D. From an EM lens, it depicts the documentary layers—objectives → procedures → data → sign-offs—that transform sustainability ideals into verifiable organizational order.

5.4. Sustainability as Experimental Practice in R&D Management

In the context of the Bottle Washer Equipment Upgrade, sustainability is enacted not as a declarative goal but as a testable, verifiable, and negotiated practice.

The Trial Protocol transforms improvement aspirations into controlled acts of experimentation—rendering energy, water, and chemical efficiency measurable within the lived space of production. Here, sustainability and experimentation converge: every temperature check, efficiency computation, or calibration log becomes an inscription of both technical performance and organizational virtue.

From a Practice-Based Perspective (PBP), the trial stage reveals how R&D management organizes cooperation, discipline, and learning across functions. Experimentation is not an individual engineer's task but a collective accomplishment that demands coordination among QA, Packaging, Engineering, and Supplier. The trial formalizes this cooperation by specifying who observes, who records, and who verifies, ensuring that improvement emerges from shared practice rather than solitary innovation. The Trial Protocol thus demonstrates that R&D management in a sustainability-oriented project is less about discovering novelty than about staging coordination: aligning diverse forms of expertise to produce reliable knowledge under operational constraint.

From an Ethnomethodological (EM) view, the Trial Protocol also performs the documentary work through which this coordination is made visible and accountable. Its sections—objectives, methodology, data forms, and sign-off tables—transform lived actions into institutional evidence. Each filled-in cell, recorded temperature, or "no abnormality observed" note is a practical method of showing that the plant conducts itself responsibly. Sustainability, in this light, is not an external mandate but a reflexively maintained organizational order—something that exists because members continually write it into being.

The trial therefore stands as the moment where technical rationality and accountability intersect. To run an experiment is to rehearse the plant's ethics of care:

conservation, accuracy, transparency. R&D management is enacted through experimental practice precisely because experimentation provides a shared grammar of legitimacy—one that allows improvement to be tested, witnessed, and verified within the plant's procedural culture.

5.5. Illustrative Excerpts and Interpretation

The following excerpts from the Trial Protocol illustrate how experimental documentation, coordination, and verification transform sustainability from aspiration into organizational routine.

Excerpt 1: *"Evaluate the effectiveness of the caustic additive through the following activities: Measure the bottle washing efficiency (BWE) with the use of soaker-cleanable bottles twice a week… record pertinent bottle-washer data in the existing form used by QA for Bottle-washer Operations Verification."*

Interpretation: This instruction exemplifies sustainability as evidence-based stewardship. Measuring and recording BWE links operational precision with environmental responsibility. Through systematic monitoring, QA converts cleaning performance into auditable data, embodying both the Scientific Process and Performance Principles. The phrase "existing form used by QA" signals the integration of experimentation into the plant's habitual documentation cycle—proof that sustainability work inhabits the same procedural pathways as quality assurance. From a PBP view, this entry shows coordination between measurement and meaning-making; from an EM view, it shows how observation is made institutionally accountable through documentation.

Excerpt 2: “Monitor electronic bottle inspection (EBI) Rejection Rate (for Rewash) twice a week… Randomly check the bottles in the Rewash conveyor for bottle-washer-related defects (125 bottles sample size).”

Interpretation: Here, experimentation becomes a practice of collective vigilance. The routine of monitoring EBI rejections situates sustainability within the organizational ethos of precision and care. The quantitative frame (sample size, frequency) reflects the Planning and Foresight and Human-Centered Principles—anticipating errors not to assign blame but to maintain confidence in shared performance. From a PBP stance, it reveals how improvement relies on distributed observation across teams; from an EM stance, it shows how numeric routines (twice-weekly checks, 125 samples) function as rituals of accountability that stabilize trust in data and people alike.

Excerpt 3: “Collate wastewater data from the existing effluent analysis of COD, pH, and phosphate, and compare this with the latest three-month period before the trial.”

Interpretation: This directive captures the Technology–Society Principle at work: the plant’s experimental attention to resource reduction is simultaneously a form of environmental self-examination. Comparing effluent data transforms compliance into reflexive learning—linking laboratory metrics to ecological consequence. Through this act of collation and comparison, members demonstrate that sustainability is not a future promise but an ongoing calculation of responsibility. From a PBP view, it represents learning through feedback loops; from an EM view, it shows how environmental performance becomes a textual phenomenon, rendered visible through tables, comparisons, and archival continuity.

Excerpt 4: “Prepare report and recommendation, submit to BTG and National Manufacturing.”

Interpretation: This closing instruction converts experimentation into organizational discourse. The report is both an analytical summary and a performance of legitimacy: it tells the story of improvement in a language legible to higher management. It embodies the Value-Orientation and Total Quality Management (TQM) Principles, asserting that good experimentation is inseparable from ethical communication and continuous improvement. From a PBP lens, the submission of results extends the cycle of practice from doing to reflecting; from an EM lens, the report formalizes accountability by transforming local activity into institutional narrative. Sustainability becomes a story the organization can tell about itself, backed by data, method, and procedure.

Across these excerpts, sustainability emerges as an experimental order—a set of coordinated, documented, and reflexive actions through which improvement becomes socially legitimate. The Trial Protocol converts technical trials into organizational morality performances: every sample, form, and report are both a test of equipment and a demonstration of the organization’s conscience. From a PBP stance, experimentation is a collective craft of coordination and learning; from an EM stance, it is a continuous inscription of responsibility. In R&D management, sustainability is thus enacted through experimental practice—where to measure is to care, to verify is to trust, and to document is to sustain.

5.6. Coding Consolidation: Codes, Sub-Themes, and Theme

Across these protocol elements, a patterned structuring of sustainability as measurable experimentation becomes apparent.

Table 5.10

Coding Consolidation: Codes, Sub-Themes, and Theme (Stage 5)

Excerpt Pattern	Code	Sub-theme	Theme
≥25% water reduction requirement	Quantified performance threshold	Measurable innovation framing	Innovating through accountable experimentation
ROI ≤ 5 years condition	Economic viability boundary	Economic boundary setting	
Enumeration of success criteria	Pre-defined evaluation logic	Anticipatory accountability	
Inclusion of microbiological compliance	Quality safeguard invocation	Quality-constrained innovation	

The sub-themes of measurable innovation framing, economic boundary-setting, anticipatory accountability, and quality-constrained innovation merge into the theme of Sustainability Innovation Framed as Accountable and Measurable Experimentation. The trial protocol translates strategic objectives into an experimental design governed by quantified targets and predefined success criteria.

This stage reveals that innovation is not pursued in isolation but bounded by economic viability, microbiological compliance, and environmental performance thresholds. Sustainability becomes trialable under institutional constraints, ensuring that innovation aligns with operational, financial, and quality safeguards.

From a practice-based perspective, the protocol constitutes anticipatory governance: it pre-defines evaluation logic before execution begins. The integration of environmental and economic thresholds reflects the Creativity and Innovativeness Principle operating within the Performance and Scientific Process Principles.

5.7. Analytic Linkage to Research Questions

RQ1: What R&D management practices are enacted during the elicitation, evaluation, and execution of a sustainability-oriented project?

Elicitation: The Trial Protocol converts objectives into testable designs—articulating rationales, parameters, success criteria, data forms, and roles. It elicits what counts as evidence and how it will be shown (planning and foresight embedded in design).

Evaluation (formative): Trial runs (once approved) generate and compare measurements (e.g., BWE, EBI rejections, utilities) against baselines and criteria to appraise feasibility and benefits. This is collaborative, method-driven appraisal (scientific process + human-centered judgment), culminating in recommendations.

Execution (anticipated): In this stage, execution is anticipated not only through technical parameters but through the coordinated assignment of responsibility across QA, Production, Engineering, R&D, and suppliers. The Trial Protocol organizes who will act, observe, verify, and report during the trial, demonstrating how sustainability-oriented R&D is enacted as collective organizational work before physical implementation begins.

5.8. Synthesis of RQ1

Across these practices, the Trial Protocol demonstrates how sustainability-oriented R&D advances from elicited hypotheses to formative evaluation, producing shared evidence for decision-making. Planning anticipates improvement; evaluation verifies it; execution performs it. Each phase transforms sustainability into something that can be tested, witnessed, and trusted. The Trial Protocol thereby bridges the normative and procedural dimensions of R&D management—showing that

sustainability is not a static policy goal but an unfolding experiment in coordinated reliability.

Stage 6 – Evaluation & Approval

The Evaluation & Approval stage is where the Trial Protocol is rendered organizationally legitimate through deliberation. Here, the proposed experiment becomes discussable and defensible, and accountability is distributed in advance. Rather than “rubber-stamping” a document, the meeting translates sustainability commitments into a shared, bounded authorization: what may be tried, under which conditions, with whose responsibilities.

In R&D management terms, this stage bridges late elicitation and formative evaluation. The trial can proceed only after the organization agrees that it should be tried—under specified baselines, controls, and roles. The minutes are analyzed both as ethnomethodological texts (documenting how accountability is organized) and as interactional events (where the meaning of “trial-readiness” is negotiated).

In this stage, sustainability is not enacted through measurement or implementation, but through deliberation. Here, sustainability is enacted socially through deliberative interaction—where responsibility, risk, and legitimacy are collectively negotiated and stabilized before any physical execution occurs.

6.1. Analytic Result

PBP: Deliberation as Coordination Work

Deliberation co-constructs the conditions of responsible testing. Departments publicly commit to segments of the trial’s future: Engineering to fit-up windows and reliability safeguards; QA to safety and hygiene parameters; Production to operator

orientation and schedule feasibility; Finance to exposure and ROI frames; and R&D to analysis and learning capture. Approval is not a moment but a choreography of readiness—a practical alignment that makes the trial feasible and auditable.

EM: Decision as Documentary Accountability

The meeting does accountability by writing it down. Phrases such as “secure baseline data,” “confirm supplier readiness,” and “conduct operator orientation” function as advance commitments. Minutes, action items, and sign-offs stabilize visibility across time and hierarchy, exhibiting the organization’s disciplined, auditable order of work. Decision-making is thus an inscription practice that sets expectations before data are produced.

CA: Approval as an Interactional Accomplishment

Conversation Analysis reveals that approval is not declared—it is achieved interactionally and accomplished turn by turn. Table 5.11 presents the meeting talk, excerpted from record of the Evaluation and Approval meeting—that unfolds as a sequence of proposals, overlaps, and affiliative uptake through which the meaning of “trial readiness” is progressively stabilized. This segment illustrates how organizational consensus is accomplished through talk-in-interaction.

Table 5.11

Excerpt from Minutes of the Meeting for TP Evaluation & Approval

Turn	Speaker	Talk / Extract	Interactional Notes & Analytic Comments
1	**GM:**	“We’re here to evaluate the proposed Trial Protocol… We must be clear that this is still at the trial stage—not yet a full replacement.”	Establishes the meeting’s boundary frame (“trial, not replacement”). The GM performs category control

Turn	Speaker	Talk / Extract	Interactional Notes & Analytic Comments
			and positions the activity as risk-bounded evaluation.
2	**R&D:**	"The design integrates modular manifolds and heat recovery—expected to reduce resource use by 15–25%. This aligns with our resource-efficiency targets and can produce data for energy recovery and water reuse retrofits."	Introduces sustainability as innovation and organizational learning; indexes "trial" to the strategic roadmap.
3	**QA:**	"Our primary concern is product safety during the trial… the trial remains within acceptable risk and sustainable being cleaner process with less chemical stress."	Re-keys sustainability from ecological innovation to safety. The category "sustainability" is reframed within QA's accountability grammar.
4	**PROD:**	"We must ensure that utilities lines and dosing systems are compatible. Operators must be briefed before trial start-up. Efficiency improvement is welcome, but we must avoid unplanned downtime."	Introduces temporal coordination concerns; turns discussion toward practicality.
5	**ENG:**	"We've checked the layout—fit-up is fine. We'll handle integration."	Provides technical reassurance; displays competence and readiness.
6	**FIN:**	"Cost exposure is minimal… If the targets are met, we can justify investment later."	Re-categorizes sustainability as fiscal prudence; ecological efficiency reframed into ROI logic.
7	**GM:**	"I appreciate everyone's points. We're testing the concept of efficient washing, not yet replacing the machine."	Closure moves recycling the opening category ("trial") to secure consensus and transition toward decision.
8	**QA:**	"Yes, and this also allows us to document the baseline for microbiological safety versus utilities efficiency. It's important the trial data reflect both sides—performance and hygiene accountability."	Confirms alignment while inserting procedural safeguards—talk enacts vigilance.

Turn	Speaker	Talk / Extract	Interactional Notes & Analytic Comments
9	**R&D (overlap):**	"Exactly, the data should not just prove reduction figures but demonstrate operational cost effectiveness and sustainability."	Overlap performs affiliative alignment; preserves innovation frame while integrating QA's caution.
10	**R&D:**	"Then we recommend approval for controlled implementation effective September 15."	Concludes sequence by transforming agreement into institutional action; talk becomes authorization.

Across these turns, "approval" emerges as a collective accomplishment.

- **Turn-taking:** The GM's structured allocation of turns regulates participation and constructs managerial order.
- **Overlap and uptake:** R&D's "Exactly…" displays affiliative repair—showing consensus-building through alignment rather than contradiction.
- **Category work:** Sustainability oscillates across institutional grammars—innovation (R&D), safety (QA), efficiency (FIN), readiness (ENG), and coordination (PROD).
- **Sequential organization:** The discussion advances from uncertainty ("is it safe?") to consensus ("testing the concept"), demonstrating decision-making as a performed rationality.

Thus, the CA lens reveals sustainability not as a static value but as a topic-in-interaction—something continually redefined until it fits the organization's recognizable form of accountable action.

6.2. Ethnomethodological Sensibilities

Building on the methodological orientation established in Chapter IV, the analysis of the Evaluation and Approval meeting draws upon the core

ethnomethodological sensibilities of indexicality, reflexivity, and accountability (Garfinkel, 1967; Trace, 2016; Maynard, 2023). These sensibilities shift analytic attention from what is decided to how decision-making is accomplished *in situ*—through language, timing, and documentation that render evaluation an observable, legitimate, and repeatable organizational event.

The meeting is not merely a procedural checkpoint; it is a performative site where scientific, managerial, and organizational morality orders converge. In this setting, members do more than deliberate—they display rationality, caution, and stewardship in real time. Through these sensibilities, the act of approving a trial becomes a reflexive demonstration that the organization governs responsibly.

Indexicality

The discourse of "trial," "fit-up," and "clean" acquires meaning only within the situated grammar of the meeting. These are not neutral descriptors but indexical expressions—their sense derives from the shared operational context that gives them intelligibility.

To say a system is "fit-up" is not a simple statement of readiness; it invokes a recognizable procedural milestone known to those who inhabit the plant's routines. "Trial," in turn, marks a bounded space of risk—an event where uncertainty is tolerated under the watch of disciplined supervision. Even "clean" operates as a multilayered term, simultaneously referencing the visible (absence of residues), the microbiological (absence of contaminants), and the moral (adherence to GMP and stewardship values).

Such expressions cannot be detached from the lived practices in which they are used. They encode tacit understandings about equipment integrity, resource

accountability, and the acceptable thresholds of deviation. In this sense, the meeting's talk is a linguistic bridge between procedural reality and managerial discourse—translating material states ("fit," "clean") into institutional assurances ("ready," "safe," "compliant"). Indexicality thus exposes how local vocabulary sustains corporate order: meaning is stabilized not by definition but by competent, context-sensitive use.

Reflexivity

The Evaluation and Approval meeting does not simply describe order; it performs it. As members specify baselines, approval conditions, and contingency plans, they enact the very rationality and procedural discipline they claim to represent. The sequence of discussion—from summarizing results, verifying baselines, to final endorsement—constitutes a live demonstration of good governance.

In this reflexive process, each utterance serves dual functions: it communicates an instruction *("We'll begin the trial after microbiological clearance")* and simultaneously provides evidence that the organization operates methodically and responsibly. Minutes, presentations, and sign-offs are not passive records—they are reflexive instruments through which members display that the plant's decision-making is reasoned, transparent, and compliant with corporate standards.

The meeting thereby becomes a scene of rationality: the organization produces itself as a responsible actor through the very grammar of evaluation. The deliberation is not merely about whether to proceed with the trial—it is a situated enactment of what "responsible proceeding" means within the company's moral economy of risk and assurance.

Accountability

Accountability in the Evaluation and Approval process is both distributed and recursive. It unfolds horizontally through mutual visibility—QA presenting results to

Engineering and Packaging, Production clarifying operational implications, and R&D mediating between plant-level findings and corporate criteria. Each exchange sustains the intersubjective recognition that everyone is watching and being watched, that decisions are collectively owned.

Vertically, accountability ascends toward corporate oversight, as minutes, approvals, and supporting documents are escalated to the Beverage Technical Group (BTG) and National Manufacturing for confirmation. This dual movement transforms conversation into inscription: every statement made in the meeting is destined to become a textual trace—email, form, or report—that stabilizes responsibility across time and hierarchy.

From an ethnomethodological view, this distributed accountability is not a bureaucratic burden but the very mechanism that makes evaluation workable. It allows participants to translate uncertainty into recordable order, aligning local judgment with corporate assurance. Talk and text thus co-produce legitimacy: the decision to approve is not only made but made accountable.

6.3. Synthesis

Viewed through these sensibilities, the Evaluation and Approval meeting is revealed as an organizational accomplishment rather than a routine administrative step. Through indexicality, members render technical states intelligible in locally meaningful terms; through reflexivity, they enact procedural reason as a lived display of responsibility; and through accountability, they transform deliberation into an auditable chain of legitimacy.

Evaluation, in this sense, is a moral performance as much as a managerial act. The plant demonstrates its integrity not by declaring compliance but by methodically

producing evidence of care—minutes, clearances, and sign-offs that collectively do stewardship.

From a Practice-Based Perspective, this moment exemplifies how sustainability decisions are not external evaluations but situated practices of coordination and trust-building. From an Ethnomethodological lens, the meeting shows how organizational order is continuously achieved in talk, documentation, and shared understanding—turning decision-making into a collaborative method of maintaining the moral economy of R&D.

6.4. Sustainability as Organizational Deliberation in R&D Management

In the Evaluation & Approval stage, sustainability is enacted not as measurement but as organizational morality foresight—a practice of anticipating accountability before it is empirically proven. The meeting dramatizes how ecological commitment becomes credible before it becomes calculable: sustainability must first sound right in deliberation before it can look right in data.

Here, the organization performs a distinct mode of R&D rationality—one that fuses technical reasoning with ethical rehearsal. The meeting serves as an anticipatory laboratory of responsibility: through talk, members rehearse the grammar of stewardship that will later organize the actual trial.

From a Practice-Based Perspective (PBP), deliberation functions as a coordination technology—a distributed process through which situated foresight is negotiated among domains of expertise. Each department brings its own anticipatory rationality:

- **R&D** frames the innovation's scientific plausibility;
- **QA** articulates safety and hygiene discipline;

- **Engineering** validates mechanical and utility readiness;
- **Production** translates proposed procedures into schedule feasibility; and
- **Finance** mediates the language of exposure, cost, and risk.

Through this choreography, sustainability is transformed from an abstract goal into a *shared anticipatory accountability*: a collective ability to predict, justify, and own the implications of action. Deliberation thus becomes a *pre-emptive form of coordination*—the organization rehearsing its ethics before acting.

From an Ethnomethodological and Conversation Analytic (EM/CA) stance, the meeting is a communicative moral order where responsibility is *performed through talk*. Members display competence not only by what they know but by how they reason publicly. Each turn of speech accomplishes organizational morality alignment—*"sustainable being cleaner process with less chemical stress"/ "Exactly, the data should not just prove reduction figures but demonstrate operational cost effectiveness and sustainability.*"—illustrating how different moral grammars (safety, efficiency, evidence) are harmonized through sequential exchange.

In this sense, to deliberate carefully is to act sustainably: the interaction itself becomes an index of institutional virtue. Reflexive talk transforms potential conflict into consensus, while minute-taking converts speech into durable trace. Through these intertwined acts of conversation and inscription, sustainability acquires organizational form—it is *spoken into being*, documented as credible, and circulated as policy.

The Evaluation & Approval meeting, then, is not simply a prelude to experimentation; it is experimentation of another kind—a discursive test of the organization's own capacity to reason, align, and justify. Words temporarily substitute for acts, and through the rhythm of dialogue, the institution performs its stewardship in

advance. Before the first trial bottle is washed, sustainability has already begun—as a moral achievement of deliberative order.

6.5. Coding Consolidation: Codes, Sub-Themes, and Theme

Across these deliberations, a patterned form of negotiated governance of sustainability claims becomes visible.

Table 5.12

Coding Consolidation: Codes, Sub-Themes, and Theme (Stage 6)

Excerpt Pattern	Code	Sub-theme	Theme
Requirement for baseline data prior to approval	Data validation requirement	Scientific gatekeeping	Negotiating governance across functions
Review of ROI acceptability	Financial scrutiny	Economic justification work	
Reference to alignment with environmental objectives	Strategic coherence invocation	Strategic alignment invocation	
Discussion among QA, Engineering, and R&D	Cross-functional deliberation	Collective sense-making	

The sub-themes of Scientific Gatekeeping, Economic Justification Work, Strategic Alignment Invocation, and Collective Sense-Making synthesize into the theme of Negotiated Governance of Sustainability Claims Through Cross-Functional Deliberation. At this stage, sustainability proposals are interactionally scrutinized, justified, and aligned before institutional endorsement.

Approval is not automatic but socially organized through validation of baseline data, ROI evaluation, and alignment with environmental objectives. Sustainability

claims must withstand both scientific and economic interrogation, demonstrating that decision-making itself constitutes sustainability work.

From an EM standpoint, evaluation meetings function as sites of accountability production: actors invoke standards, justify positions, and negotiate acceptable risk. The patterned reliance on deliberation reflects the Human-Centered Principle and the Performance Principle, showing how the social dimension of sustainability emerges in collective managerial judgment.

6.6. Analytic Linkage to Research Questions

RQ1 – What R&D management practices are enacted during the elicitation, evaluation, and execution of a sustainability-oriented project?

Elicitation (carryover): The meeting re-contextualizes technical proposals into deliberative accountability, where plans are scrutinized through anticipatory reasoning—enacting planning and foresight.

Evaluation (this stage): Decision-making unfolds as a dialogic reasoning process integrating scientific, financial, operational, and organizational morality grammars, through which sustainability is socially authorized before execution.

6.7. Synthesis of RQ1

The Evaluation & Approval stage enacts R&D management as communicative coordination. It demonstrates that before experimentation, the organization experiments with its own sense of order—testing how sustainability can be *spoken*, *trusted*, and *procedurally owned*. Deliberation becomes a form of pre-execution practice: a situated test of collective foresight where managerial, technical, and ethical intelligibilities are aligned through talk.

Collectively, stages 5-6 reveal a patterned progression from visibility to governance. Sustainability is not introduced as an external ideal but is progressively stabilized through operational documentation, institutional classification, quantified commitment, programmatic embedding, experimental structuring, and negotiated validation.

Stage 7 – Trial Execution and Monitoring

The Trial Execution and Monitoring stage marks the transition from authorized proposal to situated performance under real production conditions. While Stage 6 centered on approval as a collective accomplishment, Stage 7 centers on stabilization work—how sustainability commitments survive operational variability.

Execution is the moment where sustainability ceases to be a promise and becomes a discipline—no longer negotiated in speech but defended through measurement, recalibration, and accountable continuation.

Following the September 15 effectivity of the Trial Protocol, the project proceeded to actual run on September 25–29, 2023. The primary corpus for this stage is the Minutes of the Meeting for Trial Execution and Monitoring Review (September 30, 2023).

In this stage, sustainability is no longer hypothetical. It is exposed to:

- Throughput pressures
- Parameter drift
- Microbiological fluctuation
- Utility recalibration
- Financial scrutiny

Execution, therefore, becomes a test of whether sustainability can be maintained under real operational load.

Condensed Raw Data Summary

Table 5.13 presents a condensed representation of the key monitoring objects, baselines, observed deviations, and corrective actions documented during the September 30 review meeting. The following excerpt from the Minutes of the Meeting for Trial Execution and Monitoring Review illustrates how organizational actors interpreted performance deviations, justified corrective actions, and assessed whether the trial remained within acceptable parameters. As an organizational account of monitoring work, the minutes show how sustainability gains were evaluated alongside quality, operational stability, and financial implications during actual implementation.

Table 5.13

Condensed Raw Data Summary of Trial Execution and Monitoring

Monitoring Object (Success Criteria Link)	Baseline / Target	Days 1–5 Observed Values	Documented Issue / Deviation	Repair / Corrective Action	Interim Status
Water consumption (C8a)	Baseline: 17.9 L/1,000 bottles; Target: ≥25% reduction	13.3 L/1,000 bottles (25.8% reduction)	None flagged as non-compliant	Continue monitoring	On target
Caustic consumption (C8b)	Baseline: 1.20 kg/1,000 bottles; Target: ≥20% reduction	Days 1–3: 0.92 kg (23% reduction); Day 5: 1.15 kg (4% reduction)	Dosing drift after shift change	Re-standardize dosing; refresher briefing	Stabilizing
Steam/energy (C8c)	Baseline: 5.0 kg/1,000 bottles; Target: ≥15% reduction	4.33 kg/1,000 bottles (13.4% reduction)	Steam spike Day 4; heat recovery misalignment	Heat recovery tuning; recalibration	Slightly below target
Bottle washing efficiency (C1)	Target: ≥98%	Days 1–3: 99.2/99.0/98.7%; Day 4: 97.5%; Day 5: 96.8%; Day 6 preliminary: 98.9%	Nozzle pressure drop	Cleaning + rinse inspection	Restored

Monitoring Object (Success Criteria Link)	Baseline / Target	Days 1–5 Observed Values	Documented Issue / Deviation	Repair / Corrective Action	Interim Status
Microbiological compliance (C4)	Target: <100 CFU/bottle	Day 1: 20; Day 2: 28; Day 3: 35; Day 4: 80; Day 5: 150; Day 6: 45	Day 5 exceedance	Caustic stabilization (2.0–2.2%); rinse temp verification (82–85°C)	Restored
Dirty Side (C6)	Target: ≤25 ppm	Days 1–3: 15–18 ppm; Day 4: 40; Day 5: 75	Throughput increase beyond validated setting	Restore validated conveyor speed	Stabilized
EBI rewash rejects (C5)	“No excessive rejects attributable to washer”	Days 1–3: 0.8%; Days 4–5: 1.5%; Day 6: 0.7%	Temporary increase aligned with DS deviation	Parameter restoration	Controlled
Wastewater load (C7)	“No increase vs 3-month baseline”	Baseline: COD 1480 mg/L; pH 7.4; PO_4 12.5 mg/L. Trial: COD 1465; pH 7.3; PO_4 11.8	None indicated as adverse	Continue comparison	No increase
Design learnings (C9)	“Identify recommendations”	Heat recovery valve optimization; rinse recirculation redesign; steam	N/A	Capture learnings for final disposition	Emerging outputs

Monitoring Object (Success Criteria Link)	Baseline / Target	Days 1–5 Observed Values	Documented Issue / Deviation	Repair / Corrective Action	Interim Status
		trap recalibration protocol			

This condensed table demonstrates the analytic character of execution work: sustainability objectives and quality safeguards are not merely monitored—they are kept in order through repair, calibration, and cross-functional accountability when performance drifts during real operations.

7.1. Analytic Result

PBP: Execution as Coordinated Repair and Stabilization Work

From a Practice-Based Perspective (PBP), Stage 7 reveals that “execution” is not a linear implementation of an approved plan. Rather, execution is a coordination achievement composed of routine monitoring, localized adjustments, and cross-functional repair. The record shows how the organization holds multiple performance logics in tension—resource efficiency (water/caustic/steam), operational continuity (throughput), quality assurance (BWE, microbiology), and environmental compliance (wastewater load)—while sustaining the trial as a viable, governable practice.

More importantly, deviations (e.g., microbiological exceedance on Day 5; BWE drop; Dirty Side rise) were not treated as “failures” but as situated disturbances that require technical diagnosis and procedural correction. In practice-based terms, sustainability-oriented execution is enacted through stabilization work: restoring parameters to acceptable ranges, aligning operator practices with validated settings, and ensuring that improvements in resource use do not come at the expense of hygiene accountability.

Execution, therefore, is where sustainability is tested as a practical accomplishment: the ability of the organization to preserve cleanliness, compliance, and continuity while pursuing efficiency gains under real production constraints.

EM: Monitoring Minutes as Documentary Accountability in Motion

From an Ethnomethodological (EM) standpoint, the monitoring minutes function as an accountability device that does more than record outcomes. It organizes how the trial becomes intelligible and defensible to organizational audiences. The minutes display:

- what counts as a deviation (e.g., Day 5 microbiological exceedance),
- what counts as repair (recalibration, restored settings),
- and what counts as a justified continuation (deviations "traceable and correctable," restored to compliant levels).

In this sense, the monitoring meeting is not simply "about" data. It is a formal scene where members convert operational variability into accountable order by producing a shared, documentable narrative: deviation → diagnosis → corrective action → restored compliance → decision to proceed.

Thus, the minutes are not neutral representations but a method for rendering execution governable — showing that sustainability outcomes are not presumed; they are maintained through documentary work.

CA: Monitoring as an Interactional Site of Conditional Continuation

The meeting accomplishes a critical interactional task, that can be examined as a sequential accomplishment of "continuation under conditions."

Table 5.14

Excerpt from Minutes of the Meeting for Trial Execution & Monitoring Review

Turn	Speaker	Talk / Extract	Interactional Notes & Analytic Comments
1	R&D (Chair)	"The question is whether these deviations indicate systemic instability, or whether they reflect a normal optimization phase…"	Frames the interpretive task; categorizes deviations as either systemic or repairable.
2	QA	"Microbiological compliance remains the primary gating condition… the spike to 150 CFU is unacceptable if sustained."	Boundary-setting move; establishes safety as non-negotiable condition.
3	ENG	"The deviation was associated with nozzle pressure drop… mechanical and calibration-related rather than design flaw."	Technical diagnosis; reframes deviation as localized and correctable.
4	SUPP	"Variability is expected during the initial week… calibration should stabilize performance."	Normalizes disturbance as optimization phase; reduces alarm framing.
5	PROD	"As long as validated parameters are followed, Production does not foresee operational risk."	Inserts operational feasibility; conditions continuation on adherence.
6	FIN	"ROI remains viable if reductions are sustained… stability is important before capital commitment."	Converts variability into financial prudence language.
7	GM	"The objective is to determine whether efficiency gains can be achieved without compromising safety and stability."	Integrative hierarchy-setting; synthesizes sustainability + quality + continuity.
8	R&D	"We recommend proceeding with Days 6–10 under continued monitoring."	Transforms deliberation into institutional recommendation.

Turn	Speaker	Talk / Extract	Interactional Notes & Analytic Comments
9	GM	“Proceed, but document every corrective action.”	Authorization plus documentary accountability requirement.
10	QA	“Provided daily monitoring continues… QA supports continuation.”	Conditional alignment; closes sequence through accountable agreement.

Across these turns, “continuation” is not assumed — it is constructed. The interaction demonstrates:

- **Boundary work** (QA defines the non-negotiable threshold)
- **Repair framing** (Engineering attributes deviation to controllable factors)
- **Normalization** (Supplier reframes instability as early-phase adjustment)
- **Multi-logic balancing** (Finance introduces ROI stability)
- **Integrative authority** (GM synthesizes efficiency-with-safety)
- **Conditional authorization** (Proceed — but document)

Sustainability is thus not a static value. It is re-specified turn by turn until it fits the organization’s recognizable form of accountable action.

If Stage 6 showed “approval” as a collective accomplishment, Stage 7 shows “continuation” as a collective accomplishment under conditions.

7.2. Ethnomethodological Sensibilities

Building on the methodological orientation established in Chapter IV, the analysis of the Trial Execution and Monitoring meeting draws upon the core ethnomethodological sensibilities of indexicality, reflexivity, and accountability

(Garfinkel, 1967; Trace, 2016; Maynard, 2023). These sensibilities shift analytic attention away from whether the trial “performed well” and toward how organizational order was actively reconstituted when performance fluctuated.

Unlike the Evaluation & Approval stage—where members anticipated uncertainty—Stage 7 confronts uncertainty as it unfolds. Here, rationality is not rehearsed in foresight but displayed in repair. The monitoring meeting becomes a performative site where instability is interpreted, categorized, and stabilized in real time. Members do not merely observe deviations; they produce a recognizable grammar through which deviations become accountable, repairable, and governable.

Whereas Evaluation & Approval performs responsibility in advance, Execution performs responsibility in response. The organization no longer asks, “Should we proceed?” but “Can we sustain what we have begun?” Responsibility shifts from anticipatory caution to operational vigilance. Sustainability is no longer secured through agreement alone; it must be continually demonstrated through measurement, interpretation, recalibration, and documented continuity.

In this shift, rationality is not rehearsed in foresight but enacted in stabilization. The monitoring meeting becomes a site where uncertainty is not predicted but absorbed—where deviations are interpreted, contextualized, and re-aligned within recognizable institutional thresholds. Responsibility is therefore no longer prospective; it is responsive, iterative, and situationally accountable.

In this setting, sustainability is no longer an aspiration but a situated test: can efficiency gains coexist with hygiene integrity under operational pressure? The answer is not found in the numbers alone, but in how members reason about them together.

Indexicality

The language of execution is saturated with indexical expressions whose meaning depends on shared operational competence.

Terms such as: “stability”, “controlled deviation”, “optimization phase”, “gating condition”, “on track”, and “restored compliance” are not neutral descriptors. They derive intelligibility from the plant’s lived routines and quality grammar.

For instance, when QA invokes “microbiological compliance as the primary gating condition,” the phrase does more than set a limit. It invokes a moral hierarchy embedded in plant culture: hygiene integrity supersedes efficiency gains. “Gating” indexes an invisible but collectively understood rule—some thresholds are negotiable, others are not.

Similarly, “optimization phase” functions as a normalizing category. It reframes early instability not as failure but as expected adjustment. The term stabilizes perception, transforming variance into developmental progress.

Even “no increase in wastewater load” is indexical. It references not abstract environmental virtue, but compliance relative to a three-month baseline—an operationalized ecological morality expressed numerically (COD 1,465 vs. 1,480 mg/L; phosphate 11.8 vs. 12.5 mg/L). The meaning of “no increase” is inseparable from shared measurement practices and permit thresholds.

Through indexicality, execution talk translates fluctuating material states into institutionally intelligible categories—turning instability into accountable order.

Reflexivity

The monitoring meeting does not merely report stabilization; it enacts it. As members narrate deviation → diagnosis → corrective action → restored value, they are simultaneously performing the rationality of governance. Each explanation of a

nozzle pressure drops, each recalibration described, each re-test cited becomes evidence that the organization is methodical and responsive.

The minutes operate reflexively. They are not passive records of repair; they are instruments through which repair becomes visible and legitimate. By documenting restored BWE, corrected microbiological counts, and recalibrated utilities, the organization produces itself as competent in the face of disturbance.

Reflexivity here is subtle but powerful: the very act of explaining instability as traceable and correctable transforms uncertainty into institutional confidence. Stabilization is achieved not only technically, but narratively.

The meeting thereby becomes a scene of disciplined resilience. The plant demonstrates that sustainability is not fragile idealism but governable practice—capable of absorbing fluctuation without collapsing into disorder.

Accountability

Accountability in Stage 7 intensifies compared to Stage 6. In Stage 6, accountability was anticipatory — members rehearsed caution before action. In Stage 7, accountability becomes responsive —members justify continuation after deviation.

Horizontally, accountability is distributed across domains:

- QA defends hygiene thresholds.
- Engineering diagnoses mechanical causes.
- Production clarifies operator behavior.
- Finance recalculates ROI implications.
- R&D mediates interpretive framing.
- GM synthesizes and authorizes.

Each participant becomes both observer and observed. No deviation is privately owned; each is publicly reasoned.

Vertically, accountability extends forward in time. The GM's directive — "document every corrective action"—ensures that today's explanation becomes tomorrow's audit trail. Conversation is destined for inscription. Minutes convert variability into durable trace.

From an ethnomethodological perspective, this distributed accountability is not bureaucratic excess. It is the method by which execution remains legitimate. Sustainability during execution survives because deviations are narratively and numerically accounted for.

7.3. Synthesis

Viewed through these sensibilities, the Trial Execution and Monitoring meeting is revealed as an organizational accomplishment of stabilization rather than mere performance review. Through indexicality, members render fluctuating technical states intelligible within shared operational grammars. Through reflexivity, they transform disturbance into visible competence. Through accountability, they convert variability into documented legitimacy.

If Stage 6 demonstrated sustainability as moral foresight, Stage 7 demonstrates sustainability as disciplined resilience. Execution is thus not the mechanical continuation of approval. It is a second-order test: can the organization sustain its ethical commitments when efficiency experiments encounter friction?

From a Practice-Based Perspective, execution is a choreography of coordinated repair—sustainability enacted as the ongoing alignment of technology, labor, measurement, and governance.

From an Ethnomethodological and Conversation Analytic stance, the meeting shows how organizational order is continuously re-achieved through reason-giving sequences. “Continuation” is not automatic; it is sequentially accomplished through boundary-setting, normalization, technical attribution, and conditional authorization.

Sustainability here is not simply achieved or failed. It is stabilized.

7.4. Sustainability as Organizational Stabilization in R&D Management

In the Trial Execution & Monitoring stage, sustainability becomes a practice of disciplined endurance. Unlike the anticipatory morality of Evaluation & Approval, execution situates sustainability within operational strain. The plant must now prove that ecological efficiency can coexist with microbiological integrity, financial prudence, and throughput continuity.

The monitoring meeting becomes a laboratory of resilience: members test not only the bottle washer, but the organization’s capacity to absorb variance without abandoning its principles.

From a Practice-Based Perspective, execution is coordination under pressure. Each department brings its own interpretive rationality:

- QA enforces hygienic discipline.
- Engineering diagnoses mechanical variance.
- Production safeguards flow.
- Finance guards capital exposure.
- R&D preserves innovation logic.
- Management integrates competing grammars.

Through this interplay, sustainability is transformed from reduction metrics into collective stewardship—an achievement of maintaining balance among competing institutional logics.

From an EM/CA perspective, stabilization is interactionally produced. Talk does not merely accompany repair; it constitutes the moral order that makes repair meaningful. When members agree to “proceed under monitoring,” they enact a form of conditional trust—confidence grounded not in optimism but in documented oversight.

Thus, in Stage 7, sustainability matures. It moves from aspiration (Stage 6) to accountability under strain (Stage 7). Before the final disposition in Stage 8, the organization has already demonstrated something essential: sustainability is not only a target to be measured but a discipline to be maintained.

The trial continues not because performance was perfect, but because performance was governable.

7.5. Coding Consolidation: Codes, Sub-Themes, and Theme

Across the monitoring deliberations, a patterned form of coordinated stabilization of sustainability performance becomes visible. Unlike Stage 6—where sustainability claims were scrutinized before approval—Stage 7 reveals how sustainability commitments are sustained, repaired, and conditionally continued under operational strain.

Table 5.15

Coding Consolidation: Codes, Sub-Themes, and Theme (Stage 7)

Excerpt Pattern	Code	Sub-theme	Theme
Framing deviations as “traceable and correctable”	Repairable variance framing	Stabilization work	Realigning functions to stabilize sustainability
QA invoking microbiological compliance as “gating condition”	Boundary condition invocation	Quality-constrained sustainability	
Recalibration of dosing, steam recovery, and conveyor settings	Technical repair articulation	Procedural corrective discipline	
ROI discussion tied to sustained reductions	Performance stability scrutiny	Economic continuity governance	
Decision to proceed “under daily monitoring”	Conditional continuation framing	Accountable continuation mechanism	
GM’s directive to document all corrective actions	Documentary reinforcement	Institutional trace production	

The sub-themes of stabilization work, quality-constrained sustainability, procedural corrective discipline, economic continuity governance, accountable continuation, and institutional trace production synthesize into the theme of: Coordinated Stabilization of Sustainability Performance Through Cross-Functional Re-Alignment.

At this stage, sustainability is not defended rhetorically nor celebrated numerically. It is stabilized procedurally. Performance must be recalibrated when

variance emerges. Sustainability gains must remain aligned with hygiene integrity, economic viability, and operational continuity. Deviation does not signify breakdown; it triggers governance.

From an ethnomethodological standpoint, monitoring meetings function as sites of order-restoration: actors convert variability into accountable explanations and documented correction. The patterned reliance on repair reflects the Scientific Process Principle and Total Quality Management Principle, while the distributed deliberation displays the Human-Centered Principle in action. Here, the social dimension of sustainability emerges in collective stabilization work.

7.6. Analytic Linkage to Research Questions

RQ1 – What R&D management practices are enacted during the elicitation, evaluation, and execution of a sustainability-oriented project?

Elicitation (carryover): Sustainability aspirations are operationalized into measurable trial parameters, embedding foresight into experimental structure.

Execution (this stage): Sustainability is enacted as disciplined performance stabilization under operational variability, where monitoring, recalibration, interpretive framing, and conditional continuation constitute the central managerial practices.

In Stage 7, the organization transitions from anticipatory accountability to responsive accountability. The work of R&D management shifts from predicting uncertainty to governing it as it unfolds.

Execution reveals a patterned cycle: Measurement → Comparison → Interpretation → Re-alignment → Verification → Conditional continuation.

These are not mechanical steps but socially coordinated practices. Deviations (e.g., microbiological exceedance, BWE fluctuation, utility drift) do not automatically

signal failure; they trigger interpretive deliberation and structured recalibration. Sustainability is sustained not through flawless performance but through disciplined governance of performance.

7.7. Synthesis of RQ1

The Trial Execution & Monitoring stage enacts R&D management as coordinated stabilization under live conditions. If Stage 6 demonstrated communicative coordination before action, Stage 7 demonstrates operational coordination during action. Sustainability commitments move from being verbally authorized to being empirically tested within production realities.

Execution becomes a second-order experiment: not only testing the bottle washer but testing the organization's capacity to maintain coherence across competing logics—efficiency, hygiene, financial prudence, and throughput continuity.

Managerial work in this stage is neither visionary nor rhetorical. It is vigilant. Sustainability is preserved through:

- Cross-functional monitoring
- Numeric accountability
- Procedural recalibration
- Conditional authorization

The social dimension of sustainability becomes especially visible here: no single department "owns" stability. It is collectively produced through distributed vigilance. Execution, therefore, demonstrates that sustainability is not secured at approval—it must be continually stabilized through coordinated practice.

The Trial Execution & Monitoring stage closes the operational testing phase of the trial's life cycle. What follows is not further stabilization, but institutional crystallization. In Stage 8, accumulated evidence is consolidated and transformed into formal disposition.

Execution demonstrates that sustainability is not validated by perfect performance but by governable performance. Through cycles of measurement, interpretation, documentation, and conditional continuation, the organization sustains institutional alignment amid operational variability.

If Stage 6 asked whether sustainability could be responsibly authorized, and Stage 7 asked whether it could be responsibly stabilized, Stage 8 asks whether it can be responsibly institutionalized.

Stage 8 – Trial Evaluation and Disposition

The 8th stage, Trial Evaluation and Disposition, marks the transformation of stabilized performance into institutional judgment. Whereas Stage 6 authorized experimentation and Stage 7 stabilized execution under operational variability, Stage 8 determines whether sustainability gains are sufficiently reliable to be embedded into organizational routine.

If execution demonstrated governable performance, evaluation determines governable permanence.

The empirical anchor for this stage is the Minutes of the Meeting for Trial Evaluation and Disposition (October 10, 2023), where consolidated 10-day performance data were reviewed against all nine Success Criteria, and a formal decision regarding adoption and replication was rendered.

At this stage, sustainability is no longer framed as possibility or stabilization. It is framed as standard.

Condensed Raw Data Anchor

The consolidated performance data for the 10-day trial demonstrate that all nine Success Criteria were achieved based on rolling average performance:

- Water reduction: 26.3%
- Caustic reduction: 22.5%
- Steam reduction: 15.2%
- COD reduction: −18 mg/L
- Phosphate reduction: −0.9 mg/L
- Microbiological average: 46 CFU (within <100 CFU threshold)
- ROI projection: 4.2 years

These values exceed or meet the predefined criteria and form the evidentiary basis for institutionalization.

8.1. Analytic Result

PBP: Institutionalization as Programmatic Embedding

From a Practice-Based Perspective, this stage demonstrates how experimental outcomes are translated into structured commitment.

Institutionalization involves:

- Incorporation into Environmental Plans & Programs (EPP)
- Conversion of trial metrics into routine performance targets

- Formalization of calibration procedures into SOPs
- Inclusion of performance data in management review cycles

This is not merely adoption of equipment. It is adoption of accountability routines. Sustainability here moves from project-based experimentation to programmatic embedding. The practice shifts from “trial monitoring” to “standard performance governance.”

EM: Evaluation Minutes as Documentary Crystallization of Institutional Legitimacy

From an Ethnomethodological (EM) standpoint, the Evaluation and Disposition minutes function as a crystallizing accountability device. They do more than summarize consolidated performance data; they organize how the trial becomes institutionally recognizable as complete, sufficient, and transferable.

The minutes display:

• what counts as “achievement” (all nine criteria satisfied on rolling 10-day average),

• what counts as “stability” (post-corrective microbiological compliance maintained below threshold),

• what counts as “economic legitimacy” (ROI ≤ 5 years; utilities reductions exceeding target), and

• what counts as “readiness for institutionalization” (EPP integration, SOP formalization, replication planning).

In this sense, the evaluation meeting is not merely “about” confirming success. It is a formal scene where members convert stabilized performance into institutional commitment by producing a documentable narrative: evidence consolidation → threshold validation → cross-functional endorsement → formal approval → programmatic embedding.

The consolidated table does not neutrally reflect performance; it performs sufficiency. By arranging Baseline → Target → 10-Day Average → Status, the document demonstrates that the trial has crossed from conditional experiment to organizational norm.

Thus, the minutes are not passive archives but methods for rendering sustainability durable — showing that institutionalization is not declared rhetorically but accomplished through documentary work that stabilizes success as policy.

CA: Evaluation as an Interactional Site of Institutional Authorization

The Evaluation and Disposition meeting accomplishes a critical interactional task: it converts stabilized performance into formal institutional commitment. Unlike Stage 7, where talk organized “continuation under conditions,” Stage 8 organizes “authorization for embedding.”

Table 5.16

Excerpt from Minutes of the Meeting for Trial Evaluation and Disposition

Turn	Speaker	Talk / Extract	Interactional Notes & Analytic Comments
1	R&D (Chair)	“Rolling averages across the full 10-day cycle meet or exceed all nine success criteria.”	Opens with evidentiary consolidation; frames the meeting around sufficiency rather than uncertainty

2	QA	“Microbiological compliance remained below 50 CFU from Days 6–10.”	Reasserts safety as primary gatekeeping category; confirms absence of residual instability
3	ENG	“Steam reduction target was achieved after calibration; no systemic design flaw identified.”	Reframes prior deviations as resolved; stabilizes technical legitimacy
4	FIN	“With ROI projected at 4.2 years, financial viability is confirmed.”	Converts performance stability into economic authorization
5	PROD	“Operational impact is negligible under validated parameters.”	Aligns institutionalization with production continuity
6	GM	“The objective was controlled efficiency, not mere reduction.”	Reformulates success criteria into governance principle; integrates efficiency with accountability
7	R&D	“We recommend adoption and phased evaluation for other breweries.”	Transforms consolidated agreement into forward-looking institutional proposal
8	GM	“Approved for adoption at Plant A and for phased technical assessment at other sites.”	Formal closure device; converts consensus into authoritative institutional decision

Conversation Analytic Interpretation

Across these turns, “institutionalization” is not assumed — it is constructed. The interaction demonstrates:

• **Threshold confirmation** (R&D consolidates sufficiency before deliberation proceeds)

• **Safety re-validation** (QA reaffirms microbiological compliance as non-negotiable)

• **Technical stabilization framing** (Engineering normalizes earlier deviation as resolved)

• **Economic legitimization** (Finance translates sustainability into investment rationality)

• **Operational alignment** (Production confirms feasibility under standard conditions)

• **Integrative authority** (GM synthesizes efficiency with governance integrity)

• **Formal authorization** (Adoption and replication articulated as institutional decision)

Sequentially, the meeting moves from evidentiary sufficiency → multi-logic alignment → executive endorsement. The GM's final approval functions as a decisive closure formulation. It transforms stabilized performance into institutional fact. At this point, sustainability is no longer conditional; it is authorized.

If Stage 7 showed "continuation" as a collective accomplishment under monitored conditions, Stage 8 shows "institutionalization" as a collective accomplishment under validated sufficiency. Sustainability becomes durable not because no deviations occurred, but because deviations were resolved and rendered governable before endorsement.

8.2. Ethnomethodological Sensibilities

Building on the methodological orientation established in Chapter IV, the analysis of the Trial Evaluation and Disposition meeting draws upon the core ethnomethodological sensibilities of indexicality, reflexivity, and accountability

(Garfinkel, 1967; Trace, 2016; Maynard, 2023). These sensibilities shift analytic attention away from whether the trial “performed successfully” and toward how organizational legitimacy was formally constituted at the moment of institutional decision.

Unlike the Trial Execution & Monitoring stage—where members confronted uncertainty as it unfolded—Stage 8 confronts the question of durability. Here, rationality is not enacted in repair but displayed in consolidation. The evaluation meeting becomes a performative site where stabilized performance is interpreted, categorized, and elevated into organizational norm.

Members do not merely confirm that targets were met; they produce a recognizable grammar through which “achievement” becomes sufficient for institutional embedding. Where Execution asked, “Can we sustain what we have begun?”, Evaluation asks, “Is it durable enough to formalize?”

Responsibility shifts once again. It is no longer anticipatory (Stage 6) nor responsive (Stage 7); it becomes institutional. Sustainability is no longer demonstrated through repair or vigilance alone. It must be rendered transferable, documentable, and governable over time.

In this setting, sustainability is no longer a test but a threshold: has the organization accumulated enough stabilized evidence to convert experiment into standard?

Indexicality

The language of execution is saturated with indexical expressions whose meaning depends on shared governance competence.

Terms such as: “Achieved,” “Adoption,” “Institutionalization,” “Integration into EPP,” and “Phased Replication” are not neutral descriptors. They derive intelligibility from the plant’s environmental management routines and accountability grammar.

For instance, when the consolidated table marks all nine criteria as “Achieved,” the term does more than summarize numbers. It invokes a collectively understood sufficiency threshold: rolling averages validated, deviations corrected, performance sustained. “Achieved” indexes readiness — not perfection, but governable stability.

Similarly, “Institutionalization” does not signify abstract permanence. It indexes specific organizational consequences:

- Integration into Environmental Plans & Programs (EPP)
- Conversion of trial metrics into routine monitoring targets
- Inclusion in periodic management review
- SOP formalization and cross-plant baseline validation

The phrase “approved for adoption” carries institutional weight. It transforms a bounded experiment into an operational expectation. Its meaning is inseparable from shared knowledge of program cycles, audit preparation, and performance reporting structures.

Even numeric expressions — “26.3% water reduction,” “4.2-year ROI,” “46 CFU average”—are indexical. They reference not abstract improvement but validated comparison against predefined thresholds. Their legitimacy depends on shared measurement practices and prior agreement about acceptable boundaries.

Through indexicality, evaluation talk translates stabilized performance into institutional category—turning success into standard.

Reflexivity

The Evaluation and Disposition meeting does not merely declare institutionalization; it performs it. The consolidated structure — Baseline → Target → 10-Day Average → Status → Decision—functions as a reflexive device. It simultaneously:

- Displays rational comparison
- Demonstrates procedural discipline
- Produces the legitimacy required for formal embedding

By arranging evidence sequentially and recording cross-functional endorsement, the meeting enacts closure.

The minutes operate reflexively. They are not passive records of success; they are instruments through which success becomes durable. By documenting consolidated averages, confirming all nine criteria, and inscribing the final decision, the organization produces itself as competent, disciplined, and prepared for replication.

Reflexivity here transforms stabilized performance into institutional fact. Adoption is not a declaration; it is the culmination of documented sufficiency.

The meeting thus becomes a scene of crystallization. The organization demonstrates that sustainability is not episodic enthusiasm but structured commitment — capable of being embedded, monitored, and transferred.

Accountability

Accountability in Stage 8 extends beyond correction and continuation into durable governance. In Stage 6, accountability was anticipatory. In Stage 7,

accountability was responsive. In Stage 8, accountability becomes programmatic. Horizontally, accountability remains distributed:

- QA validates hygienic integrity.
- Engineering confirms mechanical durability.
- Production affirms operational continuity.
- Finance confirms economic viability.
- R&D synthesizes performance narrative.
- GM authorizes formal embedding.

Each department endorses sufficiency within its domain before institutionalization proceeds. No single metric is decisive; legitimacy emerges through multi-logic alignment.

Vertically, accountability extends forward in time. Integration into EPP, monthly monitoring commitments, and replication planning ensure that today's decision becomes tomorrow's review cycle. Institutionalization redistributes oversight rather than terminating it.

Conversation becomes inscription; inscription becomes obligation.

From an ethnomethodological perspective, this distributed and longitudinal accountability is not bureaucratic ritual. It is the method by which sustainability becomes durable. The organization does not assume permanence; it constructs permanence through documentation, endorsement, and forward planning.

8.3. Synthesis

Viewed through these sensibilities, the Trial Evaluation and Disposition meeting is revealed as an organizational accomplishment of crystallization rather than mere performance confirmation.

Through indexicality, members render stabilized performance intelligible as readiness. Through reflexivity, they transform consolidated evidence into institutional legitimacy. Through accountability, they extend responsibility across time and across sites.

If Stage 6 demonstrated sustainability as moral foresight, and Stage 7 demonstrated sustainability as disciplined resilience, Stage 8 demonstrates sustainability as institutional durability.

Institutionalization is thus not administrative closure. It is a third-order test: can the organization convert stabilized improvement into enduring governance structure?

From a Practice-Based Perspective, evaluation is the choreography of embedding—where experimental gains are integrated into program cycles, monitoring routines, and replication frameworks.

From an Ethnomethodological and Conversation Analytic stance, institutionalization is interactionally achieved. “Adoption” is not automatic; it is sequentially produced through threshold validation, multi-logic endorsement, executive authorization, and documentary inscription.

Sustainability here is not merely stabilized. It is crystallized.

8.4. Sustainability as Organizational Institutionalization in R&D Management

Unlike the stabilization phase, where performance required ongoing monitoring and justification, institutionalization marks the point at which sustainability metrics are absorbed into routine governance and treated as normative operational standards.

In the Trial Evaluation & Disposition stage, sustainability becomes a practice of disciplined institutionalization. Unlike the responsive vigilance of Execution & Monitoring, evaluation situates sustainability within the question of durability. The plant

must now determine whether ecological efficiency can coexist not only with microbiological integrity, financial prudence, and throughput continuity—but with routinization. Sustainability must move from managed performance to governed permanence.

The evaluation meeting becomes a laboratory of crystallization: members test not only the bottle washer's performance, but the organization's readiness to convert stabilized improvement into structured commitment.

From a Practice-Based Perspective, institutionalization is coordination beyond pressure. Each department brings its stabilized rationality to the table:

- QA confirms that hygiene integrity remains non-negotiable.
- Engineering validates those technical adjustments resolved systemic risk.
- Production affirms operational continuity under validated parameters.
- Finance confirms economic viability within capital planning thresholds.
- R&D synthesizes performance data into adoption recommendation.
- Management integrates these grammars into formal authorization.

Through this interplay, sustainability is transformed from controlled experiment into organizational standard—an achievement of embedding ecological and operational gains within structured governance.

From an EM/CA perspective, institutionalization is interactionally produced. Talk does not merely accompany adoption; it constitutes the institutional fact of adoption. When members confirm that "all nine criteria are achieved" and the GM declares approval for integration into Environmental Plans & Programs, they enact more than consensus. They enact durability.

Unlike Stage 7, where continuation was authorized under conditions of ongoing monitoring, Stage 8 produces definitive alignment. Agreement is no longer framed as provisional or contingent; it is rendered sufficient for institutional embedding.

Thus, in Stage 8, sustainability matures once more. It moves from:

- aspiration (Stage 6),
- to accountability under strain (Stage 7),
- to accountable permanence (Stage 8).

Before Chapter V concludes, the organization demonstrates something decisive: sustainability is not only measurable, not only governable, but embed-able. The trial concludes not because performance was flawless, but because performance was sufficiently stabilized, validated, and aligned to justify institutional commitment.

8.5. Coding Consolidation: Codes, Sub-Themes, and Theme

Across the evaluation deliberations, a patterned form of institutional embedding of sustainability performance becomes visible. Unlike Stage 7—where sustainability commitments were stabilized under operational variability—Stage 8 reveals how sustainability gains are formalized, routinized, and prepared for diffusion.

Table 5.17

Coding Consolidation: Codes, Sub-Themes, and Theme (Stage 8)

Excerpt Pattern	Code	Sub-theme	Theme
Consolidation of 10-day rolling averages	Evidentiary consolidation	Standardization readiness	Embedding sustainability into governance
Confirmation of all nine criteria achieved	Threshold validation	Legitimacy confirmation	
Approval for EPP integration	Programmatic embedding articulation	Governance formalization	
Inclusion in management review cycles	Longitudinal accountability planning	Durability structuring	
Replication discussion for other breweries	Scalability framing	Organizational diffusion	
GM formal approval statement	Institutional authorization formulation	Decision crystallization	

The sub-themes of standardization readiness, legitimacy confirmation, governance formalization, durability structuring, organizational diffusion, and decision crystallization synthesize into the theme of Institutionalization of Sustainability Through Formal Governance Embedding.

At this stage, sustainability is no longer defended through repair nor justified through anticipation. It is embedded procedurally. Performance metrics are converted into routine targets. Trial learnings are formalized into SOPs. Monitoring shifts from

daily vigilance to programmatic review. Deviation no longer triggers repair; it will now trigger audit.

From an ethnomethodological standpoint, evaluation meetings function as sites of order-crystallization: actors convert stabilized performance into durable institutional fact. The patterned reliance on evidentiary consolidation reflects the Scientific Process Principle, while EPP integration and management review inclusion demonstrate the Total Quality Management and Planning & Foresight Principles. The distributed endorsement across departments reflects the Human-Centered Principle in its most mature form—collective authorization of permanence.

Here, the social dimension of sustainability emerges not as vigilance, but as collective institutional commitment.

8.6. Analytic Linkage to Research Questions

RQ1 – What R&D management practices are enacted during the elicitation, evaluation, and execution of a sustainability-oriented project?

Elicitation (carryover): Sustainability aspirations are translated into structured objectives and measurable trial parameters, embedding foresight into formal experimental design.

Execution (carryover): Sustainability commitments are stabilized under operational variability through monitoring, recalibration, interpretive framing, and conditional continuation.

Evaluation & Disposition (this stage): Sustainability is enacted as institutional crystallization—where consolidated evidence, cross-functional endorsement, formal authorization, and programmatic embedding constitute the central managerial practices.

In Stage 8, the organization transitions from responsive accountability to institutional accountability. The work of R&D management shifts from governing live variability to determining durable embedding.

Evaluation reveals a patterned sequence: Evidence consolidation → Threshold validation → Multi-logic endorsement → Executive authorization → Programmatic integration → Replication planning.

These are not bureaucratic formalities but socially coordinated practices. Achieved metrics (e.g., 26.3% water reduction; 22.5% caustic reduction; 46 CFU average; 4.2-year ROI) do not automatically become standards. They are interpreted, endorsed, and authorized through deliberative alignment.

Sustainability is institutionalized not because performance was perfect, but because performance was sufficiently stabilized, validated, and governable.

8.7. Synthesis of RQ1

The Trial Evaluation and Disposition stage represents the point at which sustainability-oriented experimentation is translated into institutional commitment. If Stage 6 demonstrated communicative coordination before action, and Stage 7 demonstrated operational coordination during action, Stage 8 demonstrates structural coordination beyond action. At this stage, sustainability commitments move from being verbally authorized, to empirically stabilized, and finally to programmatically embedded within organizational governance structures.

Evaluation in this stage therefore operates as a third-order test. Earlier stages assessed whether the proposed technological intervention could function under operational conditions and whether the organization could maintain stability during implementation. The final evaluation instead addresses a different question: whether

the stabilized improvement is sufficient to justify institutionalization. Managerial work becomes consolidative rather than anticipatory or reactive. Evidence generated during the trial is reviewed collectively, cross-functional sufficiency is confirmed, and the resulting decision is formally inscribed into organizational documents and environmental programs.

The empirical results of the trial—such as the observed reductions in water consumption (26.3%), caustic usage (22.5%), and steam consumption (15.2%), together with sustained microbiological compliance and favorable ROI projections—are no longer treated merely as experimental indicators. Instead, they become operational expectations that guide routine practice. Sustainability performance is thus translated from provisional trial outcomes into durable organizational standards.

From a governance perspective, the social dimension of sustainability becomes most visible at this stage. Institutionalization is not the decision of a single managerial unit but the outcome of distributed endorsement across organizational functions. Durability emerges through coordinated authorization, documentation, and monitoring commitments that collectively embed the innovation within existing environmental programs and operational routines.

Through this progression, sustainability completes its transition across the project lifecycle—from early identification and commitment (Stages 1–4), to negotiated authorization (Stage 6), to operational stabilization (Stage 7), and ultimately to institutional crystallization (Stage 8). Sustainability therefore emerges not as a single decision point but as the outcome of a structured sequence of organizational practices that progressively render environmental improvement visible, testable, and governable.

Taken together, the eight stages examined in this section illustrate how sustainability-oriented R&D initiatives are elicited, evaluated, executed, and ultimately institutionalized through coordinated managerial practice. The analysis demonstrates that sustainability is accomplished through the interaction of documentation, deliberation, experimentation, monitoring, and formal decision-making processes embedded in everyday organizational work.

While the preceding analysis has described the practices through which sustainability-oriented R&D projects are enacted, the findings also indicate that these practices are guided by recurring forms of managerial reasoning. Managers and technical staff draw upon shared principles, such as planning and foresight, scientific validation, performance orientation, and quality management, to interpret sustainability concerns and justify project decisions.

The following section therefore addresses the second research question by examining the underlying R&D management principles that shape these enacted practices.

Underlying Principles of Sustainability-Oriented R&D Management Practices

Building on the findings presented in R&D Management Practices in the Elicitation, Evaluation, and Execution of Sustainability-Oriented Projects, this section focuses on the underlying managerial orientations that shape those practices. The principles identified in RQ2 are not treated as separate from practice; rather, they are understood as the underlying logics enacted through the practices identified in RQ1. Derived from recurring patterns observed across the eight stages of the project lifecycle, these principles provide an interpretive lens for explaining how sustainability

concerns become actionable, legitimate, and governable in everyday R&D work. The discussion that follows therefore examines how organizational practices are accomplished through specific principles that shape what members regard as relevant evidence, acceptable risk, and defensible decision-making.

Across the eight stages—from operations mapping to final evaluation and institutionalization—managers and technical staff repeatedly rely on shared orientations to interpret sustainability concerns, justify project actions, and coordinate decisions.

From an ethnomethodological perspective, these orientations are not treated as abstract doctrines existing outside practice. Rather, they become visible through the practical methods by which organizational actors render project work intelligible, accountable, and defensible. Documents such as environmental registers, trial protocols, monitoring records, and minutes of meetings function as members' methods through which sustainability concerns are interpreted, prioritized, and organized *in situ*. Complementing this, a practice-based perspective treats these recurring orientations as embedded principles within everyday organizational routines—principles that guide how sustainability-oriented innovation is pursued and stabilized over time.

Comparative analysis across the eight stages of the project lifecycle indicates that sustainability-oriented R&D management in the organization is structured around eight interrelated principles: Planning and Foresight, Human-Centered Orientation, Value Orientation, Performance Orientation, Creativity and Innovativeness, Scientific Process, Technology-Society Orientation, and Total Quality Management. These principles do not operate independently; rather, they interact across stages and are repeatedly enacted through documentary and interactional work as sustainability

initiatives are identified, tested, evaluated, and embedded into organizational governance.

The principles identified are treated not as abstract values but as empirically grounded managerial orientations evident in recurring documentary and interactional patterns throughout the project lifecycle. Although certain principles are more prominent in specific stages, the analysis also demonstrates how they overlap and reappear as enabling conditions across multiple stages. To maintain consistency with the staged presentation of the findings, each stage is examined in terms of its primary principles (most salient) and supporting principles (enabling or reinforcing), with direct reference to the enacted practices and empirical excerpts through which these principles become visible.

Table 5.18 summarizes the stage-linked integration of the RQ1 practices and the RQ2 principles, indicating the primary and supporting principles enacted at each stage and the corresponding ethnomethodological function of the stage's documentary and interactional work.

Table 5.18

Stage-Linked Integration of R&D Management Practices (RQ1) and Underlying R&D Management Principles (RQ2), Showing Primary vs Supporting Principles and the Role of Each Stage as Ethnomethodological Function

Project Stage	Practice (RQ1)	Primary Principles	Supporting / Enabling Principles	Role in the Stage (Ethnomethodological function)
Stage 1 – Operations, Product & Process Mapping	Anticipating operational sustainability needs	**Strategic Planning and Foresight**	Quality Management and Performance Excellence	Establishes operational visibility and anticipatory baselines for sustainability-oriented improvement work
Stage 2 – Registry of Environmental Aspects & Impacts	Classifying priorities and directing sustainability efforts	**Value Orientation and Technology–Society Integration**	Strategic Planning and Foresight	Frames impacts as organizational responsibilities and prioritizes them through significance and improvement pathways
Stage 3 – Environmental Objectives	Formalizing sustainability targets	**Performance Excellence and Value Orientation**	Technology–Society Integration	Converts sustainability commitments into measurable, auditable goals anchored to stewardship and compliance frames
Stage 4 – Environmental	Stabilizing sustainability programs	**Strategic Planning, Foresight and Performance**	Human-Centeredness and Quality Management	Aligns sustainability initiatives with operational strategies through coordination routines,

Project Stage	Practice (RQ1)	Primary Principles	Supporting / Enabling Principles	Role in the Stage (Ethnomethodological function)
Plans & Programs				ownership allocation, and monitoring governance
Stage 5 – Trial Protocol	Innovating through accountable experimentation	**Scientific Inquiry, Creativity, and Innovation**	Performance Excellence and Quality Management	Structures experimentation through defined methods, baselines, targets, and success criteria to test sustainability improvements
Stage 6 – Evaluation & Approval	Negotiating governance across functions	**Human-Centeredness and Value Orientation**	Strategic Planning, Foresight and Scientific Inquiry	Negotiates trial legitimacy and bounded commitment; specifies readiness conditions and allocates responsibilities before execution
Stage 7 – Execution & Monitoring	Realigning functions to stabilize sustainability	**Quality Management and Performance Excellence**	Human-Centeredness and Scientific Inquiry	Governs sustainability performance under operational variability through deviation management, corrective alignment, and conditional continuation
Stage 8 – Trial Evaluation & Disposition	Embedding sustainability into governance	**Scientific Inquiry and Quality Management**	Value Orientation, Strategic Planning and Foresight	Consolidates evidence against criteria and embeds validated improvements into routine governance (EPP integration, SOPs, replication pathway)

Primary principles indicate the most salient managerial orientations organizing the stage's work, while supporting principles capture enabling logics that recur across stages and contribute to the continuity and governability of sustainability-oriented R&D practice.

Stage 1 – Operations, Product & Process Mapping: Planning and Foresight as Foundational Sustainability Work

Stage 1 operationalizes sustainability-oriented R&D management through the documentation of operational resource flows and process conditions, forming the earliest organizational basis for identifying where improvements may be possible and defensible. In this stage, the mapping activity does not function merely as a descriptive inventory of process steps. Rather, it performs anticipatory work by rendering the bottle-washing operation visible, comparable, and improvable—thereby preparing the conditions under which later sustainability claims can be argued and evaluated.

In this stage, the RQ1 practice is accomplished primarily through Planning and Foresight, supported by Performance Orientation and Total Quality Management, which together supply the criteria and orientations through which the work is rendered accountable.

1.1. Primary Principle: Strategic Planning and Foresight

The Planning and Foresight Principle is enacted in Stage 1 through the disciplined production of an "operational picture" that anticipates what future R&D intervention should attend to—namely, the system's resource dependencies, outputs, and quality control points. This anticipatory orientation is empirically visible in how the

mapping document explicitly names operational consequences that later become objects of improvement and governance.

For example, the mapping's identification of wastewater as an ordinary output already frames water consumption and effluent generation as matters that can be made accountable and targeted for improvement:

Excerpt: "Wastewater from rinsing and washing stages."

Similarly, by specifying chemical residues as requiring controlled handling, the mapping prefigures later sustainability work around chemical reduction and waste stream management—before any trial proposal is written:

Excerpt: "Residual chemical solution requiring neutralization/disposal."

These entries operate as *anticipatory categorizations*: they translate routine production outputs into reportable objects that can later be codified in the RAI, formalized in objectives, and tested through trial protocols. In this sense, the planning work is not postponed to later stages; it begins here, where the organization establishes what counts as relevant operational realities for sustainability-oriented R&D management.

1.2. Supporting Principles: Quality Management and Performance Excellence

While Planning and Foresight is primary in Stage 1, the mapping activity is simultaneously shaped by Performance Orientation and Total Quality Management (TQM) principles. The mapping does not frame the process only in terms of environmental inputs/outputs; it frames it as a quality-governed system oriented toward performance integrity. This is visible where the mapping defines the intended output in quality terms, linking operational success to standardized acceptability:

Excerpt: *"Cleaned and inspected bottles, suitable for filling."*

This fragment shows that performance and quality are not external checks applied after sustainability initiatives are proposed; they are already embedded in the stage that surfaces improvement opportunities. Sustainability-oriented R&D work is therefore anticipated within a bounded logic: improvement opportunities must remain compatible with performance and hygiene expectations that define what the organization can recognize as “successful” bottle washing. The mapping thus functions as an early TQM-oriented accountability device—producing a process account that is inspectable and later verifiable through downstream evaluation and monitoring.

1.3. Interpretive basis

The Stage 1 mapping demonstrates principle enactment because it establishes a recurring governance logic that is carried forward across later stages: sustainability work begins by producing structured operational visibility that anticipates improvement possibilities while remaining constrained by performance and quality accountability. The mapping’s documentary naming of wastewater and chemical residues functions as a foresight mechanism—a way of making potential sustainability interventions intelligible in advance. At the same time, its framing of “cleaned and inspected bottles” anchors improvement possibilities to TQM and performance standards, ensuring that subsequent sustainability claims remain governable within core product safety expectations.

In short, Stage 1 shows that sustainability-oriented R&D management is initiated through a planning logic that is already integrated with performance and quality rationalities. Rather than treating sustainability as an abstract criterion applied later, the organization begins by producing documentary visibility of resource flows and constraints—making later R&D work both possible and accountable. Taken

together, these principles explain how the RQ1 practice is not incidental but systematically organized—i.e., how members make the practice repeatable, defensible, and governable as sustainability-oriented R&D work.

Stage 2 – Registry of Environmental Aspects & Impacts (RAI): Value-Orientation and Technology–Society as Sustainability Prioritization Work

Stage 2 advances sustainability-oriented R&D management through the systematic identification and prioritization of environmental aspects, using the Registry of Environmental Aspects & Impacts (RAI) as the central documentary mechanism. In this stage, sustainability is not treated as a general aspiration; it is rendered *organizationally actionable* through formal classification—i.e., by defining what counts as an "aspect," what counts as an "impact," how significance is established, and what improvement directions are implied. The RAI thus functions as more than a record: it is an institutional device that translates operational realities (e.g., energy and water use) into ranked organizational responsibilities that can guide subsequent objective-setting and trial work.

In this stage, the RQ1 practice of systematic identification and prioritization is accomplished primarily through Value-Orientation and Technology–Society principles, supported by Planning and Foresight, which together provide the classificatory and accountability logic through which "significance" is produced and made actionable.

2.1. Primary Principles: Value Orientation and Technology–Society Integration

The RAI most strongly enacts the Value-Orientation Principle by institutionalizing how the organization assigns importance, priority, and legitimacy to sustainability concerns. Rather than leaving environmental significance to informal

judgment, the RAI embeds value through formal categorizations, numerical ratings, and significance labels that stabilize “what matters” in a way that is inspectable and repeatable. This becomes especially visible where the RAI formalizes significance through likelihood, severity, and a resulting impact rating:

Excerpt: *“Rating: Likelihood (L) … Rating: Severity (S) … Impact Rating (LxS) … Impact Category”*

In the excerpted RAI entries for Bottle Washing, energy and water use are not merely described as technical inputs. They are explicitly positioned as organizationally consequential through significance scoring and categorization. For example, electricity use is scored and categorized as “Significant,” converting resource dependence into an institutional priority:

Excerpt: *“Use of electricity … ‘Resource draw from grid (coal-dependent supply)’ …* Impact Rating (LxS): 20 … Impact Category: Significant”

Alongside this value-orientation work, the RAI simultaneously enacts the Technology–Society Principle by framing operational resource use as a matter of broader responsibility rather than purely internal efficiency. The water entry illustrates this clearly: the RAI links routine bottle-washing consumption to a societal and environmental condition (“localized water stress”), thereby making the environmental consequence socially meaningful within the organization’s accountability grammar:

Excerpt: “Use of water … ‘Water consumed in pre-rinse, soaking, and final rinse stages’ … ‘Resource depletion; localized water stress’”

This excerpt performs a distinctive reframing: it shifts water consumption from a production necessity into a socially consequential issue. The phrase “localized water stress” functions as a bridge between internal operational practice and external

ecological consequence. In this way, the RAI does not only track environmental effects—it organizationally authorizes them as legitimate grounds for improvement decisions and future project work.

2.2. Supporting Principle: Strategic Planning and Foresight (as Projective "Improvement Pathway" Work)

Although Value-Orientation and Technology–Society are primary in Stage 2, the RAI also exhibits Planning and Foresight as an enabling principle through the way it projects potential improvement directions. This is most evident in the RAI's inclusion of an explicit "Improvement Pathway / Priority Signal" column. The registry does not stop at identifying impacts—it points forward to how such impacts may be acted upon through future interventions. For instance, the electricity entry explicitly anticipates design-level improvement work:

Excerpt (RAI – Improvement Pathway): *"Signals potential project priority for energy recovery retrofits in washer design"*

Similarly, the water entry anticipates reuse/recycling development, projecting sustainability work beyond documentation and into prospective R&D or engineering initiatives:

Excerpt (RAI – Improvement Pathway): "Highlights opportunity for reuse/recycling system development"

These statements demonstrate that the RAI is not merely evaluative; it is projective. It transforms classified environmental aspects into forward-facing "pathways," thereby enabling later stages (EO, EPP, Trial Protocol) to proceed with a pre-structured logic of what is improvable and why. In practice-based terms, this is foresight work embedded in routine documentation: the organization anticipates

improvement trajectories by producing documentary cues that make future proposals more accountable and easier to justify.

2.3. Interpretive basis

Stage 2 demonstrates “principles” (rather than merely listing environmental data) because the RAI repeatedly performs a stable organizational logic that governs sustainability relevance and prioritization:

1. **Value-Orientation is enacted through classification and ranking.** Environmental concerns are made organizationally “real” through scoring (L, S, LxS), significance labeling, and formal categorization (e.g., “Significant”). This stabilizes what counts as important and legitimizes attention and resources.

2. **Technology–Society is enacted through the framing of impacts as broader responsibilities.** Terms like “localized water stress” embed societal/environmental consequence into the organizational account, ensuring the issue is not reducible to internal technical efficiency alone.

3. **Planning and Foresight is enacted through explicit improvement signaling.** The “Improvement Pathway/ Priority Signal” column converts classification into projective direction—e.g., energy recovery retrofits and reuse/recycling development—showing how the registry anticipates and structures future intervention work.

Taken together, these recurring documentary practices justify interpreting Stage 2 as the organizational site where sustainability becomes institutionally prioritized—not merely observed. The RAI provides a members’ method for translating operational dependencies into actionable responsibilities, enabling sustainability-oriented R&D management to proceed with a structured and accountable basis for

objective-setting and experimentation. Thus, the RAI does not simply document impacts; it operationalizes the principles through which the organization makes prioritization consequential for subsequent objectives and trial work.

Stage 3 – Environmental Objectives: Converting Sustainability Commitments into Measurable and Governable Targets

Stage 3 advances sustainability-oriented R&D management through the formal articulation of sustainability targets. Building directly on the prioritized impacts produced in Stage 2, this stage makes sustainability operational by turning “what matters” into explicit objectives that can later be planned, tested, monitored, and defended. Consistent with the overall analytic framing, the principles identified in RQ2 are the underlying principles of the practices surfaced in RQ1—that is, they underlie and are enacted through the RQ1 practice in this stage (the formal articulation of targets). In Stage 3, targets do not function as neutral statements; they function as managerial commitments that define what counts as improved performance, what counts as acceptable progress, and what counts as credible evidence across later stages of the project lifecycle.

In this stage, the RQ1 practice of formalizing sustainability targets is accomplished primarily through the Performance and Value-Orientation principles, supported by a Technology–Society orientation. Together, these principles supply the criteria by which sustainability commitments become measurable, auditable, and defensible as organizational work (rather than remaining rhetorical aspirations).

3.1. Primary Principles: Performance Excellence and Value Orientation

The Performance Principle is enacted in Stage 3 by expressing sustainability commitments as quantified thresholds that can be tracked and assessed. Rather than describing “reduce resource use” in general terms, the organization formalizes performance through numerical targets that establish clear comparators for improvement.

This performance orientation is visible in how targets appear in the documentary corpus as fixed thresholds. For example, the organization specifies electricity and water objectives as measurable limits:

Excerpt (Target – Energy): *“PKG SO: ≤ 0.153 KwH/case”*

Excerpt (Target – Water): *“SO: ≤ 0.173 hL/case”*

These are not presented as optional aspirations; they are expressed as upper-bound performance thresholds (“≤”), which is significant because the form of the target already anticipates auditability: the organization can later demonstrate whether performance is within, above, or below an agreed limit.

The Performance Principle also appears as the organization projects quantifiable improvement expectations into deliberation. In the approval meeting, sustainability improvements are framed in measurable ranges that anticipate evaluation:

Excerpt (Approval framing): *“The equipment’s design… expected to reduce resource use by 15–25%.”*

Here, the improvement is not left as a qualitative claim (“more efficient”); it is framed as a measurable reduction that later becomes testable through baselines, monitoring, and success criteria.

The Value-Orientation Principle is enacted in Stage 3 by defining targets as expressions of what the organization treats as important and legitimate—i.e., what it is willing to be held accountable to. In other words, objectives are not only performance measures; they are value commitments stabilized into documentary form.

This value orientation becomes visible in the way targets are anchored to internal and external legitimacy sources (e.g., legal/regulatory expectations and internal sustainability objectives). The documentary record ties target-setting to compliance and governance references:

Excerpt (Target legitimacy – Energy): *"RA 11285 (Energy Efficiency & Conservation Act); PKG SO: ≤ 0.153 KwH/case"*

Excerpt (Target legitimacy – Water): *"PD 1067 (Water Code) … SO: ≤ 0.173 hL/case"*

This anchoring shows that targets are not merely internal preferences; they are documented as accountable commitments that the organization can justify (to auditors, managers, and internal governance bodies). In practice-based terms, the organization is doing "value work" by establishing which sustainability outcomes are worth formal commitment—and by embedding these commitments in the same documentary ecosystem that governs operational decision-making.

3.2. Supporting Principle: Technology–Society Integration

Stage 3 targets are also supported by a Technology–Society integration because resource-use objectives are framed as consequential beyond internal efficiency. This is visible where water is not only treated as a production input but also linked to broader resource conditions:

Excerpt (Societal framing – Water): *“Resource depletion; localized water stress”*

While Stage 2 introduced this framing through impact classification, Stage 3 carries it forward by stabilizing it into targets that can guide future action. In this way, the Technology–Society orientation supports target-setting by supplying a stewardship rationale: water performance objectives matter not only because they improve operations, but because they respond to recognized environmental and social resource conditions.

Putting these together, Stage 3 demonstrates how the RQ2 principles are the underlying principles of the RQ1 practice:

- **Performance Orientation** underlies the practice by requiring that sustainability commitments be expressed as measurable thresholds (e.g., “≤ 0.153 kWh/case”; “≤ 0.173 hL/case”), enabling later monitoring and verification.
- **Value-Orientation** underlies the practice by legitimizing targets as commitments the organization is prepared to defend—anchored in internal objectives and external regulatory frames (e.g., RA 11285; PD 1067).
- **Technology–Society** supports the practice by sustaining the framing of resource-use objectives as stewardship obligations (e.g., “localized water stress”), ensuring targets are not reducible to purely internal cost logic.

As a result, target-setting becomes more than “writing numbers”: it becomes the stage where sustainability is translated into governable commitments that future stages can treat as decision criteria.

3.3. Interpretive basis

Stage 3 demonstrates a clear principle–practice linkage because targets function as organizational accountability devices rather than descriptive statements. The documentary form of objectives ("≤" thresholds, quantified targets, and legal/internal anchors) performs ethnomethodological work: it makes sustainability claims reportable, comparable, and contestable in later interaction and governance routines.

Put differently, Stage 3 is the point where sustainability becomes "countable" and therefore governable. By fixing objectives as measurable limits and expected reductions, the organization creates the conditions for later stages to ask (and answer) questions like: Did we meet the target? If not, why not? Is the deviation acceptable? What corrective action is required? Those later questions—and the monitoring/decision practices that follow—are only possible because Stage 3 already enacted the Performance and Value-Orientation principles in documentary form.

In this way, the Stage 3 practice surfaced in RQ1 (formal articulation of sustainability targets) is not incidental; it is systematically organized through the underlying principles in RQ2. The principles underlie and are enacted through the practice by defining what counts as a legitimate sustainability commitment (Value-Orientation), what counts as measurable improvement (Performance), and why resource-use targets matter beyond internal efficiency (Technology–Society).

Stage 4 – Environmental Plans & Programs (EPP): Coordinating Sustainability Commitments into Governable Operational Action

Stage 4 advances sustainability-oriented R&D management through the translation of objectives into coordinated operational programs. After sustainability

concerns have been prioritized (Stage 2) and translated into explicit targets (Stage 3), the EPP stage performs the practical work of converting those targets into concrete routines, cross-functional coordination mechanisms, and operational controls.

Consistent with the overall analytic framing, the principles identified in RQ2 are the underlying principles of the practices surfaced in RQ1—that is, they underlie and are enacted through the RQ1 practice in this stage (the translation of objectives into coordinated operational programs). In Stage 4, sustainability does not remain a commitment expressed only through targets; it becomes a program of action embedded within operational rhythms, responsibilities, and verification routines.

In this stage, the RQ1 practice of translating objectives into coordinated operational programs is accomplished primarily through the Planning and Foresight and Performance principles, supported by Human-Centered and Total Quality Management orientations. Together, these principles supply the criteria by which sustainability commitments become routinized, coordinated, monitored, and sustained as everyday organizational work (rather than being treated as separate compliance tasks or one-off initiatives).

4.1. Primary Principles: Strategic Planning, Foresight and Performance

The Planning and Foresight Principle is enacted in Stage 4 by embedding sustainability objectives within the practical conditions of operations, anticipating implementation constraints, and distributing responsibilities across functions. Rather than treating sustainability as a stand-alone initiative, the EPP explicitly positions it as work that must be coordinated within production rhythms and daily operational realities. This is visible in the Energy Program’s contextual framing:

Excerpt (Contextual Frame – Energy Program): “Anchored in RA 11285 (Energy Efficiency and Conservation Act) and corporate Enercon programs, this initiative is situated within the practical conditions of machine start-ups, shutdowns, and production scheduling. Energy management here is an everyday responsibility shared across Packaging, Utilities, and QA, embedded within standard operational rhythms rather than handled as a separate compliance task.”

This excerpt shows foresight in two ways: (1) it anticipates the conditions under which sustainability must be pursued (start-ups, shutdowns, scheduling), and (2) it pre-structures implementation as distributed responsibility rather than isolated ownership. The EPP then operationalizes this anticipatory logic by explicitly linking sustainability work to production planning, indicating that resource efficiency is pursued through planned coordination rather than ad hoc effort:

Excerpt (Operationalized Program – Energy Program): *“Coordinate with production planning to minimize changeovers and idle gaps, linking energy efficiency directly with production scheduling.”*

The same foresight logic appears in the Water Program, where the contextual framing anticipates both operational and environmental pressures and treats water stewardship as a balancing problem that must be managed through programming:

Excerpt (Contextual Frame–Water Program): *“Aligned with PD 1067 (Water Code of the Philippines) and corporate water-conservation programs, this plan addresses both plant-level operational constraints and regional groundwater pressures. Water efficiency is framed as a matter of operational prudence and resource security, balancing process requirements (e.g., caustic dosing, rinsing) with conservation imperatives.”*

Here, planning and foresight are enacted through anticipatory balancing: the EPP explicitly acknowledges competing demands (process requirements vs. conservation) and structures water stewardship as a coordinated program rather than a simple reduction mandate.

The Performance Principle is enacted in Stage 4 by retaining sustainability commitments as measurable operational targets and by specifying program actions that are plausibly linked to achieving those targets. The EPP embeds performance as explicit thresholds:

Excerpt (Operational Target – Energy Program): *"Operational Target: ≤ 0.153 kwh/case"*

Excerpt (Operational Target – Water Program): *"Operational Target: ≤ 0.173 hL/case."*

These targets are not merely restated; they are placed at the center of program design, making implementation work accountable to measurable outcomes. The EPP then specifies operationalized programs that directly connect to resource performance, such as audit routines, leak repair, recovery optimization, and parameter adjustment:

Excerpt (Operationalized Programs – Energy Program): *"Conduct joint Packaging–Engineering utilities audits to detect abnormalities, ensure equipment optimization, and document corrective actions."*

Excerpt (Operationalized Programs – Water Program): *"Conduct joint Packaging–Engineering audits to identify and promptly repair water and steam leaks."*

Excerpt (Operationalized Programs – Water Program): *"Optimize steam-condensate recovery to minimize freshwater input for boiler make-up."*

Excerpt (Operationalized Programs – Water Program): *"Adjust washer water parameters to maintain caustic concentration efficiency while conserving overall volume."*

These excerpts show that Stage 4 performance is not framed as abstract "improvement," but as measurable outcomes linked to concrete operational controls. In other words, the EPP converts targets into performance-governed programs that can later be monitored, evaluated, and reported.

4.2. Supporting/ Enabling Principles: Human-Centeredness and Quality Management

Stage 4 is supported by a Human-Centered orientation because the EPP explicitly frames sustainability as everyday responsibility enacted through people, routines, and cross-functional coordination. This is evident where sustainability is framed as shared responsibility across roles and embedded in "standard operational rhythms":

Excerpt (Shared responsibility – Energy Program): *"Energy management here is an everyday responsibility shared across Packaging, Utilities, and QA, embedded within standard operational rhythms rather than handled as a separate compliance task."*

The EPP also includes routine behavioral discipline as a mechanism for achieving sustainability targets (i.e., embedding sustainability in daily work practices rather than limiting it to technical interventions):

Excerpt (Routine discipline – Energy Program): *"Integrate in the PAWIM established SOPs on energy conservation: switching off lights and computers when*

not in use, proper air-conditioning settings, and optimized sequencing for machine start-up and shutdown."

Excerpt (Routine discipline – Water Program): *"Integrate in the PAWIM established SOPs on water conservation: timely opening and closure of water supply valves, disciplined use of cleaning water, and faucet shut-off reminders."*

These excerpts demonstrate that sustainability in Stage 4 is accomplished through routine human participation: adherence, discipline, coordination, and shared responsibility are treated as essential to sustaining operational performance.

Stage 4 is also supported by a Total Quality Management (TQM) orientation because the EPP embeds verification and corrective-action logic into sustainability programming. The clearest evidence is the explicit integration of audit and documentation practices:

Excerpt (Audit + corrective action documentation – Energy Program): *"Conduct joint Packaging–Engineering utilities audits to detect abnormalities, ensure equipment optimization, and document corrective actions."*

This excerpt is strongly TQM-aligned because it establishes a recurring governance loop: identify abnormalities → optimize equipment → document corrective actions. Under your ethnomethodological framing, "document corrective actions" is particularly important because it treats documentation not as after-the-fact reporting but as an accountability method that stabilizes sustainability performance as auditable organizational work.

Stage 4 demonstrates how the RQ2 principles are the underlying principles of the RQ1 practice (translation into coordinated programs):

- **Planning and Foresight** is enacted through the practice by explicitly anticipating operational conditions (start-ups, shutdowns, production scheduling) and embedding sustainability into cross-functional responsibilities and production planning coordination.

- **Performance orientation** is enacted through the practice by retaining quantified targets (≤ 0.153 kwh/case; ≤ 0.173 hL/case) and specifying program actions that are plausibly linked to achieving and sustaining those targets (audits, leak repair, recovery optimization, parameter adjustment).

- **Human-Centered orientation** supports the practice by framing sustainability as “everyday responsibility” enacted through routine behavioral discipline and distributed role participation, rather than as isolated technical compliance activity.

- **Total Quality Management** supports the practice by embedding audit, abnormality detection, equipment optimization, and corrective-action documentation as built-in governance loops through which sustainability performance is maintained and made defensible.

As a result, Stage 4 programming becomes more than listing initiatives: it becomes the stage where sustainability commitments are converted into coordinated, repeatable, and accountable operational governance.

4.3. Interpretive basis

Stage 4 demonstrates a clear principle–practice linkage because the EPP functions as an organizational accountability device rather than a descriptive plan. The EPP’s structure (targets + contextual framing + operationalized programs) performs ethnomethodological work by rendering sustainability implementation intelligible and

reportable: it defines what counts as responsible action (shared responsibility), what counts as relevant constraints (scheduling, operational rhythms), what counts as performance (numeric thresholds), and what counts as control and correction (audits and documented corrective actions).

In this way, the Stage 4 practice surfaced in RQ1 (translation of objectives into coordinated operational programs) is not incidental; it is systematically organized through the underlying principles in RQ2. The principles underlie and are enacted through the practice by embedding sustainability into routinized coordination (Planning & Foresight), anchoring initiatives to measurable thresholds (Performance), distributing enactment across members and routines (Human-Centered), and stabilizing implementation through auditable control loops (Total Quality Management).

Stage 5 – Trial Protocol (TP): Structuring Sustainability Innovation as Accountable and Measurable Experimentation

Stage 5 advances sustainability-oriented R&D management through the design of experimental intervention and monitoring procedures, formalized in the Trial Protocol (TP). At this stage, sustainability moves from being a prioritized concern (Stage 2) and a quantified commitment (Stage 3–4) into an experimentally testable intervention with defined methods, responsibilities, and success conditions. Consistent with our overall analytic framing, the principles identified in RQ2 are the underlying principles of the practices surfaced in RQ1—that is, they underlie and are enacted through the RQ1 practice in this stage (the design of the trial protocol as structured experimentation). In Stage 5, the organization does not merely “try” an upgrade; it designs a controlled trial in which sustainability claims (resource reduction,

safety compliance, cost-effectiveness) are made measurable, auditable, and governable through documentary specification.

In this stage, the RQ1 practice of designing experimental intervention and monitoring procedures is accomplished primarily through the Scientific Process and Creativity and Innovativeness principles, supported by Performance and Total Quality Management orientations. Together, these principles supply the criteria by which sustainability-oriented innovation becomes a structured experiment rather than an informal adjustment—i.e., a trial that can produce credible evidence for decision-making, institutionalization, and future replication.

5.1. Primary Principles: Scientific Inquiry, Creativity, and Innovation

The Scientific Process Principle is enacted in Stage 5 through the protocol's insistence on (a) defined objectives, (b) explicit trial design, (c) systematic data collection, (d) defined responsibilities, and (e) evaluation against pre-specified success criteria. Rather than positioning the equipment upgrade as self-evidently beneficial, the TP requires that the claim "this upgrade improves sustainability" be demonstrated through measurable indicators and controlled monitoring.

This scientific orientation becomes visible first in how the TP specifies trial objectives as measurable reductions and non-negotiable compliance thresholds:

Excerpt (Objectives): *"To evaluate the performance of the upgraded bottle washer in reducing: • Water consumption by ≥ 25% • Caustic consumption by ≥ 20% • Energy/steam consumption by ≥ 15%."*

Excerpt (Objectives – quality gate): *"To ensure consistent compliance with quality and microbiological safety standards (TPC < 100 cfu/bottle; residual caustic = 0 ppm)."*

These objective formulations show that the trial is designed as a controlled evaluation: improvements must be quantified and safety must be demonstrated through explicit thresholds. The TP further formalizes scientific method through its trial design parameters (duration, parameters, and measurement categories):

Excerpt (Trial Design – duration): *"Duration: 10 operating days per product type (mainstream lager and specialty beer)."*

Excerpt (Data Collection Parameters): *"Water consumption per 1,000 bottles; Caustic dosing levels and recovery efficiency; Energy/steam use per cycle; Temperature profiles per zone; Defect rates…; Microbiological compliance (TPC < 100 cfu/bottle; residual caustic = 0 ppm)."*

The scientific process is also enacted through procedural sequencing—i.e., the TP does not allow "evaluation" to begin until specified preparatory steps are completed. This is a methodological commitment that protects baseline comparability and procedural integrity:

Excerpt (Procedural prerequisite): *"Official line performance evaluation to start once all the following are done…"*

Excerpt (Examples of prerequisites): *"Photos… before routine cleaning… Cleaning… Photos… after routine cleaning… Installation and commissioning of the dosing system…"*

The TP then specifies systematic measurement and verification routines, including frequency, standards, and documentation requirements:

Excerpt (BWE measurement + standard): *"Measure the bottle washing efficiency (BWE)… twice a week. Minimum standard is 98%… record… in the existing form used by QA for Bottlewasher Operations Verification."*

Excerpt (Microbiological monitoring): *"Conduct microbiological sampling and analysis… in accordance with the Sampling and Testing Frequency (STF)."*

Excerpt (Wastewater comparison): *"Collate wastewater data… COD, pH, and phosphate, and compare this with the latest 3-months period before the trial."*

These excerpts show that Stage 5 functions as a scientific staging mechanism: sustainability improvements are rendered testable through explicitly specified methods, baselines, measurement routines, and comparators.

Alongside scientific structuring, the TP enacts the Creativity and Innovativeness Principle by framing the intervention as a design upgrade with novel features and by explicitly using the trial to generate technical learning for future modifications and retrofits. In other words, the protocol is not only about validating performance; it is also about exploring innovation potential and documenting design-level insights.

This is visible in the protocol's description of the upgraded washer's design features:

Excerpt (Trial Setup – innovation features): *"Installation of next-generation washer with modular spray manifolds, optimized caustic and additive dosing and recovery system, variable-speed conveyors, and integrated heat-recovery features."*

The TP also positions the trial as a learning exercise aimed at producing baseline technical data for future design improvements—not just verifying immediate savings. This is explicitly stated in both the rationale and the objectives:

Excerpt (Rationale – design limitations + need for evaluation): *"Several design and engineering limitations were also noted—such as heat-loss inefficiencies, pump sizing mismatches, and inadequate rinse-zone recovery—that may hinder the*

attainment of optimal performance and will require further engineering evaluation during the trial phase."

Excerpt (Objective – future modifications): *"To generate baseline technical data for possible energy recovery retrofits and water reuse/recycling system modifications applicable to existing or future washer models."*

Finally, the trial is explicitly required to produce design recommendations as part of its success criteria:

Excerpt (Success Criterion 9): *"Identified design recommendations for existing and future energy-recovery and water-reuse modifications."*

Together, these excerpts show how Stage 5 constitutes innovation as a managed organizational activity: creativity is not left as informal tinkering but is built into the protocol as a legitimate output (design recommendations, retrofit pathways, future model implications) produced through a controlled trial.

5.2. Supporting/ Enabling Principles: Performance Excellence and Quality Management

While Scientific Process and Creativity/Innovativeness are primary, the TP is also deeply anchored in a Performance orientation because it defines success in terms of measurable operational outcomes (utilities, quality, cost). The protocol explicitly frames the rationale for the upgrade in terms of current performance shortfalls and benchmark comparisons:

Excerpt (Rationale – baseline performance gap): *"Average water consumption (~17.9 L/case) exceeds both internal environmental objectives and competitor benchmarks (~17.5 L/case). Rising energy and caustic usage have also resulted in higher utilities cost…"*

It further expands performance beyond resource reduction by requiring evidence on operational stability and reliability:

Excerpt (Objective – operational stability): *"To assess operational stability and reliability (downtime, nozzle performance, maintenance intervals)."*

And it anchors decision readiness to economic performance through explicit ROI expectations:

Excerpt (Objective – financial performance): *"To determine projected return on investment (ROI ≤ 5 years) based on utilities savings and maintenance cost reduction."*

This shows that the TP treats sustainability as a performance problem that must be demonstrable across multiple dimensions (resource use, safety, reliability, and cost). Sustainability claims are therefore bounded by operational and financial performance expectations—making them governable in later evaluation and adoption decisions.

The TP also enacts a strong Total Quality Management (TQM) orientation by embedding verification routines, defect monitoring, and abort conditions that protect quality and safety while experimentation occurs. This is most visible in the protocol's systematic quality control checks and defect-monitoring routines:

Excerpt (Quality/defect monitoring): *"Inspect the output… The following defects should be absent… dirty base (DB), dirty side (DS), dirty outside bottle (DOB)."*

Excerpt (EBI rejects monitoring): *"Monitor electronic bottle inspection (EBI) Rejection Rate… twice a week… Randomly check… (125 bottles sample size)."*

Excerpt (Shift-level defect quantification): *"Monitor defectives intercepted at Manual Inspection… every shift. Quantify DB, DS, and DOB defects."*

TQM is also visible in the way the protocol institutionalizes the right to stop the trial if quality or operational abnormalities become significant—an explicit governance mechanism for controlling risk during experimentation:

Excerpt (Abort condition): *"The trial may be aborted at any given time if there will be significant abnormality in the operation or significant quality issue on the washed bottle during its use."*

Finally, the TP formalizes TQM through the articulation of success criteria—a comprehensive checklist that stabilizes what counts as acceptable quality, process stability, wastewater performance, cost-effectiveness, and design learnings:

Excerpt (Success Criteria – selected): *"Attainment of… 98% BWE… 100% compliance to microbiological quality… Below 25ppm DS… No increase in wastewater load… Cost effectiveness… Water reduced by ≥25%… Caustic ≥20%… Energy/steam ≥15%… ROI ≤5 years…"*

These criteria demonstrate that the organization treats trial work as quality-governed experimentation rather than unconstrained testing. Improvement must be validated through disciplined monitoring, defect control, and predetermined thresholds for continuation or termination.

Stage 5 demonstrates how the RQ2 principles are the underlying principles of the Stage 5 RQ1 practice (design of experimental intervention and monitoring procedures):

- **Scientific Process** is enacted through the practice by specifying measurable objectives, structured trial design, defined data-collection parameters, procedural prerequisites, measurement frequencies, and baseline comparisons—making sustainability claims testable and verifiable.

- **Creativity and Innovativeness** is enacted through the practice by defining novel design features (modular manifolds, variable-speed conveyors, heat recovery) and treating the trial as a vehicle for generating design learnings and recommendations for future retrofits and reuse/recycling modifications.

- **Performance orientation** supports the practice by bounding sustainability innovation within measurable operational and financial expectations (utilities reductions, stability/reliability indicators, ROI ≤ 5 years), ensuring innovations remain organizationally consequential.

- **Total Quality Management** supports the practice by embedding defect monitoring, microbiological compliance routines, success criteria checklists, and abort conditions that stabilize experimentation within quality governance and risk control.

As a result, the trial protocol becomes more than a technical plan: it becomes the documentary infrastructure through which sustainability-oriented innovation is made measurable, governable, and defensible as organizational work.

5.3. Interpretive Basis

Stage 5 demonstrates a clear principle–practice linkage because the Trial Protocol operates as a members' method for turning sustainability claims into accountable experimentation. The TP does not merely describe the upgrade; it defines the procedures, measurement apparatus, and decision conditions through which organizational members can legitimately claim improvement, detect deviation, and justify continuation or termination.

In ethnomethodological terms, the TP makes sustainability work reportable and auditable: it specifies what counts as relevant evidence (utilities, defects, microbiology,

wastewater, cost), how evidence is to be produced (measurement frequency, sample sizes, comparisons), and what thresholds determine acceptable performance (success criteria and abort conditions).

In this way, the Stage 5 practice surfaced in RQ1 (design of experimental intervention and monitoring procedures) is not incidental; it is systematically organized through the underlying principles in RQ2. The principles underlie and are enacted through the practice by structuring experimentation as a disciplined scientific process (Scientific Process), legitimizing innovation as design learning (Creativity & Innovativeness), bounding outcomes in measurable operational and financial terms (Performance), and stabilizing execution through quality governance and controlled risk (Total Quality Management).

Stage 6 – Evaluation & Approval: Negotiated Governance of Sustainability Claims Through Cross-Functional Deliberation

Stage 6 advances sustainability-oriented R&D management through cross-functional deliberation and authorization of the trial. At this stage, sustainability is not treated as a self-evident technical improvement; it is made organizationally consequential through formal evaluation, challenge, justification, and decision. The approval meeting functions as a governance moment where multiple functions (R&D, QA, Production, Engineering, Finance, and leadership) jointly establish whether the proposed sustainability-oriented intervention is legitimate to pursue under controlled conditions.

Consistent with the analytic framing, the principles identified in RQ2 are the underlying principles of the practices surfaced in RQ1—that is, they underlie and are enacted through the RQ1 practice in this stage (cross-functional deliberation and

authorization). In Stage 6, authorization is not merely a procedural requirement; it is an interactional and documentary accomplishment through which sustainability claims become acceptable, bounded, and accountable as organizational action.

In this stage, the RQ1 practice of cross-functional deliberation and authorization is accomplished primarily through the Human-Centered and Value-Orientation principles, supported by Planning and Foresight and Scientific Process orientations. Together, these principles supply the criteria by which the organization treats sustainability experimentation as (a) ethically and operationally acceptable (Human-Centered), (b) strategically and institutionally aligned (Value-Orientation), (c) appropriately staged and bounded (Planning and Foresight), and (d) evidentially testable (Scientific Process).

6.1. Primary Principles: Human-Centeredness and Value Orientation

The Human-Centered Principle is enacted in Stage 6 through how deliberation is explicitly constrained by product safety, acceptable risk, and operational stability. The meeting record shows that approval is not granted on the basis of resource reduction alone; rather, sustainability is treated as legitimate only if it coexists with non-negotiable quality and safety thresholds.

This orientation is made explicit by QA's formulation of risk boundaries and monitoring obligations:

QA: *"Our primary concern is product safety during the trial. We'll monitor residual caustic, TPC, and visual cleanliness… As long as these are strictly followed, the trial remains within acceptable risk…"*

Here, "acceptable risk" and "primary concern" function as human-centered constraints that govern what sustainability experimentation can be allowed to do. This

same human-centered gating logic recurs during Stage 7 monitoring when deviations occur, where QA explicitly defines microbiological compliance as the decisive condition for continuation:

QA: *"Microbiological compliance is non-negotiable."*

QA: *"From QA's standpoint, microbiological compliance remains the primary gating condition… Provided that daily monitoring continues and no further breach… occurs, QA supports continuation of the trial."*

These excerpts show that Stage 6 authorization is anchored to human-centered accountability: sustainability gains are permitted only under conditions that maintain safety and protect consumers. This is not a general value statement; it is an operationalized decision constraint enacted through deliberation and documented in the minutes.

The Value-Orientation Principle is enacted in Stage 6 through explicit alignment work—participants repeatedly frame the trial as legitimate because it supports organizational sustainability commitments, strategic priorities, and institutional credibility. R&D situates the trial within the corporate sustainability roadmap and positions evidence generation as the basis for future decisions:

R&D: *"The proposed trial supports our corporate sustainability roadmap… expected to reduce resource use by 15–25%… We're not committing yet to full adoption, but this will generate evidence for a future upgrade decision."*

This excerpt performs value-orientation work by showing why the trial matters beyond immediate operational change: it is framed as strategic alignment and future decision support. Finance reinforces this value framing by linking trial evidence to economic legitimacy and institutional incentives:

FIN: *“If results achieve projected resource savings, ROI projections can justify full investment later. Also, the trial data can support… green financing or potential tax incentives under R.A. 11285.”*

Leadership then synthesizes these orientations, framing the trial as a decision mechanism that tests “sustainability promise” before major spending:

GM: *“This trial is our way of testing both technical feasibility and sustainability promise before any major spending.”*

Across these turns, value-orientation is enacted as an organizational method for legitimizing action: sustainability is treated as something worth pursuing because it aligns with corporate roadmaps, can be financially justified, and can be institutionally defended through documented evidence.

6.2. Supporting/ Enabling Principles: Strategic Planning, Foresight and Scientific Inquiry

Stage 6 deliberation is also demonstrates Planning and Foresight through the organization’s practice of bounding commitment and staging authorization as a “trial first, adoption later” process. This is evident in the Minutes of the Meeting for TP Evaluation & Approval by the General Manager (GM), where the limits of commitment are explicitly defined at the start of deliberation:

GM: *“We must be clear that this is still at the trial stage—not yet a full replacement.”*

The phrase “trial—not yet replacement” functions as a foresight mechanism: it anticipates the risks of premature institutionalization and establishes a staged governance pathway. This planning logic is further operationalized through the explicit action points and timeline that specify readiness conditions (inspection, operator

orientation, baseline, reporting) prior to execution—showing that authorization includes forward coordination rather than simple approval.

Foresight also recurs in Stage 7 monitoring deliberation, where R&D explicitly frames the governance question as whether deviations are “systemic instability” or “normal optimization phase,” underscoring the organization’s concern for future stability rather than short-term results:

R&D: *“The question… is whether these deviations indicate systemic instability, or whether they reflect a normal optimization phase within a controlled trial environment… stability across the full duration is critical.”*

This excerpt shows planning/foresight as an enacted deliberative orientation: decision-making anticipates longer-run stability and governability, not merely immediate gains.

Stage 6 is also supported by the Scientific Process Principle, evident in how deliberation treats evidence generation, measurement criteria, and documentation as conditions for decision legitimacy. R&D explicitly frames the trial as an evidence-producing exercise:

R&D: *“We’re not committing yet to full adoption, but this will generate evidence for a future upgrade decision.”*

QA reinforces scientific-process logic by anchoring acceptability to specified success criteria and monitoring:

QA: *“The document specifies success criteria (TPC < 100 CFU/bottle; residual caustic 0 ppm)… the trial remains within acceptable risk…”*

This evidence-centered orientation continues through the lifecycle: in Stage 8, final deliberation explicitly validates success through rolling averages and criteria confirmation, and adoption is justified through evidence consolidation:

R&D: *"Across the full 10-day cycle, rolling averages meet or exceed all nine success criteria…"*

GM: *"The data demonstrate that sustainability gains coexist with quality and operational stability."*

These excerpts show scientific-process reasoning as an enabling condition for governance: decisions are legitimized through measurable criteria, rolling averages, and documented confirmation—rather than through intuition alone.

Stage 6 demonstrates how the RQ2 principles are the underlying principles of the Stage 6 RQ1 practice (cross-functional deliberation and authorization of the trial):

- **Human-Centered** underlies and is enacted through the practice by treating product safety and acceptable risk as the decisive constraints of authorization (e.g., "primary concern," "non-negotiable," "gating condition").
- **Value-Orientation** underlies and is enacted through the practice by framing the trial as strategically aligned with sustainability roadmaps and as institutionally legitimate through financing, incentives, and corporate commitments.
- **Planning and Foresight** supports the practice by bounding commitment ("trial—not replacement"), staging decision pathways, and orienting deliberation toward stability across the trial duration rather than short-term performance snapshots.

- **Scientific Process** supports the practice by anchoring authorization and continuation to evidence generation, measurable success criteria, rolling averages, and documented validation across monitoring and final disposition.

As a result, authorization becomes more than a formal step: it becomes the stage where sustainability-oriented experimentation is rendered legitimate through cross-functional accountability, strategic alignment, staged commitment, and evidential reasoning.

6.3. Interpretive Basis

Stage 6 demonstrates a clear principle–practice linkage because deliberation functions as an organizational accountability method through which sustainability claims are negotiated into acceptable action. In ethnomethodological terms, the meeting minutes record not simply a decision outcome but the methods by which members make the decision defensible: participants invoke safety thresholds, align the trial with sustainability roadmaps, justify financial exposure, and bound commitment as “trial” rather than “replacement.”

Crucially, this accountability logic is not confined to the approval meeting alone—it continues through monitoring and final disposition, where deviations are evaluated, corrected, and conditionally authorized (Stage 7) and where adoption is justified through criteria-based evidence consolidation (Stage 8) In this way, the Stage 6 practice surfaced in RQ1 (cross-functional deliberation and authorization) is not incidental; it is systematically organized through the underlying principles in RQ2. The principles underlie and are enacted through the practice by (a) constraining sustainability experimentation through human-centered safety gates, (b) legitimizing action through value alignment, (c) staging commitment through foresight, and (d)

grounding decisions in evidence-based evaluation consistent with scientific-process reasoning.

Stage 7 – Trial Execution & Monitoring: Total Quality Management and Performance as Stabilization Work Under Operational Variability

Stage 7 operationalizes sustainability-oriented R&D management through the implementation of the approved trial and the monitoring of operational performance under real production conditions. Unlike earlier stages—where sustainability is surfaced, formalized, and authorized—this stage tests whether sustainability gains can be maintained when the process encounters variability (e.g., parameter drift, throughput adjustments, hygiene deviations, and utilities instability). The RQ1 practice here is therefore not simply "running the trial," but governing the trial as an accountable performance: detecting deviations, diagnosing causes, implementing corrective actions, and determining whether continuation remains justified.

In Stage 7, the RQ1 practice is accomplished primarily through Total Quality Management (TQM) and Performance Orientation, supported by Human-Centered and Scientific Process principles. Together, these principles supply the organizational criteria through which sustainability becomes governable during execution—i.e., not only "achieved," but stabilized, defended, and made accountable in the face of operational strain.

7.1. Primary Principle: Quality Management and Performance Excellence

The Total Quality Management Principle is enacted in Stage 7 through the organization's reliance on a disciplined loop of deviation identification → diagnosis → corrective action → verification → decision to proceed. This is visible in how the

monitoring meeting is structured around (a) success criteria, (b) deviation handling, and (c) documented corrective alignment before continuation is endorsed.

A key hallmark of TQM here is that deviations are not treated as informal observations; they are treated as nonconformities requiring structured response. This logic is explicitly articulated when the R&D chair frames deviations as either systemic instability or normal optimization that must be evidenced as correctable:

Excerpt: *"Based on the data presented, the deviations observed during Days 4 and 5 appear to be technically traceable and correctable. The question before the committee is whether these deviations indicate systemic instability, or whether they reflect a normal optimization phase within a controlled trial environment."*

TQM is further visible in how the meeting formalizes "continuation" as conditional upon documentary accountability. The organization does not merely continue because improvements look promising; it continues because deviations are treated as governable through corrective alignment and recorded justification:

Excerpt: *"Proceed with Days 6–10 under daily cross-functional monitoring. Final evaluation to be based on rolling average stability across all nine success criteria."*

Finally, TQM is operationalized through the explicit instruction to document corrective actions, indicating that governance depends on an auditable trail of stabilization work:

Excerpt: *"All corrective actions must be fully documented to support final evaluation and disposition."*

Together, these excerpts show that Stage 7 is not simply execution; it is quality-governed execution, where sustainability improvements must survive as controlled performance rather than fragile or accidental outcomes.

The Performance Principle is enacted in Stage 7 through the monitoring of concrete performance indicators against predefined targets—utilities reduction, washing efficiency, microbiological thresholds, and wastewater indicators. Performance orientation is visible in the way results are framed as “on target,” “below target,” or “restored,” and in the insistence that improvements must be sustained and stable to remain meaningful.

This principle becomes explicit when Finance links trial legitimacy to sustained performance stability, rather than isolated improvements:

Excerpt: “ROI assumes sustained reduction. Stability is important.”

It is also visible when quality thresholds are treated as performance gates rather than negotiable trade-offs. QA’s insistence that microbiological compliance is non-negotiable positions performance as bounded by safety and quality integrity:

Excerpt: *“Microbiological compliance is non-negotiable.”*

Likewise, the GM synthesizes the stage’s performance logic by clarifying that the goal is not reduction alone but controlled efficiency—a formulation that ties sustainability gains to stable, disciplined operation:

Excerpt: *“The trial’s objective is not to achieve perfection within five days but to determine whether sustainable efficiency gains can be achieved without compromising product safety and operational stability.”*

In this sense, performance orientation ensures that sustainability is not treated as an isolated environmental achievement, but as a measurable and defensible

improvement that must remain compatible with operational continuity and hygiene assurance.

7.2. Supporting Principle: Human-Centeredness and Scientific Inquiry

Although Stage 7 is dominated by TQM and performance governance, it is enabled by a Human-Centered Principle visible in cross-functional accountability, role-based gatekeeping, and shared responsibility for risk. The meeting shows that no single function "owns" the trial; instead, legitimacy is produced through the coordinated judgments of R&D, QA, Engineering, Production, Finance, and the Supplier.

This is visible in how QA frames itself as the gatekeeper of acceptable risk while still supporting continuation if control is restored:

Excerpt: *"From QA's standpoint, microbiological compliance remains the primary gating condition… Provided that daily monitoring continues and no further breach of the <100 CFU requirement occurs, QA supports continuation of the trial."*

Likewise, Production frames continuation as conditional on operator adherence and clear communication—emphasizing that stability is a collective accomplishment, not merely a technical adjustment:

Excerpt: *"As long as communication to operators remains clear and validated parameters are strictly followed, Production does not foresee operational risk in continuing."*

Here, the "social" work of sustainability becomes visible: sustainability gains depend on coordinated human action—briefing, adherence, monitoring discipline—not only on equipment design.

The Scientific Process Principle operates as an enabling logic through the reliance on baselines, rolling averages, corrective testing, and criteria-based

interpretation. The meeting frames deviations as subject to evidence-based interpretation rather than speculation: the question is whether deviations indicate systemic instability or a normal optimization phase, and that question is answered through measurement and comparative logic.

This principle is particularly visible in the emphasis on rolling averages and the insistence that continuation is justified only if performance is demonstrably stabilizing:

Excerpt: *"The rolling averages remain aligned with most of the success criteria, but stability across the full duration is critical."*

It is also visible in the use of re-testing after corrective action (e.g., restored counts after exceedance) and the insistence that final evaluation will be based on evidence across the full trial period, not isolated data points.

In short, scientific process here is not "lab science" separate from operations—it is the organization's method of turning operational variability into interpretable evidence under agreed criteria.

7.3. Interpretive Basis

Stage 7 demonstrates principle enactment because it reveals how sustainability-oriented R&D execution is governed as a stabilization problem. Sustainability gains (e.g., water/caustic/steam reductions) do not automatically validate themselves; they must be continuously defended against operational disturbances. In this stage:

- **TQM** supplies the governance logic that makes deviations manageable rather than discrediting (through structured correction and verification).
- **Performance Orientation** supplies the measurement discipline that turns sustainability into accountable operational outcomes.

- **Human-Centered** principles supply the cross-functional gatekeeping and shared responsibility needed to maintain legitimacy under risk.
- **Scientific Process** supplies the evidence logic (baselines, rolling averages, re-testing, criteria-based interpretation) that allows continuation and eventual institutional decisions to remain defensible.

Thus, Stage 7 shows sustainability not as a "result" but as a collectively governed performance, maintained through disciplined monitoring, repair, and accountable continuation.

Stage 8 – Trial Evaluation & Disposition: Scientific Process and Total Quality Management as Institutionalization Work

Stage 8 operationalizes sustainability-oriented R&D management through the final evaluation of trial outcomes and the formal disposition of the project—specifically, whether validated improvements are adopted, embedded into routine governance, and positioned for replication. Unlike Stage 7, where the organization governs continuation under conditions, Stage 8 governs closure with institutional consequences. The RQ1 practice here is therefore not only "evaluating results," but converting stabilized performance into an organizational standard through criteria-based confirmation, cross-functional endorsement, and formal authorization.

In Stage 8, the RQ1 practice is accomplished primarily through the Scientific Process Principle and Total Quality Management (TQM), supported by Value-Orientation and Planning and Foresight. Together, these principles supply the logic through which the organization transforms trial evidence into institutional decisions—

i.e., sustainability is not merely reported as improved, but validated, formalized, and made governable over time.

8.1. Primary Principle: Scientific Inquiry and Quality Management

The Scientific Process Principle is enacted in Stage 8 through the organization's reliance on pre-defined success criteria, baseline comparison, consolidated performance evidence, and structured interpretation of whether results satisfy agreed thresholds. The evaluation is treated as a matter of evidentiary sufficiency rather than narrative persuasion: the trial is considered successful because its outcomes are shown to meet the criteria across the full run.

This evidence orientation is explicitly articulated in the evaluation meeting's opening framing of sufficiency:

Excerpt: *"Across the full 10-day cycle, rolling averages meet or exceed all nine success criteria."*

The scientific logic is further reinforced through domain-specific confirmation that the critical gating condition (microbiological safety) is not only met, but stabilized on the consolidated period:

Excerpt: *"Microbiological compliance was restored and maintained below 50 CFU for Days 6–10. The single exceedance was correctable and did not indicate systemic failure."*

Likewise, technical performance claims are not treated as impressions but as criteria-based conclusions anchored to calibrated stability:

Excerpt: *"The heat recovery optimization achieved the ≥15% steam reduction target after recalibration."*

In this stage, the “scientific” quality of evaluation lies in the organization’s insistence that adoption must follow from consolidated criteria-based evidence, not from isolated peak performance or optimistic interpretation.

The Total Quality Management Principle is enacted in Stage 8 through the organization’s movement from controlled trial governance into standardization and governance embedding. If Stage 7 shows TQM as stabilization work (repair and control under variability), Stage 8 shows TQM as institutionalization work: translating validated outcomes into durable routines, monitoring commitments, and procedural requirements that allow sustainability performance to remain repeatable and auditable.

This standardization logic is visible in how adoption is accompanied by explicit governance actions and continuing controls—rather than being treated as a one-time endorsement:

Excerpt: *“The Bottle Washer Equipment Upgrade is approved for: Adoption at Plant A, Institutionalization into standard operating framework, Phased evaluation for application to other breweries.”*

The TQM orientation becomes especially visible in the institutional integration decisions that convert trial outcomes into routinized governance requirements:

Excerpt: *“Utilities reduction metrics will be monitored monthly as part of routine performance tracking.”*

Excerpt: *“Microbiological compliance (<100 CFU/bottle) will remain a non-negotiable operational threshold.”*

Excerpt: *“Heat recovery calibration and dosing control procedures will be formalized into standard operating protocols.”*

Excerpt: *"Performance data will be included in periodic management review meetings."*

These statements show that "success" is not treated as an endpoint; rather, success triggers a new form of accountable work: monitoring cadence, threshold maintenance, proceduralization, and management review integration. That is the distinctive TQM move of Stage 8—turning outcomes into standards and standards into governable routines.

8.2. Supporting Principle: Value Orientation, Strategic Planning and Foresight

Although Stage 8 is governed primarily by evidence logic (Scientific Process) and standardization logic (TQM), it is enabled by Value-Orientation in how leaders frame adoption as a legitimate organizational commitment—not merely technical success. Here, sustainability is framed as worthwhile precisely because it aligns with the organization's preferred form of improvement: disciplined, controlled efficiency rather than reduction for its own sake. This is explicitly stated in leadership's synthesis of what "counts" as success:

Excerpt: *"The objective was not only efficiency reduction but controlled efficiency. The data demonstrate that sustainability gains coexist with quality and operational stability. I am satisfied that this trial has achieved both performance and governance integrity."*

Finance also contributes to the value-orientation work by translating sustainability gains into organizational viability and legitimacy in investment terms:

Excerpt: *"With a projected ROI of 4.2 years and sustained utilities reduction above target, financial viability is confirmed."*

Value-orientation is thus not presented as abstract values talk; it appears as the organization's practical criteria for what kind of sustainability improvement merits adoption—improvement that is evidence-based, stable, and governable.

Planning and foresight reappear in Stage 8 as durability and diffusion planning—how the organization anticipates the conditions under which adoption can remain stable and replication can remain defensible. Even at the point of successful evaluation, the organization does not treat scaling as automatic; it stages replication as a phased and conditioned pathway.

This foresight orientation is visible in how replication is conditioned on baseline validation and site-specific assessment:

Excerpt: *"Replication to other plants should consider site-specific utility baseline differences."*

Excerpt: *"The Committee further agreed that a phased technical assessment shall be conducted prior to replication at other brewery sites, subject to baseline validation and site-specific utility configuration."*

In other words, the organization anticipates that sustainability performance is not "plug-and-play"; it must be re-grounded in local baselines and configuration constraints to remain credible across sites. Planning and foresight therefore function here as an enabling governance logic that protects the integrity of institutionalization and prevents premature generalization.

8.3. Interpretive Basis

Stage 8 demonstrates principle enactment because it shows how sustainability-oriented R&D is institutionalized through a structured decision logic:

- The **Scientific Process Principle** makes adoption an outcome of consolidated criteria-based evidence, not rhetorical confidence.

- **TQM** makes adoption an outcome of governance embedding—monitoring commitments, non-negotiable thresholds, SOP formalization, and management review integration.
- **Value-Orientation** enables endorsement by framing success as disciplined improvement (“controlled efficiency”) compatible with organizational priorities and integrity.
- **Planning and Foresight** enable durability and replication by structuring diffusion as phased and conditional (baseline validation, site differences).

Thus, Stage 8 shows sustainability not only as achieved performance, but as institutionally authorized and made repeatable through evidence, standardization, and forward governance planning.

Interpretive Synthesis of RQ2

Taken together, the eight principles identified above indicate that sustainability-oriented R&D management in the organization is governed by a coherent configuration of managerial orientations. These principles do not appear as abstract managerial doctrines imposed from outside practice. Instead, they become visible through the recurring methods by which organizational actors identify priorities, justify decisions, coordinate actions, and evaluate outcomes across the project lifecycle.

While particular principles become most salient at specific stages, the analysis shows that principles overlap and reappear as enabling conditions across stages, allowing sustainability work to remain coherent, repeatable, and governable across the project lifecycle.

Viewed collectively, the principles reveal that sustainability is governed through a combination of anticipatory planning, collaborative coordination, empirical verification, and continuous improvement. Planning and foresight make sustainability concerns visible in advance; value orientation provides normative legitimacy; creativity and scientific process transform concerns into testable interventions; performance monitoring verifies outcomes; human-centered coordination enables implementation; technology–society orientation links technical action to broader responsibility; and total quality management stabilizes improvements within routine governance systems.

In this way, the analysis demonstrates that sustainability-oriented R&D management is not reducible to isolated decision points or technical optimizations. Rather, it is accomplished through a structured configuration of principles embedded within everyday organizational practices. These principles provide the underlying logic that connects the staged practices observed across the project lifecycle into a coherent system of sustainability-oriented innovation management.

The following section therefore integrates the preceding findings on organizational practices and underlying managerial principles to show how they collectively constitute sustainability as an accomplished form of R&D management.

Integrative Synthesis of Findings

R&D Management Practices in the Elicitation, Evaluation, and Execution of Sustainability-Oriented Projects and Underlying Principles of Sustainability-Oriented R&D Management Practices examined the findings of the study from two complementary perspectives. The first focused on the organizational practices through which sustainability-oriented R&D projects are elicited, evaluated, executed, and

institutionalized across the eight stages of the project lifecycle. The second identified the underlying R&D management principles that shape these practices. Considered together, these findings reveal that sustainability-oriented R&D management in the organization is accomplished through the interaction between structured managerial practices and recurring organizational principles.

From a practice-based perspective, the eight stages analyzed in the study illustrate how sustainability initiatives emerge through coordinated organizational routines rather than through isolated decision events. Sustainability concerns are first made visible through operational mapping and environmental aspect identification. These concerns are then translated into formal objectives and programs, experimentally tested through structured trial protocols, and evaluated through cross-functional deliberation and performance monitoring. Finally, validated improvements are incorporated into organizational governance through institutionalization and continued monitoring. In this sense, sustainability becomes operationally meaningful through the progressive organization of work across multiple stages of the R&D process.

The underlying R&D management principles provide the logic that connects these practices into a coherent managerial system. Planning and foresight guide the early identification of sustainability opportunities, while value orientation frames environmental improvement as an organizational responsibility. Creativity and scientific process enable these concerns to be translated into experimental interventions, while performance orientation ensures that sustainability outcomes are measured and verified. Human-centered coordination enables cross-functional collaboration during implementation, while technology-society orientation links technical decisions to broader environmental accountability. Finally, total quality

management stabilizes successful improvements by embedding them within continuous monitoring and organizational learning processes.

Taken together, the interaction between these practices and principles reveals a patterned governance process through which sustainability-oriented innovation is accomplished. Sustainability does not emerge from a single evaluation moment or technological intervention. Rather, it is progressively constructed through a sequence of organizational activities that make environmental concerns visible, transform them into actionable initiatives, test their feasibility through experimentation, and institutionalize successful outcomes within routine operational structures.

To illustrate how these practices and principles interact across the project lifecycle, Table 5.18 synthesizes the relationship between the organizational stages and the underlying management principles, distinguishing primary and supporting principles and indicating each stage's ethnomethodological function.

From an ethnomethodological perspective, this governance process becomes visible through the documentary and interactional methods by which organizational actors make sustainability claims accountable. Documents such as environmental registers, trial protocols, monitoring reports, and evaluation records do more than record decisions; they structure how decisions are made, justified, and institutionalized. Sustainability therefore becomes a socially organized accomplishment sustained through documentation, deliberation, measurement, and collective authorization.

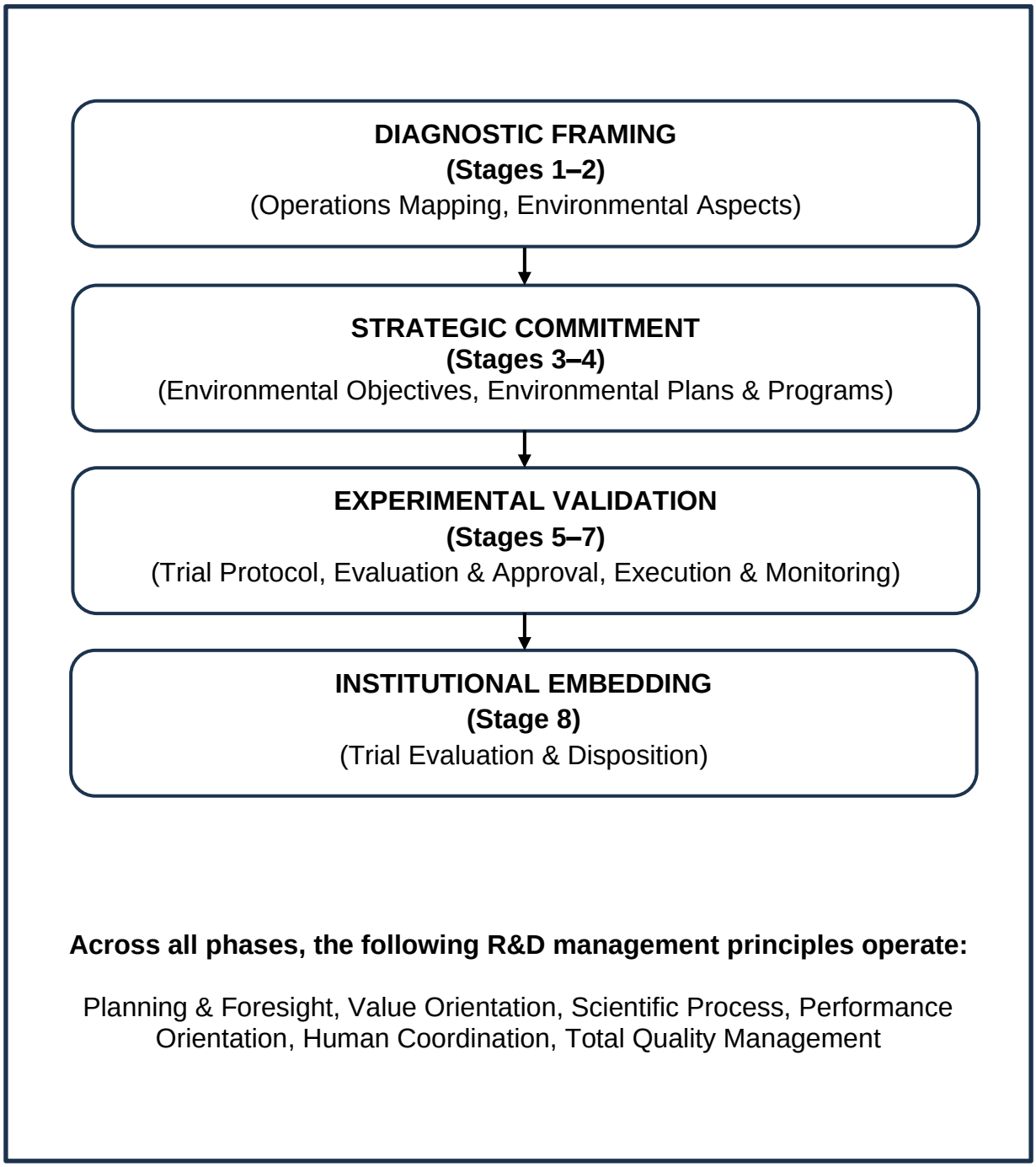
This integrative analysis shows that sustainability-oriented R&D management in the organization is not simply the result of technological innovation or isolated managerial decisions. Instead, it emerges from a structured system of practices and

principles that collectively organize how sustainability concerns are identified, tested, evaluated, and embedded within organizational governance.

To further illustrate this progression, the findings may be represented as a staged governance process through which sustainability-oriented R&D initiatives evolve from operational concerns into institutionalized organizational practices. The interaction between organizational practices and underlying managerial principles reveals a broader pattern of sustainability governance within R&D management.

Table 5.1 groups the eight stages into three R&D management phases (elicitation, evaluation, and execution with re-evaluation). Figure 5.7. reframes these stages at a higher governance level by separating early elicitation into diagnostic framing and strategic commitment, and by representing institutional embedding as a distinct final governance phase. Accordingly, Figure 5.7. groups the stages into four analytical phases—diagnostic framing, strategic commitment, experimental validation, and institutional embedding—tracing how sustainability concerns move from operational observation to formal commitment, trial validation, and routine governance integration.

Figure 5.7. Governance process of sustainability-oriented R&D project management.



The model shown in Figure 5.7. highlights that sustainability-oriented R&D management operates as a progressive governance process rather than a single evaluative decision. Sustainability initiatives first emerge through diagnostic practices that make environmental concerns visible, are then formalized through organizational

commitments, experimentally validated through structured trials, and ultimately institutionalized within routine operational governance. This staged progression demonstrates how sustainability is accomplished through the coordinated interaction of managerial practices, organizational principles, and documentary accountability mechanisms.

The following chapter builds upon this synthesis by summarizing the findings of the study and discussing their implications for R&D management practice, sustainability governance, and future research.

Chapter VI

SUMMARY, CONCLUSION AND RECOMMENDATIONS

This chapter synthesizes the findings presented in Chapter V and draws together the key insights of the study. Building on the analysis of organizational practices and managerial principles involved in sustainability-oriented R&D projects, the chapter summarizes how these practices and principles collectively shape the governance of sustainability-oriented innovation. Recommendations for R&D management practice and future research are then recommended.

Summary

This study examined how sustainability-oriented research and development (R&D) projects are accomplished in organizational practice. Rather than focusing on formal project evaluation models, the research investigated how sustainability considerations are interpreted, negotiated, and institutionalized through the everyday practices of R&D management.

The study was guided by two research questions:

RQ1. *What R&D management practices are involved in the elicitation, evaluation, and execution of sustainability-oriented projects?*

RQ2. *What underlying principles shape these R&D management practices?*

Adopting a qualitative research design grounded in a practice-based perspective (PBP), ethnomethodology (EM), and conversation analysis (CA), the study examined naturally occurring organizational materials associated with an R&D initiative aimed at improving the environmental performance of bottle washing operations. The empirical corpus included operational mapping documents,

environmental registers, trial protocols, monitoring reports, evaluation records, and meeting interactions produced throughout the project lifecycle.

The analysis revealed that sustainability-oriented R&D initiatives are not introduced through a single evaluative decision. Instead, they emerge through a sequence of organizational practices that progressively translate sustainability concerns into operational interventions and institutional commitments.

Eight organizational stages were identified in the development and management of sustainability-oriented R&D projects:

1. Operations, Product, and Process Mapping
2. Registry of Environmental Aspects and Impacts
3. Environmental Objectives
4. Environmental Plans and Programs
5. R&D Trial Protocol
6. Evaluation and Approval
7. Trial Execution and Monitoring
8. Trial Evaluation and Disposition

These stages collectively structure the elicitation, evaluation, execution, and institutionalization of sustainability-oriented initiatives within the organization.

These practices are guided by recurring R&D management principles that shape how sustainability concerns are interpreted and operationalized. These include principles related to planning and foresight, scientific validation, performance orientation, quality management, human coordination, and value-oriented decision-making.

Taken together, the findings show that sustainability in R&D management is accomplished through a structured governance process in which sustainability concerns are surfaced, formalized, experimentally validated, and ultimately embedded into routine organizational practices.

Conclusion

The results of this study lead to several key conclusions regarding sustainability-oriented R&D management.

First, sustainability-oriented R&D initiatives emerge through a structured sequence of organizational practices rather than through isolated project evaluation decisions. The elicitation, evaluation, and execution of sustainability initiatives are organized through interrelated routines involving documentation, deliberation, experimentation, and institutional review. These practices enable organizations to translate environmental concerns into concrete R&D initiatives that can be tested, validated, and integrated into operational systems.

Second, sustainability-oriented R&D management operates as a staged governance process through which sustainability concerns evolve from operational observations into institutionalized practices. Early stages of the process make environmental impacts visible through operational mapping and environmental assessment. Subsequent stages formalize these concerns into organizational commitments, design experimental interventions, and evaluate their operational feasibility. Successful interventions are then institutionalized through documentation, monitoring systems, and management review mechanisms. Table 6.1 summarizes the governance pattern of sustainability-oriented R&D management identified in this study.

Table 6.1

Governance Pattern of Sustainability-Oriented R&D Management

Governance Pattern	Stage Manifestation	Sustainability Function	Organizational Accomplishment
Diagnostic Surfacing	Operations Mapping; Environmental Aspects Identification (RAI)	Makes environmental impacts visible	Converts operational realities into sustainability concerns
Structured Commitment	Environmental Objectives; Environmental Plans and Programs	Establishes formal sustainability commitments	Aligns environmental goals with organizational planning
Experimental Structuring	R&D Trial Protocol	Designs controlled sustainability intervention	Organizes experimentation and measurement
Negotiated Authorization	Evaluation and Approval	Legitimatizes trial implementation	Aligns technical, financial, and operational perspectives
Conditional Stabilization	Trial Execution and Monitoring	Governs performance during implementation	Converts deviations into accountable improvement
Institutional Embedding	Trial Evaluation and Disposition	Formalizes successful innovation	Integrates sustainability practices into routine governance

Table 6.1 illustrates that sustainability initiatives are progressively stabilized through governance mechanisms that combine scientific validation, managerial deliberation, and documentary accountability.

Third, sustainability-oriented R&D practices are guided by a configuration of underlying R&D management principles. These principles provide interpretive frameworks through which organizational actors evaluate sustainability proposals, justify decisions, and manage uncertainty. The findings demonstrate that sustainability

decisions are shaped by the interaction of several principles, including planning and foresight, scientific validation, performance orientation, total quality management, and collective coordination among organizational actors.

Fourth, sustainability in R&D management is inherently social in its accomplishment. The findings show that sustainability commitments become credible through processes of organizational interaction, documentation, and collective decision-making. Meetings, evaluation reports, and monitoring records function not only as records of decisions but also as mechanisms through which sustainability claims are examined, negotiated, and legitimized.

Finally, the study concludes that sustainability in R&D management should be understood not as a single project attribute or evaluation criterion, but as an organizational governance process through which environmental objectives are progressively translated into operational practice.

Taken together, the findings of this study reposition sustainability in R&D management from a model-driven evaluation criterion to a staged governance accomplishment enacted through situated managerial practices. Sustainability-oriented innovation emerges not through isolated project selection decisions but through a sequence of organizational practices that progressively surface environmental concerns, structure experimental interventions, validate operational feasibility, and institutionalize successful outcomes within routine governance structures.

By demonstrating how sustainability is accomplished through the coordinated work of documentation, deliberation, experimentation, and institutional review, this study contributes a practice-based understanding of sustainability governance in R&D

management. Sustainability in this context is not merely a project attribute but an organizational discipline sustained through the continuous coordination of scientific reasoning, managerial judgment, and collective accountability.

Recommendations

Based on the findings of the study, several recommendations are proposed for R&D management practice and future research.

First, organizations seeking to strengthen sustainability-oriented innovation should design governance structures that support the systematic development and evaluation of sustainability initiatives. Structured stages such as environmental impact identification, formal objective setting, controlled experimentation, and post-trial evaluation provide important mechanisms through which sustainability initiatives can be translated into operational improvements.

Second, cross-functional deliberation should be integrated into R&D project evaluation processes. The findings demonstrate that sustainability initiatives benefit from the participation of technical specialists, operational managers, and financial decision-makers who collectively interpret trial results and determine the feasibility of implementation.

Third, organizations should strengthen documentation and monitoring systems that support the institutionalization of sustainability innovations. Environmental plans, monitoring reports, and management review processes play a crucial role in ensuring that successful sustainability initiatives are embedded into routine operational governance rather than remaining isolated experimental outcomes.

Finally, future research may extend the present study by examining sustainability-oriented R&D practices in different organizational contexts or across multiple cases. Comparative studies could further illuminate how different governance structures influence the development and institutionalization of sustainability innovations in R&D management.

Future research may also extend the present findings by examining how external stakeholders—such as suppliers, customers, or regulators—participate in, interpret, or contest sustainability-oriented R&D decisions.

In addition, the use of audio- or video-recorded interaction could enable more fine-grained conversation analytic treatment of interactional features, complementing the document-centered analysis adopted in this study.

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