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affiliée à l'Université de Montréal

Exploring the Enactment of Interorganizational R&D Collaboration: A Human-Centric Perspective

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Thèse Présentée en vue de l'obtention du diplôme de *Philosophiae Doctor*

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Cette thèse intitulée :

Exploring the Enactment of Interorganizational R&D Collaboration: A Human-Centric Perspective

présentée par **Houssam ALAOUIE**

en vue de l'obtention du diplôme de *Philosophiae Doctor*

a été dûment acceptée par le jury d'examen constitué de :

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Mario BOURGAULT, membre et directeur de recherche
Kamal BOUZINAB, membre
Brenda BERKELAAR, membre externe

DEDICATION

To all my collaborators...where do I start

It has been a stormy sea, but you've helped me not to sink and enabled me to see

Your eyes were my horizon, and your hands were masts strong with the wind

You were the bridge on which I stood tall looking for hope in the sea

You were the glue that held the ship together facing mighty waves

So here is my chance to tell you all and you know who you are

Thank you so much for supporting me to finally dock at bay

A first bay for a humble sailor in an ocean of knowledge

And you should know that you gave me courage

To be ready for the next trip

Back to the sea

Hoping to reach the ocean

…

To my parents RM, DA, SE, my wife and journey partner BM, my children K, J, L, and larger family and friends

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RÉSUMÉ

La collaboration interorganisationnelle continue de gagner en importance dans divers secteurs, y compris l'aérospatiale, pour aider à des problèmes complexes, créer des coentreprises et répondre à des enjeux de responsabilités sociales. Cependant, la gestion des relations de collaboration peut être difficile, en particulier lors des phases de la négociation, de l'exécution et de la définition du projet. Par l'entremise d'une approche centrée sur l'humain, cette recherche vise à étudier la collaboration interorganisationnelle et à développer un cadre flexible et adaptable pour améliorer la gestion de la collaboration dans l'industrie aérospatiale.

L'étude explore les interactions lors de la collaboration entre les parties prenantes individuellement et au sein des organisations, en se concentrant sur les pratiques, les comportements, les actions et les valeurs implicites dans ces interactions. Quatre études de cas du secteur aérospatial ont été analysées pour comprendre le système complexe d'interactions sociales et organisationnelles et proposer un cadre qui peut faciliter et guider ce processus. Les résultats attendus comprennent une meilleure compréhension de la construction sociale et de la dynamique de la collaboration, des améliorations potentielles des processus et des meilleures pratiques.

La thèse est organisée en six chapitres. Le chapitre 1 présente le sujet de recherche. Le chapitre 2 fournit une revue de la littérature sur la collaboration interorganisationnelle, y compris les modèles théoriques, les défis et les lacunes dans la littérature actuelle. Le chapitre 3 décrit la conception de la recherche, la méthodologie et les questions de recherche. Le chapitre 4 présente une analyse approfondie des études de cas et des résultats. Le chapitre 5 se concentre sur les principaux thèmes qui sont ressortis de la phase de l'analyse abductive, offrant une vue à multiples facettes de la dynamique de la collaboration. Le chapitre 6 conclut l'étude, résumant les principales conclusions, l'impact, les contributions au domaine et suggérant des orientations pour la recherche future.

Le cadre proposé vise à contribuer au développement d'une culture qui comprend mieux la dynamique des processus de collaboration, leur conception, ainsi que leurs principes tacites sous-jacents. Il sert également de point de départ pour élaborer une approche globale des pratiques et processus de collaboration qui prennent en compte les parties prenantes, les organisations et leurs cultures respectives. Cette recherche devrait apporter une contribution significative au domaine, avec des résultats qui peuvent être appliqués dans diverses industries et contextes.

ABSTRACT

Interorganizational collaboration continues to gain importance in various sectors, including aerospace, for addressing complex issues, creating joint ventures, and fulfilling social responsibilities. However, managing collaborative relationships can be challenging, especially during negotiation, execution, and defining project terms. Through a human-centric approach, this research aims to study the enactment of collaboration and develop a flexible and adaptable framework to improve collaboration management in the aerospace industry.

The study explores interactions and drivers of collaboration between stakeholders individually and within organizations, focusing on practices, behaviours, actions, and values embodied in these interactions. Four case studies from the aerospace sector were analyzed to understand the complex system of social and organizational interactions and to propose a framework that can facilitate and guide this process. The expected outcomes include increased understanding of the social construction of collaboration, potential process improvements, and best practices.

The thesis is organized into six chapters. Chapter 1 introduces the research topic and its importance. Chapter 2 provides a literature review on interorganizational collaboration, including theoretical models, challenges, and gaps in the current literature. Chapter 3 outlines the research design, methodology, and research questions. Chapter 4 presents a thorough analysis of the case studies and findings. Chapter 5 focuses on major themes that emerged from the abductive analysis phase, providing a multi-faceted view of the day-to-day enactment of collaboration. Chapter 6 concludes the study, summarizing the main findings, impact, contributions to the field, and suggesting directions for future research.

The proposed framework aims to contribute to the development of a culture that better understands collaboration processes, their design, as well as their underlying tacit principles. It also serves as a starting point for developing a comprehensive approach to collaboration practices and processes that consider stakeholders, organizations, and their respective cultures. This research is expected to make a significant contribution to the field, with findings that can be applied across various industries and contexts.

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LIST OF SYMBOLS AND ABBREVIATIONS

CAD	Computer-Aided Design
CARIC	Consortium for Aerospace Research and Innovation in Canada
CMM	Capability Maturity Model
CoPS	Complex Products and Systems
CRIAQ	Consortium for Research and Innovation in Aerospace in Québec
EI	Emotional Intelligence
FAA	Federal Aviation Administration
HOT	Higher-Order Thinking
HOTS	Higher-Order Thinking Skills
ICT	Information and Communication Technology
IOR	Interorganizational Relationship
IOE	Interorganizational Entity
IOC	Interorganizational Collaboration
NDA	Non-Disclosure Agreement
NSERC	Natural Sciences and Engineering Research Council of Canada
PBO	Project Based Organization
PMI	Project Management Institute
PMO	Project Management Office
TCE	Transaction Cost Economics
PPM	Project Portfolio Management
RDT	Resource Dependence Theory
R&D	Research & Development
RBV	Resource-Based View
TCE	Transaction Cost Economics
TCT	Transaction Cost

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CHAPTER 1 INTRODUCTION

Collaboration between organizations is increasing for several reasons, such as addressing complex issues, creating joint ventures (even with competitors), and fulfilling social responsibilities. This research project focuses on interorganizational collaborative R&D projects in the aerospace industry between companies and universities.

However, establishing collaborative relationships can be challenging, particularly when defining and discussing project terms and during the negotiation and execution phases. Without a clear understanding and defined processes, projects may be abandoned. Collaboration projects often involve creating temporary quasi-firms, which have their own goals and objectives and must consider the interests of stakeholders.

Collaboration projects come with challenges, and researchers and practitioners have identified solutions. Successful collaboration requires significant integration of contextual and other factors at various levels specific to the venture. By effectively implementing collaborative strategies and overcoming challenges, organizations can achieve mutual goals, share expertise, and participate in ecosystems, potentially leading to greater success and innovation.

Specifically, R&D projects between organizations, such as those in the aerospace industry face challenges in establishing and maintaining effective collaborations. These challenges arise from a lack of understanding of processes and practices for managing complex collaborative relationships and projects. There is a need for a comprehensive framework that facilitates and guides the collaboration process. A process which considers the diverse stakeholders, organizational contexts, and cultures involved.

Trusted collaboration facilitators, whether internal or external to the organization, aim to bring potential partners together and establish interactions. This intentional action is important in the collaboration process, and an essential step to succeeding in a collaboration project. Successful outcomes require trust among partners, as well as a carefully designed project plan and a common understanding of objectives and outcomes.

It was thus important, in this research, to study the enactment of collaboration through context of its antecedents such as prior relationships or resource dependence, including the establishment of collaborative relationships through to collaboration processes and the outcomes of collaboration. The practices and processes experienced by collaborators have received little research attention (Cropper et al., 2010). However, practitioners often try to mechanically manage these collaborations in isolation from the context, using tools and processes that may not be optimal for complex collaborative relationships and projects (Chen et al., 2006; Westphal et al., 2010).

Moreover, organizations—whether government, academic, non-profit, or for-profit—strive to maximize return (tangible, intangible, economic, social, or moral) for their stakeholders or meet other requirements through collaborations. Therefore, understanding the enactment of collaborations and how to guide collaboration processes through purposeful design is important to increase desired outcomes.

Existing literature on interorganizational relationships is focused on whether and how relationships are beneficial, governed, and managed (Barringer & Harrison, 2000). As there is little research on how interorganizational relationships are managed day-to-day, this research project aims to increase the understanding of collaboration day-to-day enactment for use in the development and application of management practices (Barringer & Harrison, 2000; Calamel et al., 2012; Cropper et al., 2010; Faulkner & De Rond, 2000; Ring & Van de Ven, 1994). This research is relevant given the importance of collaborative research but with a failure rate of more than 50 percent (Barringer & Harrison, 2000; Faems et al., 2005); only 35 percent are successful according to the Standish Group (Johnson & Mulder, 2021).

To effectively study interorganizational collaboration, stakeholders (including individuals and partner organizations), the collaboration project, and the operational context must be considered. This can be complex, as organizations must understand and use the language of collaboration, identify and understand the context and dimensions of collaboration, and co-create an optimal approach for their context. To address these challenges, this research proposes a flexible and adaptable framework for collaboration that can be used by

individuals and organizations without disrupting current practices and processes. The aim is to improve awareness and address various challenges in managing collaborative research, both interorganizational and intraorganizational. The expected outcomes of this study include increased understanding of the social construction and management of collaboration, as well as identifying potential process improvements that may inform best practices. This research focuses on non-competitive collaborative research projects in the science of the artificial fields where the aim is to study the design and creation of artefacts in order to attain goals (Simon, 1996).

This study explores interactions and drivers of collaboration between different stakeholders individually, as well as skills, competencies, and values embodied in these interactions. The goal is to understand this complex system of social and organizational interactions and to propose a framework that can facilitate and guide this process. It is important that this framework considers the collaboration context and describes the concepts of social construction and its key elements. Given the complexity of collaborations, the framework should be recognized by different stakeholders and allow them to create awareness about these interactions and dimensions and leverage the elements of the framework in their individual and organizational contexts.

This framework will contribute to the development of a culture that better understands and appreciates collaboration processes and practices and their fundamental principles and enactment. It will serve as a starting point for developing a comprehensive approach to designing collaboration dynamics that consider the stakeholders, organizations, and their respective cultures. This study, based on case studies from the aerospace sector, which is known for its complex products and wide range of stakeholders, is expected to make a significant contribution to this field. The case studies have been carefully selected to reflect a diverse range of collaborators and collaboration dynamics. The resulting framework provides a foundation for further analysis and development and reflects general concepts that are not specific to a particular context.

In the following chapters, based on collaboration and multidisciplinary literature and use cases, we explore if we can develop an agile framework for interorganizational

collaboration that considers the collaboration context, the social and organizational context, and other key elements of collaboration. Additionally, we explore if this framework can be proposed to enable individuals and organizations to effectively manage complex collaborative research projects in the aerospace industry.

The research objectives include, reviewing existing multidisciplinary literature on interorganizational collaboration, identifying gaps and challenges, and exploring the management of collaboration. Case studies from the aerospace industry will be studied to explore the interactions and drivers of collaboration between diverse stakeholders, as well as what is lived day-to-day by the stakeholders involved in these interactions. Furthermore, we propose and study a framework for interorganizational collaboration that is based on the reviewed literature, and which incorporates several key components which individually have demonstrated impacts on projects outcomes. And finally, potentially contribute to the development of a culture that better understands micro and macro contexts and processes to advance best practices in managing complex collaborative R&D projects. We start with chapter 2 which includes a literature review on IOC, outlining the main models and theories, as well as identifying the research challenges and gaps in the current literature. This chapter provides an overview of theories and topics related to the study, in particular interorganizational collaboration theories and concepts related to process theories, and IOC in the context of collaborative R&D projects in the aerospace sector and its complex products. Chapter 2 concludes with a proposed preliminary conceptual framework which will be used as a baseline to further explore interdisciplinary concepts of interest anchored through reflective practice. The preliminary conceptual framework proposed in Chapter 2 is a baseline that provides a priori themes for qualitative analysis of the cases in this study. The proposed conceptual framework consists of four interconnected themes around the collaboration process “black box”, design thinking, change management, and project management. In Chapter 3, the design, methodology, and research questions are outlined, as well as an overview of expected contributions. The research objectives and questions presented in this chapter draw on the literature presented in the previous chapters and in alignment with the proposed conceptual framework. Chapter 3 also presents the baseline and the motivation for the methodology, as well as the research design including the

selected case studies, as well as the data analysis strategy. We propose a deductive, inductive, and abductive approach which were used to guide the interpretation of data in our multi-method analysis approach. Chapter 4 presents a thorough analysis of the case studies and findings in relation to the preliminary conceptual framework, where the analysis of the four cases confirmed the relevance of the proposed framework and its themes and inspired additional abductive analysis and literature review reflecting new concepts and themes from the cases data. Chapter 5 presents the outcome of the abductive analysis phase and focuses on major themes that emerged which provide a multi-faceted view of the day-to-day enactment of collaboration. The additional observations and identification of patterns combined with qualitative and quantitative review confirmed new themes related to design thinking and dynamic capabilities, affordances, Higher-order thinking (HOT), and entrepreneurship which were proposed as part of a new encompassing conceptual framework. Additionally, we expand the concept of "Intangible Collaboration Affordances" and introduce the term of "Entrepreneurial Alertness" in the context of IOC. Finally, Chapter 6 summarizes the main findings, impact, and contributions to the field, and suggests directions for future research.

1.1 The context of the study in the Canadian aerospace industry

The Canadian aerospace industry is responsible for more than $31 billion in revenue, contributes over $27 billion in GDP, and adds 212,000 jobs to the Canadian economy (ISED and AIAC report, 2022). The Aero-Montreal annual report provides an overview of the aerospace cluster in the Montreal region, describing Montreal, along with Seattle and Toulouse, as a global centre for aerospace and related development. Over 70 percent of Canadian R&D in aerospace is in the Montreal region. Costs are among the lowest in North America, allowing for continued and increased focus on R&D. Also according to the AIAC report, in 2022, the Canadian aerospace Industry maintained its number one R&D ranking among all Canadian manufacturing industries.

The high R&D intensity and spending as per ResearchInfosource.com (2022), for example, Pratt & Whitney Canada, Bombardier, and CAE demonstrate the contribution of these major OEM to innovations in the aerospace industry in Canada, and much of these

innovations are due to collaboration among these organizations, stakeholders, and other tier equipment manufacturers. Collaboration feeds innovation through knowledge creation, sharing, absorption, and use, for example, the numerous aerospace related education programs in colleges and universities and several industry associations and aerospace research organizations at the provincial and federal levels in Canada.

Although the aerospace sector is faring well in terms of R&D spending and contributions to the economy, R&D spending in Canada has been stagnating since 2000 and further declining since 2005 (https://data.oecd.org/rd/gross-domestic-spending-on-r-d.htm), which requires attention from stakeholders, whether public or private. Further innovation and collaboration driven by business R&D spending is needed to create synergies through relationships, which can yield ecosystem and stakeholder benefits.

As a demonstration of increasing collaboration trends, the Natural Sciences and Engineering Research Council of Canada (NSERC) reported in December 2014 that the number of companies it works with has doubled in five years. In December 2020, NSERC reported that it connected researchers with over 4000 partners (https://www.nserc-crsng.gc.ca/Innovate-Innover/index_eng.asp), thus promoting and tracking collaborations in support of industrial innovation and R&D.

The performance of the Consortium for Research and Innovation in Aerospace in Quebec has encouraged the Canadian Government, in 2014, to support this collaboration model for the Canadian aerospace industry: A pan Canadian consortium, the Consortium for Aerospace Research and Innovation in Canada (CARIC), was created and financed for five years, to promote collaborative aerospace R&D projects in Canada. This model of collaboration is still being leveraged in support the on-going development of the aerospace collaboration ecosystems in Quebec and Canada.

The creation and sharing of knowledge is important, as well as strengthening knowledge paths for sustainability and growth. According Aero-Montreal, the Montreal region is at the top of the list of other Canadian areas in terms of funding university research programs where since 2005, more than $5 billion has been allocated to university research. Aerospace

engineering programs resulting from collaborations between the aerospace industry, universities, and other organizations keep growing and strengthening.

As an example, the Montreal metropolitan area has a vibrant research community where many major aerospace industry, academic, public, and not for profit organizations have also major presence and offices based in Montreal. Moreover, according to Investissement Quebec, Quebec has more than 20 public and private research centers which collaboration with the aerospace industry in Quebec, which is responsible for more than 70% of all Canadian aerospace R&D.

CHAPTER 2 LITERATURE REVIEW

This chapter presents a literature review on interorganizational collaboration (IOC) and its principal models and theories in relation to the collaboration between organizations versus other forms of collaborations. Definitions of interorganizational relations (IOR) and these relationships are aligned with Cropper et al. (2010), where the study of IOR "is concerned with understanding the character and pattern, origins, rationale, and consequences of such relationships. The organizations can be public, business, or non-profit and the relationships can range from dyadic … to multiplicitous" (p. 4). Also, Cropper et al. (2010) refer to interorganizational entities (IOEs) as the manifestations of these relationships, and the terminology commonly used for IOR are divided into three categories: nouns for entities, descriptors for entities, and names for acts. For example, collaboration, collaborative, and collaboration, or partnership in the first category, virtual project group in the second, or outsourcing as an example of a name for an inter-organization act. In this study and similar to Cropper et al. (2010), the interest is in relationships that are based on mutual interest, that is, cooperative or collaborative, which imply more than a simple transaction.

This chapter provides an overview of theories and topics related to the study, in particular interorganizational collaboration theories and concepts around which most of the literature has been revolving, process theories, and IOC in the context of collaborative R&D projects in the aerospace sector and its complex products. Also, this study explores challenges for interorganizational entities management (Franco, 2008; Huxham & Vangen, 2005; Veugelers, 1998) created by uncertainties associated with R&D (Westphal et al., 2010) combined with the complexities of IOC. This chapter concludes with a summary and description of the challenges and shortfalls of the current literature relating to IOC research. A proposed preliminary conceptual framework will be used as a baseline to further explore interdisciplinary concepts of interest anchored through reflective practice (Cropper et al., 2010).

2.1 Theoretical models of interorganizational collaboration

Collaborate is defined as, “work jointly”, the origin of which is the Latin “collaborare” for “laborare work” (Barber, 2005, online). Collaboration and cooperation are not new terms. Working together for the betterment of human conditions is not new, if anything, the notions of communities and civilization are rooted in people working together intellectually and physically: “Indeed, Plato, Caesar are perhaps as good analysts of cooperation as today’s management scholars. … cooperation, alliances, and joint ventures were already widespread at the turn of the twentieth century in many industries, chemicals in particular” (Faulkner & De Rond, 2000, p. v). The importance of collaboration is illustrated by Aristotle: “For each individual among the many has a share of virtue and prudence, and when they meet together, they become in a manner one man, who has many feet, and hands, and sense.” (Fan, 2012, p. 13)

This section presents relevant literature on the definition of collaboration, which may be interpreted differently depending on the discipline and the theory in which definitions are grounded. Best efforts have been made to ensure that different perspectives are presented. Faulkner and De Rond (2000) emphasize Barbara Gray’s description of collaboration as a concept that is difficult to grasp despite the surge in attention. When we collaborate there are many concepts that are elusive depending on our perspective, and this study attempts to address one of them.

The definition of collaboration has been cited in numerous literature reviews, evolved over time, and was presented in Wood and Gray (1991) as “Collaboration occurs when a group of autonomous stakeholders of a problem domain engage in an interactive process, using shared rules, norms, and structures, to act or decide on issues related to that domain” (p.146). This updated definition suggests recognizing collaboration irrespective of its manifestation and forms, nor its contexts or processes (Wood & Gray, 1991). Moreover, Agranoff and McGuire (2003) propose that collaboration is a “a purposive relationship designed to solve a problem by creating or discovering a solution within a given set of constraints” (p. 4). At the operational level Daoudi and Bourgault (2012) consider collaboration a “joint initiative that translates into observable communications …, the

coordination of different activities, and participation in decision making … to achieve common goals" (p.4). This definition was based on a literature review which are summarized in Daoudi and Bourgault (2012) as follows:

- Gray (1989), a process that enables (i) participation in decision making and (ii) synergy.
- Schrage (1990), a process of interaction between complementary skills.
- Mattessich and Monsey (1992), a well-defined relationship established to achieve a common goal.
- Chrislip and Larson (1994), a relationship that satisfies the interests of all stakeholders.
- Marshall (1995), a principle-based process of working in concert.
- Kanter (2003), an interpersonal relationship requiring communication and trust between parties.
- Himmelman (1997), an exchange of information in order to achieve a common goal.
- Keyton and Stallworth (2003), shared decision making.
- Black et al. (2003), the sum of the participants' commitments.
- Hardy et al. (2003), an ongoing communicative process.
- Butterfield et al. (2004), an interactive process using shared rules, norms, and structures to act or decide.
- Kumar et al. (2004), a set of coordination mechanisms.
- Lawrence (2005), a joint, interdependent effort that provides mutually beneficial outcomes to stakeholders.
- Sandow and Allen (2005), a coordinated effort by stakeholders.
- Thomson and Perry (2006), an interactive process.
- Czajkowski (2006), a decision-making process.
- Tabaka (2006), a commitment to actively participate in decision making.
- Peters and Manz (2007), a process that goes beyond the communicative process and requires collective participation in decision making.

Another, more elaborative, definition of collaboration is proposed by Thomson and Perry (2006) as

> a process in which autonomous actors interact through formal and informal negotiation, jointly creating rules and structures governing their relationships and ways to act or decide on the issues that brought them together; it is a process involving shared norms and mutually beneficial interactions (p. 23).

This version contains elements of some of the definitions presented earlier. The five dimensions in this definition, governance, administration, autonomy, mutuality, and norms are explored by Thomson, and Perry (2006) as the operational process of collaboration. The dimensions make up a framework of collaboration processes that promote understanding of the process and the impact of these dimensions and their management for effective collaboration (Thomson & Perry, 2006). Wood and Gray term "The 'doing' of collaboration—the process component—is … a 'black box.' … the interactive process of collaboration is least understood" (in Thomson & Perry, 2006, p. 21).

Another definition of collaboration which does not focus on any form or type of collaboration is by Phillips et al., (2000), where collaboration is "a co-operative relationship among organizations that relies on neither market nor hierarchical mechanisms of control" (p. 24). This definition distinguishes collaboration from other organizational activities through three characteristics: it is an interorganizational phenomenon, it is not mediated by market mechanisms such as price mechanisms, and it excludes relationships that use control through legitimate authority (Phillips et al., 2000).

In their research, Keyton et al. (2008) reference Huxham and Vangen's (2005) work in which they provide a structural view and constructs of collaboration, as well as perspectives that allow for reflective practice. This work is critiqued as not being clear on the communication construct, but incorporating explicit and implicit tips, which suggest that communication is present across multiple levels of abstraction of the messy collaboration process. As such Keyton et al. (2008) build on this work and advance a view for collaboration through a communicative model in which "communication is the essence of collaboration" (p. 379). They also build this communicative collaboration model as "both a structure for and the process of ways in which organizations and communities work

to resolve common problems and explore new ideas" (p. 377) and they offer the following definition: Interorganizational collaboration "is the set of communicative processes in which individuals representing multiple … stakeholders engage when working interdependently to address problems outside the spheres of individuals or organizations working in isolation" (p. 381).

Glowacki-Dudka (1999) highlights the importance of a common vocabulary in her view on collaboration as "the most in-depth form of commitment between organizations. In most cases, a new mission and common goals are created, along with the creation of a new entity. … Comprehensive planning needs to occur to define joint strategies, a joint structure with a clear division of labor, and a measure for success. Both leadership and control are shared between organizations as are risk and resources" (p. 8).

Along the same lines Fang et al. (2003) provide a definition for collaboration that underlines the criticality for the highest level of collaboration, which they call concerted work, of task and process structure, as well as the need for interactive communication (verbal or non-verbal), which is almost continuous. They go on to define collaboration "as making joint cognitive effort toward achieving an agreed upon goal" (p. 7). The authors illustrate their proposed hierarchy of collaboration, at the highest level of which is an analogy of a rowing team's effort where the action of one affects the actions of the team and how the effort must be synchronized and concerted for it to yield desired outcomes.

Castañer and Oliveira (2020) address the confusion over the meaning of collaboration, coordination, and cooperation in Interorganizational Relationships (IORs) where they redefine coordination as the joint determination of common IOR goals, while cooperation refers to the implementation of those goals. The authors finally propose that collaboration is to voluntarily help others achieve a common IOR goal or a private goal. These goals can be private altruistic, private selfish, or collective goals. The following highlights some of the Collaboration definitions highlighted by Castañer et al. (2020) in their systematic literature review of the term in the context of IORs, where collaboration is referred to as:

- Gazley (2017), “Organizational collaboration describes dynamic relationships involving coordinated activity based on mutual goals” (p. 1); it is a human activity unfolding across multiple levels.
- Lakshminarasimha (2017), it entails, for example, information sharing and joint performance measures (p. 33).
- Kretschmer and Vanneste (2017), no free-riding.
- Salvato, Reuer, and Battigalli (2017), “Act of working together by two or more persons to accomplish something” (p. 963).
- Daudi, Hauge, and Thoben (2016), includes “cooperation, cooperative logistics” (p. 19).
- Durugbo (2016), “Collaboration, along with related terms of networking, cooperation and coordination, is used to describe joint effort or collective action” (p. 3751).
- Majchrzak, Jarvenpaa, and Bagherzadeh (2015), “A cooperative, inter-organizational relationship that is negotiated in an ongoing communicative process” (p. 1338).
- Tsanos, Zografos, and Harrison (2014), “Operational collaboration (e.g., joint responsibility, shared planning) information exchange” (p. 421).
- Gulati et al. (2012), umbrella term for cooperation and coordination.
- Knoben and Oerlemans (2006), organizations working together.

Thus far, the discussion in the context of this research project is of collaboration as a higher form of “working together”. Therefore, let’s continue with the definition of collaboration by Westphal et al. (2010) as a process that is beyond the simple splitting of tasks completed independently by partners. Collaboration is working jointly, like the rowing team analogy where contributions influence each other. Their definition of collaboration is “acting in an incompletely determined and non- hierarchic way to enable joint processes with other … actors … to reach common goals” (p. 312).

Collaboration can also be viewed as a mode of integrating two organizations. Anderson's (1995) definition is:

> Formalized collaboration is a strategic mode of integration in which two or more organizations cooperate on part(s) or all stages of production, from the initial phase of research to marketing and distribution. Collaborative agreements can be short-term or long-term and encompass a spectrum of cooperation that lies between outright merger/acquisition and arms-length market transactions (p. 4).

It is noteworthy to differentiate between cooperation, coordination, and collaboration. According to McNamara (2012) and other theorists, the terms represent a continuum of increased interaction. At one end, cooperation is “an interaction between participants with capabilities to accomplish organizational goals but chose to work together, within existing structures and policies, to serve individual interests”. Next, coordination is “an interaction between participants in which formal linkages are mobilized because some assistance from others is needed to achieve organizational goals”. And finally, collaboration is “an interaction between participants who work together to pursue complex goals based on shared interests and a collective responsibility for interconnected tasks which cannot be accomplished individually” (McNamara, 2012, p. 391). Table 2.1 provides an overview of the elements distinguishing these notions.

Table 2.1 Elements Distinguishing Cooperation, Coordination, and Collaboration (Adapted from McNamara, 2012)

Element	Cooperation	Coordination	Collaboration
Design	Work within existing organizational structures	Centralized control through hierarchical structures	Shared power arrangements
Formality of the Agreement	Informal agreement	Formalized agreements	Informal and formal agreements
Organizational Autonomy	Fully autonomous; policies to govern the collective arrangement are not developed	Semi-autonomous; policies to govern the collective arrangement may be developed by higher authorities	Not autonomous; policies to govern the collective arrangement are developed jointly by participants
Key Personnel	Implementation of the partnership occurs at the lowest levels; leaders are not involved	Implementation of the partnership is based on a higher authority; a boundary spanner may be used to foster linkages	Implementation of the partnership is based on the participants: a convener may help bring participants together
Information Sharing	Basic information shared through informal channels	Information is exchanged through more formal channels	Open and frequent communications through formal and informal channels
Decision Making	Independent decision making	Centralized decision making	Participative decision making
Resolution of Turf Issues	Conflicts avoided through independence	A neutral facilitator may help resolve conflicts	Participants work together to resolve conflicts
Resource Allocation	Information is exchanged	Physical and nonphysical resources are exchanged to achieve individual goals	Physical and nonphysical resources are pooled in support of collective goals
Systems Thinking	System integration does not occur	System integration may occur to better achieve individual goals	System integration does occur to better achieve collective goals
Trust	Trust relationships are not required but may develop	Leaders work closely to create relationships based on trust	Trust between participants is needed to sustain relationships

In the context of our study, it is noteworthy to highlight the work of Koschmann, Kuhn, and Pfarrer (2012) on cross-sector partnerships where they adopt the following definition for these as "multilateral collectives that engage in mutual problem solving, information sharing, and resource allocation" (p. 332).

Given the myriad definitions of collaboration presented above and in the broader literature, for this study, ***collaboration is defined as a voluntary relationship and engagement between actors with mutual interests, who work together to develop, share, and use capabilities and resources to achieve certain benefits and advantages through formal or informal means or structures.***

2.1.1 Why organizations collaborate

The broadness of research on IOR is illustrated by Cropper et al. (2010): "it was impossible to include all major theories from the various disciplines that investigate IORs" (p. 15). Oliver and Ebers (1998) identify 17 theoretical perspectives within organizational science alone. Although the literature is fragmented and reflects the multitudes of disciplines that make use of IORs (Ebers, 1997), the majority of the literature can be explained through traditional theoretical paradigms like transaction cost economics, resource dependence, strategic choice, stakeholder theory, learning theory, and institutional theory (Barringer & Harrison, 2000; Parmigiani & Rivera-Santos, 2011).

Like Barringer and Harrison (2000), the perspective here is that, individually, these theories are not sufficient to explain most interorganizational relationships. Cropper et al. (2010) echo this by stating that there is "silo-ing" in IOR (p. 16) in different disciplines. Although the authors reaffirm the fragmentation of the literature and the tendency of research to stick within a silo of a theoretical lens, they also notice that this silo-ing is breaking down and theoretical boundaries are beginning to overlap: "the silos have not disappeared altogether, but the walls between them are becoming more permeable" (p. 733).

Parmigiani and Rivera-Santos (2011) provide a perspective focused on the firm and its collaboration intent (the why, not the how) from a combined theoretical approach that considers organizational economics and organization theory in their study of the various

forms IORs. “Each of the six theoretical paradigms offers a unique perspective on the formation of interorganizational relationships. Consequently, researchers can benefit from considering each of the paradigms when designing studies. However, blending the theoretical paradigms together may provide an even more useful means of understanding the formation of interorganizational relationships”(Barringer & Harrison, 2000, p.369). These IORs are like firms, both economic and social (Parmigiani & Rivera-Santos, 2011), and they need to be understood and nurtured from these different perspectives so they can thrive and grow.

In the following paragraphs, this study provides an overview of the most considered theories on IOR for a better appreciation of the complex phenomena of IOR from different theories.

This research focuses on collaborative relationships and does not address market, hierarchical, or competitive relationships. “Collaborative forms of interorganizational interaction occur when neither formal authority nor a market is used to govern inter-organizational relationships” (Phillips et al., 2000, p. 26). With this perspective and the established understanding of collaboration and collaborative relationships, this study explores some of the core concepts of interorganizational relationships in this section.

Social, human, organization, and management sciences have been exploring, investigating, and contributing to interorganizational relationships research. It is not a new field, as there are thousands of research artefacts aimed at studying IOR and related concepts. Cropper et al. (2010) highlight the dramatic increase in interorganizational research, for example, by noting the number of times IOR has appeared in a refereed journal—it has grown from 51 instances in 1957 to 9,609 instances in 2006. Ebers (1997) and Faulkner and De Rond (2000) also highlight the remarkable growth of cooperation among organizations, in particular interorganizational alliances in high-technology industries (Ebers, 1997) and the skyrocketing of collaborative strategic alliances as per Gray (Faulkner & De Rond, 2000).

Relationships between organizations vary, which has been heavily addressed in the literature. Relationships can be alliances, joint ventures, strategic partnerships, networks, consortia, academic collaborations, trades associations, industry associations, outsourcing,

buyer/supplier relationships, franchises, and others (Ebers, 1997; Franco, 2008). As per Franco (2008), collaborations emerged as a response to complex and turbulent environments. However, irrespective of the type of organization, the purpose of the relationship is to align with the intent of the collaboration and create a collaborative advantage. These relationships and collaborations can be attributed to several theories. For example, resource dependence is one potential theory given the shortage of qualified and specialized resources in some sectors. Organizational learning theory applies to organizations trying to understand, learn, assimilate, and apply new knowledge through collaborations. Finally, institutional theory argues that when collaborating is the norm in an environment, industry will be pressured to collaborate.

Cropper et al. (2010) suggest

> IOR would be rather more like an Italian garden, elegantly designed with its variety strictly regulated, than a jungle. It would exist if there is a community of scholars mutually recognizing one another as contributing to the common scientific undertaking of IORs and engaging in research activities leading to some form of institutionalized outcome, such as a shared body of knowledge (p. 733).

And that

> At present, however … there is still more dialogue within each of these research silos in IOR than across them. It remains difficult to relate contributions from different silos to one another, as each silo has its own theories, concepts, research traditions, and style. Nevertheless … some boundaries between silos may be more permeable than others (p. 734)

They argue that "IOR's … most important mother discipline, organization science, has successfully demonstrated … it can be most fruitful if research endeavours draw on, and learn from, concepts, theories, and methods first developed in other disciplines and fields of scientific enquiry" (p. 736).

As there is no unifying theory for collaboration, the following sections will provide an overview of the aforementioned theories from economic and social perspectives.

> Both economic and sociological forces can thus help explain why IORs exist. Organizations form IORs to improve efficiency through production and governance cost reductions arising from appropriate levels of investment, access to complementary resources, and aligned incentives. They also partner to more effectively accomplish tasks by connecting with powerful partners, improving their

> reputation and legitimacy, and leveraging social ties. While both approaches provide complementary insights into why IORs exist, scholars tend to match certain theories with particular forms (e.g., agency theory with franchising; institutional theory with cross-sector partnerships) (Parmigiani & Rivera-Santos, 2011, p. 9).

Although the collaborative advantage of IOR has been illustrated, Huxham and Vangen (2005) describe its frustrations, including collaborative inertia. They describe how practitioners responsible for making collaboration work frequently express that the experience can be quite difficult. They also suggest there is ample evidence indicating that numerous collaborations progress slowly or even fail without accomplishing any objectives. They give the following cautious message: "don't do it unless you have to" (Huxham & Vangen, 2005, p. 13).

2.1.1.1 The economic perspective

IORs are undertaken when it is more efficient to seek outside resources than to do the work internally or acquire resources through markets. "This is achieved though minimizing production and transaction costs, gaining economies of scale or scope, and pursuing value by acquiring assets and resources" (Parmigiani & Rivera-Santos, 2011, p. 4)). Several theories underlining this perspective are addressed in the following sections: market power theory, transaction cost theory, resource-based view theory, agency theory, game theory, and real options theory.

2.1.1.1.1 Market power theory

Early developments of market power theory include Chandler's (1962) *Strategy and Structure* and Ansoff's (1965) *Corporate Strategy,* and a significant contribution to strategic management came with the work of Michael Porter (Hoskisson et al., 1999). Dominating the strategic management literature in the 1980s, market power theory is associated with Michael Porter who suggests that the competitive intensity of industries is determined by fundamental forces on which a firm should act to stay competitive, which may be done through forming alliances rather than working alone. These forces are the degree of rivalry between competing firms, the power and influence of suppliers and buyers, and the threat from new entrants and substitute products or services. This theory underscores the collaborative advantage, where cooperating could be a quicker and more

cost-effective method for gaining market power than mergers, acquisitions, or natural growth. Cooperative strategy emphasizes the importance of choosing the right partner to ensure strategic alignment. Since strategic management focuses on the reasons behind alliance formation rather than their management, it examines factors both within and outside the firm, thereby allowing for an adaptable perspective on the advantages of a cooperative versus a competitive approach, as well as criteria for selecting partners. Moving beyond the economic viewpoint, strategic management theory accommodates the exercise of strategic decision-making by individuals determining organizational policies. (Faulkner & De Rond, 2000).

2.1.1.1.2 Transaction cost theory

In transaction cost theory (TCT), collaboration helps lower the expenses associated with production and transactions between partners. Transaction costs refer to the expenses incurred in organizing, managing, and overseeing transactions, including costs related to negotiation, contract drafting, logistics management, and monitoring accounts receivable (Faulkner & De Rond, 2000). An IOR provides another choice to market or internalize the work, which may be more efficient with minimized transaction costs (Barringer & Harrison, 2000). Transaction cost analysis within IORs may support an appropriate governance structure between partners. As a potential complement to market power theory, which focuses on market power and profits, TCT focuses on efficiency and cost reduction. These theories ignore other reasons for forming collaborative relationships, like learning, legitimacy, or questioning fairness or trust in the management of transactions (Barringer & Harrison, 2000; Faulkner & De Rond, 2000). Highlighted by Nooteboom in Cropper et al. (2010) from transaction cost economics “is that it is impossible to reliably judge the possible limits to other people’s opportunism and therefore trust does not yield a reliable safeguard” (p. 613).

2.1.1.1.3 Resource-based view theory

Introduced to strategic management in the 1980s, resource-based theory (RBV) became a dominant framework in the 1990s. Despite being credited to Edith Penrose in the late 1950s, its roots are traced to David Ricardo (1891) and Joseph Schumpeter (1934) (Daoudi,

2010; Faulkner & De Rond, 2000; Hoskisson et al., 1999). RBV posits that a firm's internal resources, which are valuable and rare, present a competitive advantage, which can be sustained if the firm can protect against imitation, transfer, or substitution (Barringer & Harrison, 2000; Wade & Hulland, 2004). Moreover, resource-based theory (RBT) posits that a firm can attain and maintain a competitive edge, generating Ricardian rents, by organizing its tangible and intangible assets in a manner that is challenging or even impossible to perfectly replicate. This can be achieved by possessing resources, skills, or capabilities that are sustainable and not subject to appropriation, perfect transferability, or replication (Faulkner & De Rond, 2000).

Wade and Hulland (2004) describe resources as the assets and capabilities that can be utilized and are valuable for identifying and addressing market opportunities or threats (in Faulkner & De Rond, 2000). They further state assets can be either tangible or intangible, and capabilities can include skills, such as technical or managerial ability or processes.

A collaboration may face difficulties and transaction costs may rise when it involves unique and non-replicable resources, just as it may be unfeasible to transfer the skills of a concert pianist to a less talented musician (Faulkner & De Rond, 2000). The authors also posit that considering RBV theory along TCT for understanding collaboration, as well as their success and failure, addresses efficiency, value creation, and value sustainability.

2.1.1.1.4 Agency theory

With its roots in economics and risk sharing during the 1960s and early 1970s, risk sharing was determined a problem resulting from cooperating parties adopting different attitudes toward risk. Later in the 1970s, agency theory "broadened this risk-sharing literature to include the so-called agency problem that occurs when cooperating parties have different goals and division of labor" (Eisenhardt, 1989, p. 58). Agency theory is concerned with relationship, in which the agent performs the work on behalf of the principal, for example, delegation of tasks to a contractor (Eisenhardt, 1989). In a corporate setting, agency theory is concerned with the ability of "principals" (generally shareholders) to ensure their "agents" (management) are fulfilling the objectives of the principals, whereas IOR partners become principals and agents of one another (Faulkner & De Rond, 2000).

Agency theory, as illustrated in Table 2.2, tries to explain two problems. First, the agency problem, which is the misalignment of goals between agent and principal and the cost of monitoring the agent. Second, the risk-sharing problem, which also arises from conflicting views and attitudes toward risk between principal and agent (Eisenhardt, 1989).

Table 2.2 Agency theory overview (Adapted from Eisenhardt, 1989)

Agency Theory Overview
Key idea Principal-agent relationships should reflect efficient organization of information and risk-bearing costs
Unit of analysis Contract between principal and agent
Human assumptions Self-interest Bounded rationality Risk aversion
Organizational assumptions Partial goal conflict among participants Efficiency as the effectiveness criterion Information asymmetry between principal and agent
Information assumption Information as a purchasable commodity
Contracting problems Agency (moral hazard and adverse selection Risk Sharing
Problem domain Relationships in which the principal and agent have partly differing goals and risk preferences (e.g., compensation, regulation, leadership, impression management, whistle-blowing, vertical integration, transfer pricing)

Agency theory caters to governance mechanisms including control and incentive mechanisms that limit the agent's self-serving behaviour, where a contract, for example, could be behaviour-oriented instead of outcome-oriented. Additionally, setting

expectations on the sharing of benefits and information increases trust and strengthens relationships (Faulkner & De Rond, 2000).

2.1.1.1.5 Game theory

Agency theory is a branch of game theory that emerged from Princeton mathematician Von Neumann in collaboration with the economist, Morgenstern (1944). Game theory is based on social games through which outcomes may be predicted. Game theory initially centered on conflict situations (zero-sum games), where collaboration was not incentivized, and self-interest was optimal. Recent research on nonzero-sum games, like the repeated prisoner's dilemma, reveals that self-interest doesn't always yield the best outcome and cooperation can emerge among self-interested individuals if future interactions are possible (Faulkner & De Rond, 2000). Therefore, in a repeated-interaction setting, partners who violate game agreements may have difficulty regaining trust, whereas cooperative behaviour may be reciprocal. Thomson and Perry (2006), highlight findings from game theory that support a process-oriented perspective of collaboration through individual investments in the structure of the game to improve joint outcomes. Game theory contributes to collaborative strategy by providing an understanding of the parties' behaviours that lead to acceptable outcomes and relationship sustainability.

2.1.1.1.6 Real options theory

Real options theory is an emerging approach that emphasizes cooperative behavior, concentrating on managing investments through decisions to either commit additional resources or delay further investments to mitigate risk and achieve success. By adopting this strategy, organizations can cooperate to develop a portfolio of relatively low-risk options, enabling them to make small and incremental wagers that promote learning and generate new opportunities for potential future growth. Within the context of a collaboration strategy, real options theory may appear to be out of sync with other theories that emphasize higher levels of partner commitment (Faulkner & De Rond, 2000). While real options theory allows organizations to remain flexible and adapt to changing circumstances, it may lead to lower partner commitment, which could be seen as a disadvantage in some collaborative settings. However, real options theory can provide

valuable insights for organizations seeking to balance risk and reward while fostering cooperation and long-term success.

2.1.1.2 The organization theory perspective

For a comprehensive view on IORs, organization theory complements the economic theories presented above. Collaborations are more than economic transactions; they are also vehicles to create and reinforce organizational and personal relationships. In organizational theory, social structures and relationships play a vital role in the formation of IORs. Typically, IORs are formed on the basis of pre-existing relationships, trust, and historical connections between partners. According to organization theory, organizations collaborate because of their embeddedness in social structure—their legitimacy, reputation, association with powerful partners, and access to social capital (Parmigiani & Rivera-Santos, 2011). Embeddedness, as per Kenis and Oerlemans in Cropper et al. (2010), whether 1) relational, based on repeated direct ties; 2) structural, based on reputation and referral; or 3) positional, based on networks may infer a potential partner's quality and encourages an organization to look within for potential collaborators. This embeddedness and structure "affect influence and knowledge flows between organizations, and can constrain those that do not have robust connections (Parmigiani & Rivera-Santos, 2011, p. 7). Cropper et al. (2010) propose the term "temporal embeddedness" defined as "the expected duration of an IO project and how this expected duration creates mechanisms that shape the coordination of collaborative activities between organizations" (p. 233). They also introduce the term "social embeddedness" defined by Granovetter (1985) as the "frequency, duration, and pattern of dyadic interactions for an individual or organization" and by Grabher (2002a):

> When exchanges evolve from on-off, single interactions to repeated and durable long-term relationships among many organizations, understandings become widely shared in a market or field and a rich project ecology emerges that facilitates coordination and guides collaborative activities among organizational actors (p. 233).

They conclude that "relations and understandings evolve over time to create macrocultures that function as resources and rules for participants" (p. 249), suggest that "temporal and

social embeddedness provide techniques for managing transactional uncertainty within a fluid and dynamic environment" (p. 250), and also suggest that

> swift trust is possible only because transaction uncertainly has been reduced through shared understandings that clarify knowledge content, roles, and roles behaviours needed for effective coordination…. Transactional uncertainly is attenuated through social embeddedness—shared understandings and relations that facilitate knowing what and how interactions are most effectively coordinated among participating members (p. 250).

They add "Granovetter further argues that neither institutional arrangements nor generalized morality as such are to be seen as the origins of trust in society, but rather the actors' very concrete social relationships" (p. 541), and they argue that "high trust societies are likely to be economically better-off because, among other things, trust is a 'lubricant' which eases the friction of economic dealings" (p. 542).

The following sections will explore how IORs are viewed from theories within organization and social theories: resource dependence, organizational learning, stakeholder theory, and institutional theory.

2.1.1.2.1 Resource dependence

This theory has mostly being attributed to Pfeffer and Salancik (1978) and Faulkner and De Rond (2000). It is different from RBV, which focuses on internal resources. Resource dependence theory (RDT) focuses on how to obtain critical external resources through alliances or markets to increase an organization's competitive advantage and power (Barringer & Harrison, 2000; Faulkner & De Rond, 2000). While this may seem to be economically focused, Barringer and Harrison (2000) place it second after TCT on a continuum from an economic to a behavioural perspective. Faulkner and De Rond (2000), in contrast, place it in the organizational and behavioural end of the continuum because the focus is on the context within which organizations operate, and on which they rely for resources, where the "how" to obtain resources is influenced by external environments providing resources. The key contrast between these different perspectives is that Barringer and Harrison's see Resource Dependence Theory (RDT) as more of a strategic tool used

for economic gains, while Faulkner and De Rond posit that RDT is more about how stakeholders behave and relate to their surroundings.

Cooperation will exist through taking advantage, for example, of complementary assets, special services, or exclusive membership insight into technology (Barringer & Harrison, 2000). IOR may promote joint value creation through the "rare, valuable in the market, imperfectly imitable, and nonsubstitutable" resources created by the relationship (Barringer & Harrison, 2000, p. 373). But, such a joint value creation may be critiqued when an organization that wants to increase its autonomy by collaborating, may reduce it through such joint relationships as presented by Faulkner and De Rond (2000). Another critique of RDT is that it does not explain why organizations resort to strategies other than alliances when there are resource deficiencies (e.g., mergers and acquisitions). Instead, RDT argues that organizations must exchange with their environment in order to secure resources. (Barringer & Harrison, 2000). Faulkner and De Rond (2000) contend that RDT has limitations when guiding process research and is mainly focused on rational choice and intentional efforts to adapt an organization to its context.

2.1.1.2.2 Organizational learning

Organizational learning theory has its roots in the 1970s but has recently been applied to the study of interorganizational alliances (Faulkner & De Rond, 2000).

The resource-based and resource dependence views, presented earlier, allude to organizational learning at different levels. Learning can be acquired through different resources interacting within organizations and across their boundaries, thus organizational learning is a valid rational for engaging in relationships (Barringer & Harrison, 2000). Organizational learning involves the ability of organizations to obtain, share, and maintain new knowledge to enhance future performance (Child and Faulkner, 1998), where this concept becomes relevant when each partner in a collaboration has a distinct set of skills and experiences (Faulkner & De Rond, 2000).

Learning can be new technical skills or technological capabilities because it is difficult to buy knowledge through markets. Trade associations and interlocking directorates are also motivated by learning—communication, knowledge, and information flow through these

channels. Furthermore, networks of learning firms are sources of expertise for innovation in industries that are complex and expanding, where such expertise may be scarce and where cost sharing may be an additional reason to form alliances (Barringer & Harrison, 2000).

Although learning may be challenged by strategic and cultural mismatch, the extent to each level (technical, systemic, or strategic) and type (collaborative or competitive) of learning that can be achieved depends on an organization's intention. Learning can also be challenged by absorptive capacity: “the ability of a firm to recognize the value of new, external information, assimilate it, and apply it to commercial ends” (Cohen & Levinthal, 1990, p. 128), as well as organizational support systems and culture (Barringer & Harrison, 2000; Faulkner & De Rond, 2000). Weaknesses of this theory, according to Barringer and Harrison (2000), are that it does not consider the costs of learning, and it does not address potential leak of privileged information between partners. Faulkner and De Rond (2000) suggest that the process of cooperation may have a greater impact on learning outcomes than the governance structure governing it.

2.1.1.2.3 Stakeholder theory

Stakeholder theory has become common in management and has been mentioned in the literature since Freeman’s, *Strategic Management: A Stakeholder Approach* (1984) (Donaldson & Preston, 1995). From a stakeholder management rationale, the organization is at the centre of a web of stakeholders where firm's stakeholders “are any group of individuals who can affect or are affected by the firm” (Barringer & Harrison, 2000, p. 376), and although this definition is widely accepted, it was contested by Donaldson and Preston (1995) as having an “excessive breadth” (p.86) when identifying stakeholders who may have an impact on the firm, but have no stake if the firm operation is successful. They state:

> “It is essential to draw a clear distinction between influencers and stakeholders: some actors in the enterprise (e.g., large investors) may be both, but some recognizable stakeholders (e.g., the job applicants) have no influence, and some influencers (e.g., the media) have no stakes. (p.86)

Donaldson and Preston (1995) advance the following theses related to stakeholder theory:

- It is **descriptive,** providing a description and a model of the corporation.
- It is **instrumental,** providing a framework that allows for establishing a link between stakeholder management and corporate performance goals (profitability, stability, growth, etc.).
- It is **normative** and involves acceptance of the following ideas: Stakeholders are individuals or groups with valid interests in the procedural or substantive aspects of corporate activities. They are identified based on their interest in the corporation, regardless of whether the corporation has any corresponding interest in them. The interests of every stakeholder possess intrinsic value, meaning that each stakeholder group deserves attention for its own sake, rather than solely for their capacity to advance the interests of another group, such as shareholders.
- It is **managerial**, describing existing situations, predicting cause–effect relationships, and recommending attitudes, structures, and practices. Furthermore stakeholder management requires that simultaneous attention be given to all legitimate stakeholders "in the important operational and strategic decisions that it makes" (Barringer & Harrison, 2000, p. 376). Donaldson, and Preston (1995) assert that, from the perspective of stakeholder theory, managers need to recognize and address the varied interests of different stakeholders within a supportive framework. This approach is essential for ensuring the moral legitimacy of managerial actions.

Whereas Barringer and Harrison (2000) view the relations between the firm and its stakeholders as contractual, they deem top managers responsible for contracts with stakeholders because top managers are responsible for resources. They further view organizations as vehicles for coordinating stakeholder interests and suggest they are naturally cooperative systems inclined to form coalitions to achieve common objectives. They recommend not using agency theory to explain managers (agents) of shareholders (principals) because when an IOR is formed, an agency problem will exist, which can be minimized through controls. However, these controls will impact the forming of IORs.

Another theory, stewardship theory, does not require control systems and restricts managers to complex interorganizational relationships: “From a stewardship perspective, interorganizational relationships are not as much of a problem because the manager would be expected to engage in them only to the extent that the interests of the principals are well served” (Barringer & Harrison, 2000, p. 377). They leave an open question on the practicality of stakeholder theory in large and complex organizations and state that stakeholder models do not offer advice on what forms alliances should be, regardless of the alliance’s positive impact on stakeholder goals (Barringer & Harrison, 2000).

2.1.1.2.4 Institutional theory

Institutional theory emphasizes the pursuit of legitimacy and adherence to the institutional environment, asserting that organizations face pressures to maintain legitimacy and conform to existing social norms (Barringer & Harrison, 2000). Institutional theorists posit that an organization is not just “a technical system … All social systems—hence, all organizations—exist in an institutional environment that defines and delimits social reality. And just as with technical environments, institutional environments are multiple, enormously diverse, and variable over time” (Scott, 1987, p. 508). In IOR, firms may promote their image, legitimacy, and conformance through partnerships, where stature may be enhanced and access to resources may be obtained (Barringer & Harrison, 2000; Parmigiani & Rivera-Santos, 2011). Furthermore Parmigiani and Rivera-Santos (2011) propose that, because of institutional environments, organizations tend to emulate more successful entities during periods of uncertainty or when seeking to attain legitimacy, where “one strategy for acceptance and survival is to simply acquiesce to the environment” (Barringer & Harrison, 2000, p. 381). Parmigiani & Rivera-Santos (2011) propose that within the context of two distinct IOR forms, co-exploration serves to secure legitimacy in settings with emerging or underdeveloped institutions, while co-exploitation aims to harness and transfer existing legitimacy in environments with established institutions. Limitations of this theory include its inability to explain alliances that differ from the norm, and the fact that resource imitability controverts acquiring a competitive advantage through IOR.

2.1.2 Interorganizational relationships complexity

The increasing recurrence of collaborative relationships and the complex web of stakeholders, technology, and communication are challenging methods of managing these realities. Additionally, absorption capacity of organizational/societal learning for application cannot keep up with the speed of change and new challenges.

To fully grasp the amplitude of the collaboration environment, the life cycle of the collaborative relationship must be considered, starting from its antecedents (e.g., past collaborations and relations) to its results and outcomes (Thomson and Perry, 2008). Collaboration is complex and themes such as learning, identity, culture, trust, leadership, power, and several others have significant moderating effects on collaborative relationships (Chris Huxham, Siv Vangen, 2005). An additional illustration of complex possibilities in collaborations is presented in Appendix A, where the complexity of variables and multitude of collaboration scenarios can be undertaken by interacting organizations.

Given this complexity Thomson and Perry (2006) propose that collaborating partners create rules and structures and share norms to govern relationships. This method of governing relationships is important for this study, which highlights the lack of a comprehensive life cycle, a process, and norms, and critiques existing processes as too high level, static, inflexible, and incomplete, thus failing to enable collaboration.

As “interorganizational relationships are difficult to manage” (Barringer & Harrison, 2000, p. 368), and as the collaboration process has been neglected in research, this study may lead to better success through increased understanding of the collaboration life cycle. The hill is hard to climb because more than half of IORs fail. Nonetheless, progress is required because collaborative advantage is expected, collaborative inertia is dismissed early on, and usually, only the advantages of IOR are reviewed, thus collaborative relationships keep increasing (de Rond & Bouchikhi, 2004), providing researchers with contribution opportunities. Some researchers and practitioners address the failure of collaborative advantage through intervention and facilitation techniques. However, these methods lack the inclusion of tools that would allow actors to effectively organize the

intricate network of factors involved in their collaboration, making the process more manageable (Cropper et al., 2010; Franco, 2008). This study explores a framework that sheds light on collaboration processes and practices that increases understanding of collaborative advantage.

IOR literature has focused on partnership formation issues, partner selection, and governance and performance issues, thus interorganizational relationships management research has been neglected (Barringer & Harrison, 2000; Faulkner & De Rond, 2000). Cropper et al. (2010) note "it is clear that relatively little attention has been paid to the day-to-day management of IOE and there is much scope for (micro- and intermediate scale) research that investigates and conceptualizes how IOE managers spend their time" (p. 406). Additionally,

> Scholars also seem to know more about the "why" and "what" questions related to collaboration than the "how" question. In other words, we are generating a good stream of research on antecedents and outcomes but need more on the internal processes of partnership activity (Gazley, 2017, p. 4).

A process-oriented approach for collaboration management (Cropper et al., 2010) is explored in this study to understand collaborations where a handful of process theories exist. Many of these theories are sequential, predictive, task-oriented, and focused on higher levels of the collaboration process. Earlier process models were linear and reflected a life-cycle approach; however, realizing the complexity of collaborations, scholars have proposed iterative process models (Cropper et al., 2010; Faulkner & De Rond, 2000).

An overview of relevant concepts in process theory useful for this study are presented in the next section.

2.1.2.1 Process theory

Process theories are powerful means for studying, assessing, and explaining organizational change. This section presents relevant process theories for constructing collaborations: 1) life-cycle theory; 2) teleology theory, whose purpose is to facilitate the assessment and re-evaluation of progress and change; 3) dialectical theory; and 4) evolutionary theory (de Rond & Bouchikhi, 2004; Van de Ven & Poole, 1995). These theories, according to de Rond and Bouchikhi (2004), "speak well to dynamic processes in organizational life" (p.

56). These theories are described in Table 2.3 shows how the processes unfold through analytical dimensions of the unit of change and the mode of change. Van de Ven and Poole (1995) present these processes of change in as: “A life-cycle model depicts the process of change in an entity as progressing through a necessary sequence of stages. An institutional, natural, or logical program prescribes the specific contents of these stages” (p. 520).

In IOR change is an inherent aspect as organizations evolve from a formative stage to maturity through a series of distinguishable and generic life-cycle phases, each contributing to the overall development. Each successive stage represents a logical progression from the previous stage, necessitating specific managerial tasks tailored to the phase. Lifecycle models typically assume that successful strategic alliances transition seamlessly from one phase to another, driven by rational planning and execution responsible stakeholders, making it compatible with a managerial mindset (de Rond & Bouchikhi, 2004).

The teleological model considers development as a cyclical process involving goal formulation, implementation, evaluation, and the refinement of objectives informed by the organization's learnings. This progression arises through the deliberate social interaction among members within the organization (de Rond & Bouchikhi, 2004).

Additionally, in IOR unexpected events, surprising results, and different opinions can happen. Managers can't plan for or control these events, but their role is important for learning and adapting. Successful collaborations happen when smart managers keep an eye on things, make changes to the structure and rules, and guide the collaboration to be more efficient or end it if it makes sense to do so (de Rond & Bouchikhi, 2004).

In dialectical development models, conflicts between opposing thesis and antithesis result in a synthesis, which later becomes the thesis for the next dialectical stage. This cycle is fueled by confrontations between contrasting parties.

An evolutionary development model features a repetitive cycle of variation, selection, and retention among entities in a specific population. The competition for scarce resources drives this evolutionary process (de Rond & Bouchikhi, 2004).

The change processes of Lifecycle, Evolution, Dialectic, and Teleology as describeb by Van de Ven and Poole (1995) are applicable to single or multiple entities. Interorganizational entities formations oscillate between multiple entities and a temporary single entity throughout the process, thus the interest in different process models applicability to collaboration. These change processes also allow for modes of change from prescribed to constructed and emergent mode.

A prescribed mode of change directs the evolution of entities along a pre-determined path, generally characterized by maintaining and gradually adapting their structures in a stable and predictable manner (Van de Ven & Poole, 1995). The prescribed mode of change leads to first-order change, characterized by alterations within an existing framework. These changes tend to be cumulative and predictable, with low uncertainty associated with this type of change. On the other hand, a constructive mode of change produces unique and innovative forms that often appear as discontinuous and unpredictable deviations from the past (Van de Ven & Poole, 1995). The constructive mode creates second-order change, which moves away from existing assumptions and frameworks. These changes are not predictable and the uncertainty within this motor of change is high (Van de Ven & Poole, 1995).

Thus, the motors of change are relevant to this study because they reflect a framework that allows for the description of collaboration dynamics and related processes, which may range from prescription to construction and from multiple entities to a temporary single entity.

Table 2.3 Ideal-type process theories (Adapted from Van de Ven & Poole, 1995)

Family	Life Cycle	Evolution	Dialectic	Teleology
Pioneers	Comte (1798-1857) Spencer (1820 - 1903) Piaget (1896 - 1980)	Lamarck (1744-1829) Darwin (1809-1882) Mendel (1822 - 1884) Gould & Eldridge (1977)	Hegel (1770 - 1831) Marx (1818- 1883) Freud (1856-1939)	Mead (1863-1931) Weber (1864-1920) Simon (1916-)
Event Progression	Linear & irreversible sequence of prescribed stages in unfolding of immanent potentials present at the beginning	Recurrent, cumulative, & probabilistic sequence of variation, selection. & retention events	Recurrent, discontinuous sequence of confrontation, conflict. and synthesis between contradictory values or events	Recurrent, discontinuous sequence of goal setting, implementation, and adaptation of means to reach desired end state
Generating Force	Prefigured program/rule regulated by nature, logic, or institutions	Population scarcity Competition Commensalism	Conflict & confrontation between opposing forces. interests, or classes	Goal enactment consensus on means cooperation/symbiosis

Several examples of collaboration process models are illustrated in the following paragraphs, which have been selected from the literature based on their generic nature, non-prescriptive nature, and usefulness. “A process framework for collaboration suggests that collaboration occurs over time as organizations interact formally and informally through repetitive sequences of negotiation, development of commitments, and execution of those commitments” (Thomson & Perry, 2006, p. 21). Additionally,

> Scholars have described the collaboration process in terms of a continuum of stages. For example, Gray’s (1989) three-phase framework involves problem setting, direction setting, and implementation, and Himmelman’s (1996) view of the collaboration process sees it as a continuum of strategies that range from bettering the community to transforming it through “empowerment collaboration”. Ring and Van de Ven (1994) … conceive of the process as iterative and cyclical rather than linear (Thomson & Perry, 2006, p. 22).

2.1.2.1.1 Phases of collaboration

R&D collaborations are challenging, including achieving common ground, understanding between partners, and firm commitments due to the uncertainty with R&D and its impact on contracts (formal or informal). Doz (in Faulkner & De Rond, 2000) adds that R&D cooperatives can be structured through decisive steps or evolve based on pre-existing concepts or through a self-structuring mode during phases of collaboration.

Doz (in Faulkner & De Rond, 2000) presents a model for collaboration where phases evolve from common ground and understanding to formal contracts. This process and its evolution correspond to the following steps in the design and development of the collaboration process with overlapping transition steps, 3, 5, and 7 as follows:

1. identifying interdependencies
2. developing shared norms of problem solving
3. **triggering cooperation: the need for a focal entity**
4. selecting participants
5. **making the shadow of the future visible**

6. securing the participants sustained ability to contribute
7. **designing cooperation**
8. learning and adjusting over time
9. expanding of the scope and deepening of commitments

Step 7, designing cooperation, is of specific interest for this study. Doz suggests that the very design of collaboration can either enable or hinder it, and emphasizes the significance of project structure and micro-processes in promoting successful collaboration, as they can help avoid or trigger conflict.

2.1.2.1.2 Collaboration process development framework

(Ring & Van de Ven, 1994) propose a cyclical collaboration process development framework model associated with cooperative IORs with commitments, executions, and negotiations arranged in a cyclical manner around a centered assessments component . This model is relevant for collaborative research projects where for example it "entails transaction-specific investments in deals that cannot be fully specified or controlled by the parties in advance of their execution" (p. 90). It provides a process to managers on how relationships unfold over time, beyond inputs, structure, and desired outputs.

Project work starting in the execution phase and "initially, formally designated role behavior by the parties reduces uncertainty when they execute commitments, and it makes interactions among parties predictable" (p.98), however, as trust is established, there is increased reliance on interpersonal relationships (Ring & Van de Ven, 1994). Nonetheless, the execution phase itself and its internal processes remains also a black box for collaborators.

Thomson and Perry (2006) also suggest "collaboration implies a cyclical process of renegotiation", and

> a process-oriented definition of collaboration, then, must take into account the nonlinear and emergent nature of collaboration, suggesting that collaboration evolves as parties interact over time. Findings from game theory support a process-oriented perspective on collaboration (Axelrod 1984, 1997; Ostrom 1990, 1998).

> Experimental and field research confirms that “individuals temporarily caught in a social-dilemma structure are likely to invest resources to innovate and change the structure itself in order to improve joint outcomes ... [Learning occurs through a] continuous trial-and-error process until a rule system is evolved that participants consider yields substantial net benefits (Ostrom 1998, 8) (p. 22).

2.1.2.1.3 Antecedent-process-outcome framework

In Thomson and Perry (2006), Gray (1985) presents a collaboration process model with three phases: problem setting, direction setting, and structuring. During the structuring phase, partners must “create long-term structures to support and sustain their collective appreciation and problem-solving activities” (p.917) for stakeholders. She also states “Collaboration will be enhanced when joint appreciation of the problem dynamics is shared by stakeholders, and they undertake negotiations to create a mutually acceptable regulative framework for the domain” (p.917). Interestingly, Gray considers structuring as emergent as opposed to being fixed at a point in time in the structuring phase.

There is a general tendency in the literature to focus on the overall collaboration process and ignore interactive and emergent design of the structuring and execution phases. Additionally, Alin et al. (2013) note that “although researchers have acknowledged the importance of interfirm processes in project networks when innovations are created … and implemented … few studies have examined … inter-firm process development following systemic innovation implementation” (p.79). Newell et al. (2008) state that “existing research on project management and organization has tended to focus on the individual project as the locus of innovation and is, therefore, limited in terms of its treatment of project ecologies” (p. 34). The authors emphasize that complex project ecologies that characterize collaborative research projects spanning time, space, organizations, and technology are interdependent and require significant interactivity, although some collaboration dynamics favour low interactivity for knowledge protection and short/medium term power dynamics.

Thomson and Perry (2006) state that “collaborations are not self-administering enterprises”. They explain that collaboration implementation is complex, and that given that organizations are autonomous, their usual organizational settings cannot be expected

to be applied to partners. The management and administrative practices of organizations evolve and applying the same practices across organizations is challenging.

> Most scholars of collaboration agree, however, that the key to getting things done in a collaborative setting rests in finding the right combination of administrative capacity (through coordination and elements of hierarchy) and social capacity to build relationships. In their review of collaboration research, Wood and Gray (1991) frame the discussion in terms of an antecedent-process-outcome model [Table 2.4]. The "doing" of collaboration—the process component—is in Wood and Gray's terminology, a black box (Thomson & Perry, 2006, p. 25).

Robust and comprehensive collaboration process management is also needed; Baker et al. (1999) state that “collaboration process management is still a challenging problem because most existing collaboration systems cannot fully satisfy the requirements of managing the dynamic and complicated processes that may occur among team members” (in Fan, 2012, p. 14). Yves Jongen, head of Mecatech, Belgium innovation cluster, states: “It is easy to find hundreds of project management books. But the collaborative project management manual is still to be written” (in Calamel et al., 2012, p. 48). Calamel et al. (2012) define collaborative projects as those that “bring together workers from different organisations and employers” (p. 48). They go on to say that although project management practices may seem suitable to manage interorganizational relationships, collaborative project stakeholders face several issues that traditional managerial practices cannot address (Calamel et al., 2012).

Table 2.4 The Antecedent-Process-Outcome Framework (Adapted from Thomson & Perry, 2006)

Antecedents	Process	Outcomes
- High levels of interdependence (Logsdon 1991)	GOVERNANCE	- Achievement of goals (Bardach 1998; Gray 2000)
- Need for resources and risk sharing (Alter and Hage 1993)	ADMINISTRATION	- Instrumental transactions among organizations become socially embedded relationships (Ring & Van de Ven 1994)
- Resource scarcity (Levine and White 1961)	ORGANIZATIONAL AUTONOMY	- The creation of "new value partnerships" produces capacity to leverage resources (Sagawa and Segal 2000)
- Previous history of efforts to collaborate (Radin et al. 1996)	MUTUALITY	- Self-governing collective action to solve problems of institutional supply, commitment, and monitoring (Ostrom 1990)
- Situation in which each partner has resources that other partners need (Chen and Graddy 2005; Gray 1989; Gray and Wood 1991; Pfeffer and Salancik 1978; Thomson 2001a)	NORMS OF TRUST & RECIPROCITY	
- Complex issues (O'Toole 1997)		

> The process of collaboration involves movement along the five dimensions as partners renegotiate a new equilibrium that reinforces the learning achieved at a previous equilibrium. “Because individuals are boundedly rational,” writes Ostrom, “they do not calculate a complete set of strategies for every situation they face” (1998, 9). Each situation demands a different equilibrium among the five key dimensions to achieve an optimal mix for the partners in that context. Time, respect for the fragility of the process, and close attention to the five dimensions cannot ensure positive collaboration outcomes, but these actions will increase the likelihood that this will occur (Thomson & Perry, 2006, p. 30).

The examples presented here are high-level processes proposed by key contributors to the collaboration literature. They allow reflection on collaboration process models, which can be used for a conceptual framework that considers the process elements the collaboration phenomena.

2.2 Design principles of wicked collaboration problems

The complexity of IOCs highlights the need for understanding its dynamic nature including that of behaviors of individuals, of organizational cultures, its dimensions, and the impact of various factors such as trust, communication.

Some of the aspects of the complex dynamics in interorganizational collaborations are highlighted by the work of Jarvenpaa and Majchrzak (2016) and their proposal of an interactive self-regulatory theory which addresses how individuals balance sharing and protecting knowledge in interorganizational collaborations. The theory proposes the need for individuals in such collaborations to continuously sense, seize, and reconfigure strategies to maintain a balance between sharing and protecting knowledge. This involves managing cognitive and emotional states while protecting organizational interests. An important aspect when managing the sharing-protecting tension is the ability to handle emotional intensity regarding the information being shared, which can range from cooperative to competitive interaction styles. Furthermore, Majchrzak, Jarvenpaa, and Baherzadeh (2015) review the dynamics of IOC, identifying six characteristics that change during collaboration: goals, contract frame, interaction style, decision-making control, organizational structure, and composition of actors. They also propose three different categories of sources contributing to these changes of IOC characteristics, namely, between-partner differences, external sources, and within-IOC sources. The authors posit

that more successful collaborations experienced more change in these characteristics and had dynamic patterns of change with more complex feedback loops impacting on other IOC characteristics throughout the collaboration.

Karam, Brault, Van Durme, and Macq (2018) compared interprofessional and interorganizational collaboration in healthcare, identifying key components like communication, trust, respect, mutual acquaintanceship, power, patient-centredness, task characteristics, and environment. Where "In interprofessional collaboration, communication plays a key role and is described as being the core of the processes through which collaboration takes place between healthcare professionals within an organization, at both individual and organizational levels."(p. 73). Additionally, the authors highlight "Trust, respect, mutual acquaintanceship, and power are also key determinants in both situations and are in obvious interaction with one another. Trust is built up over time, and is affected by the nature and quality of previous experiences of collaboration" (p.75). They highlighted the challenges of formalization, professional role clarification, and corporate culture differences in interorganizational collaboration. The authors conclude that promoting interorganizational collaboration poses a bigger challenge than interprofessional collaboration due to differences in corporate cultures and the difficulty in achieving a sense of belonging. Additionally, Tsanos, Zografos and Harrison (2014) propose a model which hypothesises positive behavioral antecedents such as trust, commitment, mutuality and reciprocity with supply chain integration and performance.

Knoben and Oerlemans (2006) discuss the dimensions of proximity in interorganizational collaborations and propose three relevant dimensions namely, geographical, organizational, and technological, while highlighting the importance of considering all three dimensions when forming alliances.

Given the complexity and the human centricity of collaborations they present an interesting challenge for purposeful design when addressed as wicked problems. There are many solutions to collaboration problems through purposeful design—solutions that enable collaborators to abandon old ways and choose new ways to design:

> The function of what I call design science is to solve problems by introducing … new artifacts, … which will induce their spontaneous employment by humans and thus, coincidentally, cause humans to abandon their previous problem-producing

> behaviours and devices. For example, when humans have a vital need to cross the roaring rapids of a river, as a design scientist I would design them a bridge, causing them, I am sure, to abandon spontaneously and forever the risking of their lives by trying to swim to the other shore (Fuller, 1992 in Osterwalder, 2004, p. 4).

The following paragraphs introduce early concepts of design science to later concepts, including design thinking, to demonstrate the legacy of these evolving concepts and their applicability to the wicked problems of collaboration.

Design thinking is the culmination of several generations of design science concepts and spans beyond innovation to a holistic approach in the context of collaboration. Noukka describes design thinking as a holistic approach. It is the core engine of the iterative collaboration design process:

> the concept of design thinking (cf. Brown 2008; 2009) emerged during the decade. Design thinking refers to a methodology that approaches innovation activities with a user-centered design mindset (Brown 2008, 86). Design thinking emphasizes design's involvement in the strategic level in the organization (Brown 2009, 7, 37), as well as the holistic approach to design i.e., design not as styling but as part of the process from the very beginning (Brown 2009, 7) (Noukka, 2011, p. 9).

Design science has evolved over several generations from Simon's military systems approach to Rittel and Weber's wicked problems, and Hatchuel's expandable rationality to Miller's rhetorical perspective, and Bousbaci's human as a whole, and finally to Dilnot and Fry's sustainability approach where core to this evolution is the development of a holistic approach that incorporates human, social, political, and environment considerations as part of the design process Huppatz (2015).

Huppatz (2015) provides an overview on this evolution, where he describes Simon's approach as an ambitious move from "science of design" to "design as science", based on optimization that "promised knowledge that could be clearly and efficiently communicated, data that was free from the subjectivity of intuition, experience, and judgment" (p. 35). Around the same time, "Rittel and Melvin Weber proposed an alternative model of the design process based on "wicked" problems" where "Contrary to the logic of Simon's military systems approach, no consistent, universal process can be followed, and problems are ultimately resolved rather than solved." (p. 37), additionally, "Rittel later called for "the understanding of designing as an argumentative process"—one in which judgment is crucial" (p. 37), where the designer is a problem solver who

“acknowledges the social and political agency of various stakeholders involved in the process.” (p. 37). Although Huppatz referred to Simon’s approach as dehumanizing, he gave Simon credit for being open to the social dimension and creativity. Huppatz also highlights communication between stakeholders as key to design processes, in contrast to Simon where clients and users are not present in Simon’s ‘science of design’”

Hatchuel expanded upon Simon's concept of "bounded rationality" by introducing "expandable rationality," which incorporates increased social interaction and posits that human agents are limited decision-makers but effective natural designers, including social interaction as a design area (Hatchuel, in Huppatz, 2015, p. 40). Moreover, Miller views design as a form of interaction involving negotiation between individuals engaged in the process (Miller, in Huppatz, 2015, p. 40). Bousbaci extends this notion by highlighting the various dimensions of human action that influence rationality, including poetics, rhetoric, hermeneutics, and ethics (Bousbaci, in Huppatz, 2015, p. 40). Also, design theorists like Clive Dilnot and Tony Fry have further broadened the ethical foundation of design to encompass not only the relationships among designers, clients, and stakeholders, but also the concept of sustainability as it is "embodied in practices and things" (Dilnot & Fry, in Huppatz, 2015, p. 40).

Bousbaci (2008) described Design thinking as the study of cognitive processes evident in design actions, a discipline which has evolved through multiple generations evolving from the early concepts of the rationalist and logical design, to the bounded rationality, and to a third generation of reflective practitioner know today as the “reflective turn” (p. 39). The first generation, according to Bousbaci, was characterized by its “strong reaction against the intuitive, artistic, and ‘beaux-arts’ vision of the design process” (p. 38) based on Simon’s bounded rationality,

> so when the time came to understand and acquire insights into the field of individuals’ behavior within an administrative environment, Simon was simply not satisfied with these two extreme positions…There was a sort of a “fallow land” between them that comprised a great number of human behaviours of which these theories gave no accounts. Therefore, Simon proposed the concepts of “bounded rationality” and “satisficing” with which he endorsed an “intermediate” position” (p. 43).

In the second generation, proposed by Rittel, methods leaned toward a “more participatory and argumentative design and planning processes” (Bousbaci, 2008, p. 38), which further influenced work by Lawson who states that “architects’ strategies of the design process are solution-focused ones; in opposition to scientists’ approaches, which are problem-focused” (p. 48).

The third generation focused on the “understanding of designers’ cognitive behaviors as they simply occurred in the traditional ways of their practice” (Bousbaci, 2008, p. 38). Cross, in his 1981 paper, proposed to go beyond the generational evolution and move toward a “post-industrial” design paradigm. The emergence of this “reflective turn” which was also proposed by Schön (1983) was a more comprehensive vision where the designer is a “reflective practitioner”. Since the emergence of this design paradigm, “research in design thinking tried to embrace a wide range of issues (poetical, rhetorical, phenomenological, hermeneutical, and ethical) in order to obtain greater insights and an improved understanding of the design phenomenon” (Bousbaci, 2008, p. 39).

Through the critiques across these generations, Bousbaci (2008) see an opportunity where bounded rationality is not simply a matter of scientific or technical rationality but a holistic approach to understand the factors that bound rationality in human actions:

> Rationality, whether scientific or technical, has to play a role, but it must be moderate. Thus, from a phenomenological perspective, I prefer to focus not on the concept of “bounded rationality” itself, but on what really “bounds” rationality within human action. The great danger then is to restrict the bounding factors to simply a matter of knowledge. Rationality is one part of all human faculties and condition. Therefore, what really bounds rationality in human action is nothing more than all the other parts which comprise the human existence as a whole: poetics, rhetoric, hermeneutics, and ethics; because, when humans act, they act as whole humans (p. 50).

The overview above and the following sections illustrate the evolution and complexity of design science and related concepts, and the use of the term design thinking implies a legacy of research paradigms that should be considered when referring to design as a baseline for understanding and addressing the complexities of collaboration processes and practices. Through the evolution, the holistic approach, starting with Simon’s optimization view to the latest views on design that incorporate aspects of human existence are key to

creating awareness and may benefit collaboration dynamics. These views explain designed human actions and cognitive processes that manifest into collaboration actions.

2.2.1 Human-centred design for problem solving

Design is not only concerned with aesthetics, but also with users and their environments, where, compared to problem solving in science, design problems are closer to everyday life. Science problems are describable when solved, whereas design problems require a coordinated effort relying on others' knowledge for viable solutions— transforming other experts' knowledge into desired outcomes. These learning strategies are called "design thinking" because design looks at both the problem and the solution; it is an approach to professional learning and solution finding. Design is a multi-perspective concept with three basic characteristics: 1) exploring the problem space, observing and synthesizing; 2) exploring the solution space, ideating and prototyping; and 3) iterating to align both spaces, (Lindberg, Meinel, & Wagner, 2011). The result is a solution that is innovative and suitable for the social system that the design problem addresses. Design thinking is not about how a designer thinks but about how anyone thinks when designing; it is not profession bound— and this is the sense used in this study.

Design thinking continues to gain the attention of the public, professionals, and researchers.

> The main idea is that the ways professional designers problem-solve is of value to firms trying to innovate and to societies trying to make change happen. … Three main accounts are identified: design thinking as a cognitive style, as a general theory of design, and as a resource for organizations" Kimbell (2011, p. 285).

Most of the public interest in design thinking is tied to the consultancy firm, IDEO. However, the history of design thinking is complex and dates to the 1950s and focused on how designers design. Although Alexandre, architect and design theorist, argued that designers give form to things and are mainly concerned with materiality, and Simon suggested that the work of designers is to create a desired state or what ought to be, neither were concerned with design thinking. It wasn't until 1987, with Rowe's *Design Thinking* that the term was introduced, in which he argued that the nature of the problem-solving process shapes the solution, and that design professionals rely "on hunches and presuppositions, not just facts" (p. 291).

Kimbell highlights three views related to design thinking (2011):

> Firstly, that accounts of design thinking often rest on a dualism that makes a distinction between "thinking" and "doing" and between designers and the worlds they do design in, rather than acknowledging the situated, embodied work of design thinking in practice. Secondly, attending to the diversity of designers' practices and the institutions in which they work makes it questionable to generalize about a unified design thinking exhibited across all of them. Thirdly, descriptions of design thinking rest on sometimes contradictory views about the nature of design and, for all the claims about being "user-centered", still emphasize the designer as the main agent within design (p. 289).

In the workplace, design thinking is attractive to management because it can be seen as the de-politicizing of managerial practice as proposed by Kimbell (2011). Two of the main proponents of design thinking and its role in the workplace are Tim Brown and Roger Martin (former Dean of Rotman School of Management, Toronto). Their work is part of a growing interest in design in management academia; they present design thinking as "a way to balance organizational tensions between exploration and exploitation (Martin, 2009) or as a loosely-structured organizational process that stimulates innovation (Brown, 2009)" Kimbell (2011, p. 295).

According to Brown, design thinking offers a solution to challenges facing both organizations seeking to innovate and societies grappling with complex public issues. Design thinkers recognize that there is no definitive answer to a problem. Rather, by following the non-linear, iterative design process of inspiration, ideation, and implementation, problems can be transformed into opportunities Kimbell (2011). Central to Brown's approach is the idea of empathy and design thinking as a human-centered activity. Designers are expected to understand and interpret the perspectives of end users and the issues they face, feeling their way towards a new solution. Brown argues that successful design outcomes emerge from the intersection of three concerns: what is desirable from the users' perspective, what is technically feasible, and what is commercially viable for the organization Kimbell (2011).

Kimbell (2011) proposes, however, that although designers use social sciences techniques, such as ethnography, to understand the stakeholders' perspective, social sciences processes and traditions are ignored: "design thinking fails to reference wider theories of the social

and misses opportunities to illuminate the context into which the designer is intervening" (p. 295).

Martin's views are of particular interest in that design thinking provides a competitive advantage and enables managers to better understand how firms function:

> Design thinking as practiced by good designers, Martin says, has something important to offer managers, enabling them to shift from choosing between alternatives to helping them generate entirely new concepts. Martin sees design thinking as combining abductive, as well as inductive and deductive, reasoning. This is particularly of value to businesses tackling the well-established challenge of focusing on either exploitation or exploration (cf. March 1991). … Finding a better balance between exploration and exploitation, and between abductive as well as inductive and deductive reasoning, is what Martin calls design thinking (Kimball, p. 295).

"Given the diversity of these approaches, there is still no clear description of design thinking" (Kimball, p. 296). Kimbell (2011) argues that "We must acknowledge that design practice is shaped by designers' own theoretical and political commitments (Fry 2009); we must make such knowledge part of practice and research analysis" (p. 300). With such statements, there are opportunities to study design thinking from several perspectives and propose new concepts.

2.2.2 Design thinking for complex problems

As collaboration problems require a multi-perspective view, it is important to go beyond prescribed processes, and explore how design thinking can help with such problems and help address common issues associated with a traditional, technical-focused perspective in the development process. The best technically sophisticated process or product requires a user perspective, and using design thinking can achieve this by integrating its principles and adapting organizational structure to achieve success. (Lindberg et al., 2011).

Design thinking is not a linear process, it includes human, business, and technological factors in problem forming, -solving, and -design.

> Its human-centric methodology integrates expertise from design, social sciences, engineering, and business. It blends an end-user focus with multidisciplinary collaboration and iterative improvement to produce innovative products, systems, and services. Design thinking creates a vibrant interactive environment that promotes learning through rapid conceptual prototyping. Design Thinking is about

> the creation of, as well as adaptive use of a body-of-behaviours and values. This goal stands in sharp contrast to, while complimentary to, the predominant disciplinary model based on the creation and validation of a body-of-knowledge (Lindberg et al., 2011, p. xiv).

2.2.2.1 Design thinking and design science for complex collaboration problems

Outlined in the previous sections, Faulkner and De Rond (2000) propose a design phase in the collaboration process where collaboration is a purposeful activity. Indeed, the whole collaboration process is a design process, where all stakeholders are designers of the collaboration and where the phases of collaboration are iterative and emergent as seen in the examples section on collaboration processes. “The engineer, and more generally the designer, is concerned with how things ought to be—how they ought to be in order to attain goals, and to function” and “everyone designs who devises courses of action aimed at changing existing situations into preferred ones.” (Simon, 1996, p. 111)

The complex role and broad contributions of designers in solving complex problems have been widely documented, where the designer is “an emerging synthesis of artist, inventor, mechanic, objective economist, and evolutionary strategist.” R. Buckminster Fuller... and information scientist…Design and information science are problem-solving disciplines.” (Lunin, Martin, & Hastings, 2009, p. 1874)

The interest in design thinking stems from its four rules, detailed in the following paragraphs, and where a collaboration project is considered a design challenge that can benefit from design thinking. Lindberg et al. (2011, p. xv) propose the following rules of design thinking:

- The human rule: All design activity is ultimately social in nature

> There are studies that substantiate the assertion that successful innovation through design thinking activities will always bring us back to the “human-centric point of view”. This is the imperative to solve technical problems in ways that satisfy human needs and acknowledge the human element in all technologists and managers (Lindberg et al., 2011, p. xv).

This also applies to managing all projects and in particular IOC projects, where the social aspect is a key determinant in weaving collaborative interorganizational relationships.

- The ambiguity rule: Design thinkers must preserve ambiguity

> There is no chance for "chance discovery" if the box is closed tightly, the constraints enumerated excessively, and the fear of failure is always at hand. Innovation demands experimentation at the limits of our knowledge, at the limits of our ability to control events, and with freedom to see things differently (Lindberg et al., 2011, p. xv).

As IOC project processes are not well defined, ambiguity must be preserved to allow for adaptation and change.

- The re-design rule: All design is re-design

> The human needs that we seek to satisfy have been with us for millennia. Through time and evolution there have been many successful solutions to these problems. Because technology and social circumstances change constantly, it is imperative to understand how these needs have been addressed in the past. Then we can apply "foresight tools and methods" to better estimate social and technical conditions we will encounter 5, 10, or even 20 years in the future (Lindberg et al., 2011, p. xv).

Collaboration between entities must allow re-design given the risks and uncertainties associated with IOC projects.

- The tangibility rule: Making ideas tangible always facilitates communication

> Curiously, this is one of our most recent findings. While conceptual prototyping has been a central activity in design thinking … it is only in the past few years that we have come to realize that "prototypes are communication media". Seen as media, we now have insights regarding their bandwidth, granularity, time constants, and context dependencies. The "make it tangible" rule is one of the first major findings of the design thinking research program documented in this book (Lindberg et al., 2011, p. xv).

Creating artefacts and exchanging artefacts in collaborative relationships is a method of codifying and communicating knowledge and providing and receiving feedback on project definitions, status, and progress *(Brown, 2008, 2009)*.

(Ulrich, 2011) proposes the codification of the core principles of design through the following:

1. An effective design process includes these steps: a) sense gap, b) define problem, c) explore alternatives, and d) select plan.
2. Problem definition benefits from asking the "five whys" in order to frame the challenge at the right level of abstraction.

3. Understanding user needs is a key element of problem definition, and that understanding is usually best developed with interactive and immersive methods.
4. Exploration is a form of search whose primary goal is to expose as many diverse ways to address the design problem as possible. Each domain will have idiosyncratic heuristics and methods for exploration.
5. The design process is rarely a pure flow from first to last step, but more typically involves iteration. As a result, early and frequent prototyping and testing usually results in better outcomes (p. 6).

Ulrich states that although these principles seem simple and natural, their application is "remarkably rare in society". He goes on to highlight that design processes are part of certain professions such as engineering, graphic design, and so on, but "most lawyers, business administrators, and politicians do not think of themselves as doing design, even though they frequently engage in problem-solving activities, beginning with a sensed gap and resulting in an artifact" (Ulrich, 2011, p. 130).

Brown (2009) also promotes that everyone can benefit from design thinking, which requires shifting between divergent and convergent thinking, and analysis and synthesis. Design thinking is a human-centric approach to accelerate innovation—a process that must consider a holistic approach including design for the user's emotional experience.

(Ben Mahmoud-Jouini, Midler, & Silberzahn, 2016) highlight that design thinking extends beyond mere artifact creation where it significantly influences and shapes an organization's strategy, thus making it a relevant subject for all managers to consider.

Additionally, Ulrich (2011) confirms that design thinking can

> apply to the design of organizations, social systems, business models, and services as well as they do to the design of physical goods. … An even further extension of design thinking to the creation of social systems and government policies seems quite promising (p. 20).

IDEO's CEO, Tim Brown, a renowned design thinking evangelist, highlights the importance of creativity for organizations to thrive and compete. Creativity is unlocked by setting the right conditions:

> In order to survive in today's complex world, organizations need to generate, embrace, and execute on new ideas. That takes creativity and a creatively capable workforce. It's the secret sauce, or in evolutionary terms, it's what keeps you fit. Organizations without it can't compete (Brown, 2016, para. 2).

Design thinking includes a vast array of tools and frameworks, often borrowed from other fields, which demonstrate its main focus on the human experience." Gobble (2014)

Gobble (2014) cites Martin where he proposes that design thinking is an approach

> that balances the quantitative focus of analytical thinking, with its impulse to standardization and preference for consistency, with the creativity and freedom of intuitive thinking. Martin describes the modern process of business innovation as a three-part "knowledge funnel", comprising an evolution from mystery, through heuristic, to algorithm. Intuitive thinking too easily becomes trapped in mystery, unable to reduce its insights to the repeatable "rule of thumb" that comprises a heuristic; analytical thinking has no space for mystery, engaging only in the movement form heuristic to algorithm. Only design thinking can bridge all three steps, moving from exploratory openness to a systematic process. Tim Brown's definition of design thinking in his 2008 article in Harvard Business Review—the most concise presentation of the concept I found—reflects this blending of the analytic and the creative: "Put simply, [design thinking] is a discipline that uses the designer's sensibility and methods to match people's needs with what is technologically feasible and what a viable business strategy can convert into customer value and market opportunity (p. 59).

2.2.2.2 Collaboration as a wicked design problem

The wicked problem approach was introduced by Rittel who was searching for an alternative to the linear, step-by-step model of the design process that was considered by designers and design theorists (in Buchanan, 1992). Churchman argued that wicked problems are applicable to operations research and management science (1967). Rittel and Webber (1973) extended wicked problems to other domains involving stakeholders with differing perspectives, and similar to this study, to complex collaboration problems. The three dimensions of wicked problems introduced by Weber and Khademian (2008) are:

- First, wicked problems are unstructured. This means that causes and effects are extremely difficult to identify and model, thus adding complexity and uncertainty and engendering a high degree of conflict because there is little consensus on the problem or the solution (Roberts, 2000)
- Second, the wicked problem space comprises multiple, overlapping, interconnected subsets of problems that cut across multiple policy domains and levels of government. Wicked problems, in other words, cut across hierarchy and authority structures within and between organizations and across policy domains, political and administrative jurisdictions, and political "group" interests

- Finally, wicked problems are relentless. The problems are not going to be solved once and for all (p. 336).

Following are the ten properties of wicked problems that Rittel identified in 1972:

1. Wicked problems have no definitive formulation, but every formulation of a wicked problem corresponds to the formulation of a solution.
2. Wicked problems have no stopping rules.
3. Solutions to wicked problems cannot be true or false, only good or bad.
4. In solving wicked problems there is no exhaustive list of admissible operations.
5. For every wicked problem there is always more than one possible explanation, with explanations depending on the **Weltanschauung** (… the intellectual perspective of the designer as an integral part of the design process) of the designer.
6. Every wicked problem is a symptom of another, "higher level", problem.
7. No formulation and solution of a wicked problem has a definitive test.
8. Solving a wicked problem is a "one-shot" operation, with no room for trial and error.
9. Every wicked problem is unique.
10. The wicked problem solver has no right to be wrong—they are fully responsible for their actions (in Buchanan, 1992, p. 16).

Rittel (1972) also argues that first generation planning approaches fail to address wicked problems. These are systems “characterized by a certain mode of procedure, by a certain sequence of steps or phases” (Rittel, 1972, p. 391). He proposes a second-generation system that includes those affected by the problem; He advocates for a second-generation system that involves those impacted by the problem, suggesting a cooperative approach that aims to engage those affected into active participants in the planning process, rather than simply consulting them.

2.2.3 Designers and their behaviours

Hinds and Lyon discuss how national, demographic, and other context elements compose cultural identities of designers, and how these context elements impact design thinking which is with its practices are embedded in the larger context. They report “initial insights about the role of the institutional context, especially client expectations, different attitudes

toward what it means to be creative, different interaction norms within professions, different ways of using prototypes, and different ecologies around design education", and the "context in which people are embedded as instrumental in understanding behavior" (Hinds & Lyon, 2011, p. 102).

Other researchers, such as Hanisch and Wald (2011), although not explicitly citing design thinking or collaboration projects, propose a holistic project management research framework that includes design, context, and goals as key dimensions. Design subdimensions include strategy and structure, project management and project organization, and culture and social processes.

2.2.4 Design thinking for management and sensemaking

According to various sources exploring design thinking in management, management is being depicted as more of an art of generating design visions, rather than a science of rational decisions in a stable world. This approach involves cultivating appreciative intelligence, rapid prototypes, feedback loops, and iterative pathways in an uncertain and dynamic world. And where Herb Simon's three pillars of management, which include the following three pillars, "Intelligence," "Choice," and "Design," have been overshadowed by a decision-analytic stance, despite the significance of the design pillar (Brown in Cooperrider, 2010). Design is important to democratize corporate citizenship and management to inspire transformative change; "design is now too important to be left to designers" (Brown in Cooperrider, 2010, p. 32).

Boland and Collopy (2004) highlight

> for Simon, design is the science of decision making, and it matters little whether the product … is an organization or a consumer product. Better understanding of cognitive processes, he believes, will improve decision making in all areas of professional work. … However, the potential of design thinking for organizational life has not been fully developed (p. 60).

Winch (2008) goes on to state that

> while it is undoubtedly the case that the job of senior management is designing rather than making, the purpose of designing is to enable making (if one can stretch that term to include services for the moment), so effective designing cannot take place without understanding its relationship to making (p. 204).

And that

> if managers adopted a design attitude, the world of business would be different and better. Managers would approach problems with a sensibility that swept in the broadest array of influences to shape inspiring and energizing designs for products, services and processes that are both profitable and humanly satisfying (p. 204).

Whether the conception of design as 'throwness' which considers design as

> an intense, immediate experience of full engagement in the present which is essentially reactive, or the conception of design presented by the design theorists such as Buchanan, Tzonis, and Liedtka as a process of detachment from the immediate to look forward proactively to an alternative future state (Winch, 2008, p. 205),

it is the proactive aspect of design that makes us human as per Karl Marx.

Winch hopes that "such a perspective could provide an alternative model for strategy and management that places more of an emphasis on processes of sense-making and less on a priori plans and decisions (Winch, 2008, p. 205).

2.2.4.1 Design thinking and management discourse

Johansson-Sköldberg et al. (2013) take a

> critical look at the design thinking discourse, one that has different meanings depending on its context. Within the managerial realm, design thinking has been described as the best way to be creative and innovate, while within the design realm, design thinking may be partly ignored and taken for granted, despite a long history of academic development and debate (p. 121).

Two discourses on design thinking exist, one based on academic literature and the other on business media. These perspectives are as follows:

Designerly thinking can be classified into five sub-discourses based on theoretical perspectives that have distinct origins and significant academic followings. These sub-discourses are identifiable by their foundational works, which are listed in parentheses*:*

1. Design and designerly thinking as the creation of artefacts (Simon, 1969).
2. Design and designerly thinking as a reflexive practice (Schön, 1983).
3. Design and designerly thinking as a problem-solving activity (Buchanan, 1992 based on Rittel and Webber, 1973).
4. Design and designerly thinking as a way of reasoning/making sense of things (Lawson, 2006 [1980]; Cross, 2006, 2011).

5. Design and designerly thinking as creation of meaning (Krippendorff, 2006). (Johansson-Sköldberg et al., 2013, p. 124).

Johansson-Sköldberg et al. (2013) propose that compared to contributions in the established designerly thinking discourse that has been scrutinized and reflected upon by scholars for decades, the management design thinking discourse is generally less well-developed and rigorous. Although much younger, design thinking has experienced rapid growth. For some, design thinking offers managers a more accessible means of grasping design compared to the design management discourse rooted in managerial principles. The management approaches to design connect to three origins of the design thinking discourse:

1. *Design thinking as design company IDEO's way of working with design and innovation (Kelley, 2001, 2005; Brown, 2008, 2009).*
2. *Design thinking as a way to approach indeterminate organizational problems, and a necessary skill for practising managers (Dunne & Martin, 2006; Martin, 2009).*
3. *Design thinking as part of management theory (Boland & Collopy, 2004a)* (Johansson-Sköldberg et al., 2013, p. 128).

Boland and Collopy present design in the context of management as more of a "design attitude" and less as "design thinking"

> thereby pointing less towards design as a way of working or a work process with distinct characteristics (as stressed in the IDEO version) and more towards cognitive characteristics (similar to Martin). Previously in organization and management theory, design had been considered at the organizational level (cf., Romme, 2003). Boland and Collopy credit Simon with developing a theory of the design attitude for managers, and subsequently distinguish this from a decision attitude (Johansson-Sköldberg et al., 2013, p. 129).

They propose that we are limited by our vocabularies, quoting Cooperrider, 'words are fateful--words make worlds' (Boland & Collopy, 2004c: 266), hence they conclude … with suggestions for a new 'design vocabulary for management' …. Yet there seem to be no traces of this new vocabulary reported in business or academic texts, maybe because the sources of individual concepts come from different epistemological orientations (Johansson-Sköldberg et al., 2013, p. 129).

Furthermore, Madden (2015) further explores "design attitude" as a perspective and a mindset of leaders and managers which contributes to shaping successful cross-sector

collaborations. The author proposes that design attitude as an ongoing expectation to create remarkable outcomes in each project and which has an important influence on the success of interorganizational collaborations. Madden proposes a collaboration blueprint which is designed to contribute to building better collaborations by integrating the principles and process of design thinking and its stages of inspiration, ideation, and implementation.

Johansson-Sköldberg et al. (2013) propose that design thinking cannot be generic as popularized, where creativity and tools are the only facets of design practice that must account for the designer's competence as well as required knowledge and skills:

> To talk about design and leaving the designer out is like talking about musicians and leaving the music out: a musician is identified by his or her instrument and the style of music played. Just as there is never a generic 'musician', the design thinking discourse is not one but many, as are the designerly discourses. Therefore there is little use in trying to find a single definition or description of the practice of design thinking. To do so would be to concentrate on an elegant model 'to know', without the ability to turn it into action through 'doing' detailed processes (Pfeffer & Sutton, 1999) (p. 131).

They conclude by stating there is no **"**unique meaning of 'design thinking', and accordingly we should not look for one. Instead, we look for where and how the concept is used in different situations, both theoretical and practical, and what meaning is given to the concept.**"** and "management practitioners like the concept 'design thinking' because it gives a label to something that is needed within management, but unless it is articulated, it remains undervalued" (Johansson-Sköldberg et al., 2013, p. 132).

2.2.4.2 Design thinking and R&D collaboration projects

> Academic management research can be seen as a design science (Huff et al. 2006), its mission being to develop valid knowledge to support thoughtful, designing practitioners. From the design science perspective, the main purpose of academic management research is to develop valid knowledge to support organisational problem solving in the field. That support can be direct, instrumental or more indirect—giving general enlightenment on the type of problem at hand (Saunders, 2009, p. 7).

Drawing from the work of Mahmoud-Jouini et al. (2016), exploring design thinking to address innovation projects with high uncertainty and complexity, and the position that

R&D collaboration projects manifest wicked problems, this study reinforces the applicability of design thinking for collaboration projects.

In the context of project problems, in particular R&D collaboration projects, and where requirements and technology are not always determined at the start of the project, design thinking can address uncertainty and the lack of practical approaches where standardized approaches face challenges and limitations: “Design thinking is a structured process of exploration for ill-defined problems. According to Lockwood (2009), it is ‘a human-centered innovation process that emphasizes observation, collaboration, fast learning, visualization of ideas, rapid concept prototyping, and concurrent business analysis’” (Mahmoud-Jouini et al., 2016, p. 145), where the standardized approach of project management **“**is based on a predictable, relatively simple, and rational model” (p. 145), and

> is largely decoupled from changes in the environment or in business needs (Morris, 2013; Shenhar & Dvir, 2007) and has been challenged by researchers, who observe that in contexts where uncertainty is prevalent, such as large projects or new markets, it has resulted in poor performance (p. 145).

Mahmoud-Jouini et al. note that

> design thinking addresses complex problems in uncertain contexts and mobilizes tools and attitudes to that end. Design thinking is a problem “defining and solving” approach that deals with ill-structured situations where the problem is not articulated and is considered a hypothesis where action stimulates thoughts to inspire better hypotheses (p. 150).

They conclude that “design contributes most to two particular project management challenges: the exploration challenge and the stakeholder challenge. Potential contributions also exist for addressing the strategy formulation challenge, although such contributions need to be more specified and call for further research.” (p. 145).

They highlight the similarities between project management and design thinking and how design thinking can address challenges of complex, uncertain projects, related to exploration, stakeholders’ involvement, and firm strategy. Design thinking “helps frame ill-defined issues and develops them into clearly defined problems around which key stakeholders can be mobilized” (Mahmoud-Jouini et al., 2016, p. 152).

Design thinking is a sensemaking process:

> Beyond form, aesthetic, and functionality, design is also about sensemaking and meaning: “Something must have form to be seen but must make sense to be understood and used” (Krippendorff, 1989, p. 14). Hence, to design is to make sense of things (Verganti, 2009). Design moved progressively from the world of products to other situations that involve humans and require the understanding of their behaviours, attitudes, and emotions. Therefore, the outcome of a design process can be a graphic, a shape/form, a product (tangible or intangible), a system, an interaction, an interface, or an experience. Whatever the outcome is, it is designed to solve a problem and answer any dislikes experienced by users (Mahmoud-Jouini et al., 2016, p. 147).

2.2.4.3 Design thinking and strategic thinking

As traditional approaches to strategic thinking continue to fall short in providing effective solutions, alternative approaches are gaining attention. Design thinking, which was originally applied to new product and service development, is now being adopted by some organizations to address a wide range of business challenges, including new technologies, organizational strategies, collaboration and communication methods, business models, and wicked problems. This approach, as described by Brown (2008), involves a non-linear process consisting of three spaces: inspiration, ideation, and implementation. According to Martin (2008), the core skill of design is the ability to convert seemingly intractable problems into heuristic solutions through creativity, innovation, and mastery. As design skills and business skills converge, organizations will need to shift their thinking from deductive and inductive reasoning to abductive reasoning, which involves generating multiple possibilities for trial. Designers learn through action and view constraints as opportunities rather than obstacles. Therefore, embracing design thinking will require a new mindset and a willingness to experiment and iterate. (Sakaran & Brown, 2012, p. 130)

2.2.4.4 Design thinking and cognitive bias

Liedtka (2015) provides an overview of the evolution of design thinking by tracking its roots to Rowe in 1987 on its use in business and specifically the innovation consulting firm IDEO and its founder David Kelley and the later leadership of Tim Brown. Liedtka highlights Brown’s definition of design thinking as “bringing designers’ principles, approaches, methods, and tools to problem solving” (p. 926). Brown’s definition adds to Lockwood’s definition as “a human centered innovation process that emphasizes observation, collaboration, fast learning, visualization of ideas, rapid concept prototyping,

and concurrent business analysis" (Lockwood, in Liedtka, 2015, p. 926). Liedtka (2015) argues that design thinking's tools and processes "ameliorate" some human shortcomings related to cognitive bias and reduces "cognitive flaws" such as projection bias, the egocentric empathy gap, the hot/cold gap, the focusing illusion, the say/do gap, the planning fallacy, hypothesis confirmation bias, the endowment effect, and availability bias (see Table 2.5) (p. 930). He proposes that

> design thinking practices carry the potential for improving innovation outcomes by mitigating a well-known set of cognitive flaws: humans often project their own world view onto others, limit the options considered, and ignore disconfirming data. They tend toward overconfidence in their predictions, regularly terminate the search process prematurely, and become overinvested in their early solutions—all of which impair the quality of hypothesis generation and testing (p. 937).

Table 2.5 Flaws in Cognitive Processing and Related Consequences (Adapted from Liedtka, 2015)

Projection bias is described as projection of past into future, its impact on innovation is failure to generate novel ideas.
Egocentric empathy gap is described as projection of own preferences onto others, its impact on innovation is failure to generate value-creating ideas.
Focusing illusion is described as overemphasis on particular elements, its impact on innovation is failure to generate a broad range of ideas.
Hot/cold gap is described as current state colors assessment of future state, its impact on innovation is undervaluing or overvaluing ideas.
Say/do gap is described as inability to accurately describe own preferences, its impact on innovation is inability to accurately articulate and assess future wants and needs.
Planning fallacy is described as overoptimism, its impact on innovation is overcommitment to inferior ideas.
Hypothesis confirmation bias is described as look for confirmation of hypothesis, its impact on innovation is disconfirming data missed.
Endowment effect is described as attachment to first solutions, its impact on innovation is reduction in options considered.
Availability bias is described as preference for what can be easily imagined, its impact on innovation is undervaluing of more novel ideas.

2.3 Managing change in collaboration projects

In interorganizational relationships and within organizations unexpected events, surprising results, and divergence of views and opinions can happen. Successful collaborations happen when smart managers keep an eye on things, make changes to the structure and rules, and guide the collaboration to be more efficient or end it if it makes sense to do so (de Rond & Bouchikhi, 2004). In earlier sections we have also described the processes and the motors of change in organizations, where change is an inherent aspect of interorganizational relationships processes, including temporary interorganizational projects which evolve from a formative stage to maturity through a series of distinguishable and generic life-cycle phases. However, the management of organizational change is critical to project success, yet it has received relatively little attention in the project management literature. Despite the acknowledgement by the Project Management Institute (PMI) of the importance of organizational change management to project success, project and program management standards lack a specific focus on the knowledge and skills required to manage organizational and behavioral change, as identified in various valid change management models such as Kotter's 8-step change process. Change management, a subset of organization development (OD), is defined as the process of continually renewing an organization's direction, structure, and capabilities to serve the ever-changing needs of external and internal customers. Using effective change management models, methodologies, and processes has the potential to improve the odds of project success. John Kotter, an emeritus professor at the Harvard Business School, emphasizes that change leadership involves crafting a vision that reinforces urgency and minimizes complacency, and aligning and motivating people affected by the change to support and adopt it (Hornstein, 2015).

Change management is about changing the system (Pádár et al., 2017).

> Change Management is an integral process related to all project internal and external factors, influencing project changes; to possible change forecast; to identification of already occurred changes; to planning preventive impacts; to coordination of changes across the entire project. So, Change Management faces both the outside of project—its close and distant approaches, and the inside of project. Change Management is to solve problems of project protection from the

> influence of external and internal change factors, introduce all necessary changes and control the process of changing (Voropajev, 1998, p. 17).

Project changes are common and can impact any aspect of the project. Ibbs et al. (2001) propose a change management system based on the following principles: "1) promote a balanced change culture; 2) recognize change; 3) evaluate change; 4) implement change; and 5) continuously improve from lessons learned. By applying this project change management system, project participants can minimize deleterious change and promote beneficial change" (p. 159). And,

> the central idea of any change management system is to anticipate, recognize, evaluate, resolve, document, and learn from conflicts in ways that support the overall viability of the project. Learning from the mistakes and conflicts are important, because the team members can enrich and apply their experience in the future. …By having a systematic way to deal with changes, the efficiency of project work and the likelihood of project success should increase (p. 164).

Kotter's eight-step change model is presented in the next section.

The concept of change management is considered in the context of R&D projects management and throughout the project management process. The high-level project management process analysis framework proposed by Bourgault (2012) and presented in Table 2.6 is the backdrop for the analysis of change management concepts proposed in this section and leveraged in section 2.5 for this research project proposed preliminary conceptual framework.

Table 2.6 Project management analysis framework (Adapted from Bourgault, 2012).

	Exemples d'actions constituantes (processus)	Objet visé	Critère(s)
Direction	*Monter, expliquer, justifier, piloter, défendre, rendre compte, etc.*	*La finalité*	*Valeur*
Structuration	*Fixer le cadre de fonctionnement : rôles, mécanismes de coordination, de prise de décision, etc.*	*L'organisation*	*Logique organisationnelle, cohérence avec le milieu*
Mobilisation	*Choisir les acteurs, maintenir leur l'adhésion, favoriser la coopération, etc.*	*Les personnes*	*Engagement, motivation*
Réalisation	*Projet : initier, planifier, réguler, clore* ***Objet : produire, intégrer, livrer***	*Les tâches*	*Efficience, efficacité*
Appropriation	*Tirer des leçons, transférer, intégrer la connaissance, etc.*	*Le savoir*	*Pérennité*

2.3.1 The behavioural approach to change

The behavioral approach to change focuses on how one individual can change another individual's behavior using reward and punishment to achieve intended results. This approach stems from the pure behaviorist view of the world that was prevalent in industry up to the 1960s. However, this view led to difficulties with motivating people to exhibit the 'right' behaviors, which prompted researchers to investigate management styles that worked and did not work. Douglas McGregor's research showed that managers who exhibited Theory Y beliefs were more successful in eliciting good performance from their people. Theory Y assumes that people are self-motivated, seek responsibility, and can work towards goals with a sense of commitment. On the other hand, Theory X assumes that people are inherently lazy, dislike work, and need to be closely monitored and controlled to ensure that they do what is required. If you were to approach change from a behaviorist perspective, you would be more likely to act on the assumption of McGregor's Theory X, where the only way to motivate and align workers to the change effort is through a combination of rewards and punishments. However, Frederick Herzberg's ideas suggest that there is something more at play than reward and punishment when it comes to motivating people. Herzberg investigated what motivated workers to give their best performance and concluded that hygiene factors (such as salary, working conditions, and

job security) did not motivate workers, but their withdrawal would demotivate the workforce. This implies that the provision of Herzberg's motivators cannot be used as a reward for correct behavior alone, and other factors need to be considered when motivating individuals towards desired behaviors (Cameron & Green, 2009).

2.3.2 The cognitive approach to change

The cognitive approach to change originated as a response to the limitations of the behaviourist approach, which focused exclusively on observable behaviours. Cognitive psychology, on the other hand, delves into internal processes such as language development and problem-solving capabilities. The fundamental premise of cognitive theory is that emotions and problems stem from an individual's thinking patterns, and by changing these patterns, individuals can change the way they respond to situations. The cognitive approach is concerned with beliefs and outcomes and is widely used in management coaching today. However, it has been criticized for not recognizing the inner emotional world of the individual and the impact it can have on managing change (Cameron & Green, 2009).

2.3.3 The psychodynamic approach to change

The psychodynamic approach to change is based on the idea that when individuals face change in the external world, they can experience a range of internal psychological states. Elizabeth Kubler-Ross's research on the psychological process of terminally ill patients revealed that individuals typically go through five stages as they come to terms with their prognosis: denial, anger, bargaining, depression, and acceptance. Building on Kubler-Ross's model, Adams, Hayes, and Hopson developed a model that outlines seven stages of change, namely, shock, denial, anger/bargaining/depression, acceptance, experimentation, discovery, and integration. While the Virginia Satir's model emphasizes two key events that disturb or move an individual's experience along from the old status quo to the new status quo: the foreign element and the transforming idea, where in between these there is a period of chaos, after which the transforming idea is accepted and integrated into practice. The psychodynamic approach is useful for managers who want to understand the reactions of their staff during a change process, as it provides insight into what is going on in the

inner world of employees when they encounter change. By understanding why people react the way they do, managers can better deal with their staff during a change process, and help them move through the highs and lows of the transitions curve (Cameron & Green, 2009).

2.3.4 The humanistic psychology approach to change

The humanistic psychological approach to change emerged in the US during the 1950s and 1960s, combining insights from previous approaches and developing its own. Maslow's hierarchy of needs is one of the key ideas in humanistic psychology, which proposes that until lower-level needs are met, such as physiological and safety needs, an individual will not be interested in higher-level needs, such as love, belonging and self-esteem needs. Maslow added the need for self-actualization on top of the hierarchy of needs, described as the desire to become everything one is capable of becoming. Rogers's work emphasized the importance of creating a facilitating environment through authenticity, positive regard, and empathic understanding to enable growth and development. Rogers identified key concepts, such as moving from rigidity to fluidity in thinking and feeling, accepting self-responsibility, and more options for individuals to choose. The Gestalt approach, which emphasizes experiencing, not just talking, aims to show clients how they interrupt themselves in achieving their goals. Nevis suggests that the Gestalt cycle maps onto stages in managerial decision-making, including awareness, energy/action, contact, resolution/closure, and withdrawal. The world of humanistic psychology opens up possibilities and challenges for managers, emphasizing the importance of emotional self-awareness and the ability to engage with others on an emotional level for effective management (Cameron & Green, 2009).

2.3.5 Models of organizational change

From the models to change proposed scholars, the model that has the most appeal to business managers, and thus the most influence on organizations' change management cultures is Kotter's eight steps (Cameron & Green, 2009).

> Kotter's (1995) "eight steps to transforming your organization" goes a little further than the basic machine metaphor. Kotter's eight-step model derives from analysis

> of his consulting practice with 100 different organizations going through change. His research highlighted eight key lessons, and he converted these into a useful eight-step model. The model addresses some of the power issues around making change happen, highlights the importance of a “felt need” for change in the organization, and emphasizes the need to communicate the vision and keep communication levels extremely high throughout the process (Cameron & Green, 2009, p. 114).

Kotter’s eight-step model is presented as follows:

1. Establish a sense of urgency. Discussing today's competitive realities, looking at potential future scenarios. Increasing the 'felt-need' for change.
2. Form a powerful guiding coalition. Assembling a powerful group of people who can work well together.
3. Create a vision. Building a vision to guide the change effort together with strategies for achieving this.
4. Communicate the vision. Kotter emphasizes the need to communicate at least 10 times the amount you expect to have to communicate.

   The vision and accompanying strategies and new behaviours needs to be communicated in a variety of different ways.

   The guiding coalition should be the first to role model new behaviours,
5. Empower others to act on the vision. This step includes getting rid of obstacles to change such as unhelpful structures or systems. Allow people to experiment.
6. Plan for and create short-term wins. Look for and advertise short-term visible improvements. Plan these in and reward people publicly for improvements.
7. Consolidate improvements and produce still more change.

   Promote and reward those able to promote and work towards the vision. Energize the process of change with new projects, resources, change agents.
8. Institutionalize new approaches. Ensure that everyone understands that the new behaviours lead to corporate success (Cameron & Green, 2009, p. 114).

2.4 Interorganizational collaborative research projects advantage

This study is limited to collaborative R&D settings, which will be further explored in this section. This study is further constrained to pre-competitive R&D, which typically involves networks that include universities and other specialized research and product development centers (Faulkner & De Rond, 2000), and to collaborations with customers, suppliers, and universities, but not competitors. The creation, execution and maintenance of R&D projects is challenging; however, collaborative R&D projects in open innovation settings have a collaborative advantage and result in learning.

2.4.1 Collaborative R&D

Hagedoorn (2002) uses R&D as a general term for collaborative partnering, as "the standard research and development activity devoted to increasing scientific or technical knowledge and the application of that knowledge to the creation of new and improved products and processes" (p. 477), whereas Powell et al. (1996) use the term collaborative research interchangeably with R&D alliances.

Hagedoorn et al. (2000) propose a taxonomy for research partnerships as public, private, or public/private. A second category of their proposed taxonomy considers the partnership's structure, whether informal between firms or with universities through short-term project-specific research subcontracts. Surprisingly, formal arrangements do not fall in this second category, echoed by Howells et al. (2012) who also categorize contract research and consultancy as informal irrespective of the presence of a contract. Formal arrangements are further split into research corporations and research joint ventures, where the latter are mainly contractual arrangements rather than research corporations that refer to separate firms.

In subsequent research, Hagedoorn supports the classification of R&D partnerships into two main categories: contractual partnerships, like joint R&D pacts and joint development agreements, and equity-based joint ventures. He explains that joint ventures are traditional interfirm collaborations, which are becoming less common due to their high organizational cost and failure rates. On the other hand, contractual arrangements are becoming more

prevalent because of reduced organizational dependence, lower setup time, and lower implementation costs (Hagedoorn, 2002).

Al-Laham et al. (2010) distinguish between public research organizations and private organizations, a categorization that differentiates between the type of partner and the type of alliance. Niosi (1999) describes collaboration as a goal to produce fundamental knowledge as a type of collaborative research.

Perkmann and Walsh (2009) categorize various interactions between universities and industry into collaborative research, contract research, and consulting. They further explain that collaborative research, also known as joint research, involves universities and industry working together to achieve shared research goals. They define a typology of university and industry collaboration projects: problem solving, technology development, ideas testing and knowledge generation ranging from a high level of "appliedness" to basic projects.

Suh and Kim (2012) consider three types of R&D collaborations: customer-provider, strategic alliance, and interfirm alliance. External collaboration is the core and enabler of open innovation, which allows for technology exploration and exploitation.

Huang and Yu (2011) introduce R&D collaborations as competitive collaborations such as those between competing firms racing to learn in a win-lose outcome. This type of collaboration is also for resource-based incentives and non-competitive collaborations such as those between firms and universities or research institutions. Similarly, Gnyawali and Park (2011) introduce co-opetition, a term coined by Brandenburger and Nalebuff (1996), where collaboration between competing firms is key given technological trends: "Even giant cannot go at it alone" (p. 658).

Looking at R&D partnerships, Hagedoorn (2002) explored 40 years of data in North America, Europe, and Asia. Two trends are apparent in the data: one, showing that R&D partnerships are increasing since the 1960s, and the other showing R&D joint ventures are decreasing. While high-tech industry R&D partnerships have significantly increased, medium-tech and low-tech partnerships are decreasing since the early 1980s. Of further interest is the decreasing trend of R&D collaborations in aerospace and defence since the early 1990s. In the high-tech industry, R&D contractual arrangements are more common

in aerospace and defence than in other sectors. Contractual partnering in the aerospace industry has dropped significantly since the 1960s. International R&D partnerships are also decreasing, but not in aerospace (Hagedoorn, 2002). This interesting data highlights the need for robust frameworks to manage R&D partnerships, irrespective of formal or informal arrangements or domestic or international.

There is a lot of collaborative research in the literature, thus a summary is provided in Table 2.7 to help navigate this study. Research characteristics span most partnerships including cases in this study.

Table 2.7 Collaborative Research classification

Classification	Content	Authors
Portfolio Type (Knowledge, Technology)	Exploitation (commercialisation), R&D and Non-R&D	(Al-Laham et al., 2010) , (Huang & Yu, 2011)
	Explorative (R&D)	
Technology Maturity Typology	Basic Research	(Perkmann & Walsh, 2009)
	Applied Research	
Technology/Field	Doing, Using and Interacting (DUI)	(Fitjar & Rodríguez-Pose, 2013)
	Science, Technology and Innovation (STI)	
	Other disciplines concerned with non-technological objects of analysis	(Perkmann & Walsh, 2009)
	Sciences of the artificial	
Collaboration Type	Informal Interaction	(Hagedoorn, Link, & Vonortas, 2000), (Howells, Ramlogan, & Cheng, 2012), (Howells, Ramlogan, & Cheng, 2012), (Hagedoorn, 2002)
	Formal	
	Quasi-vertical	
Collaborative Relationship Type	customer-provider, Strategic alliance, and inter-firm alliance	(Suh & Kim, 2012)
Collaborative Relationship Type	Non-Competitive	(Huang & Yu, 2011)
	Competitive	
Sectoral Technology	Mature	(Bodas Freitas, Marques, & Silva, 2013)
	Emergent	
Geographic Proximity	Regional	(Fitjar & Rodríguez-Pose, 2013), (Owen-Smith & Powell, 2004), (Bodas Freitas, Marques, & Silva, 2013), (Anderson, 1995)
	Non-regional	
Type of Entity	Private	(Al-Laham, Amburgey, & Baden-Fuller, 2010), (Hagedoorn, Link, & Vonortas, 2000)
	Public	

Understanding the partnership context allows for a better design of the structure and a better understanding of collaborative projects, thus resulting in a better collaborative advantage.

The triple helix model of university-industry-government relations theorized by Leydesdorff and Etzkowitz (1996) is at the core of R&D collaborations in the aerospace industry in Canada, within which this study occurred. Some conclusions presented by the authors in the late 1990s hold true:

> The increase of interactions among the institutions has had the effect of generating new structures within each of them, such as centers in universities or strategic alliances among companies. These interactions have also led to the creation of integrating mechanisms among the spheres in the form of networks, e.g., of academic, industrial, and governmental researchers, and hybrid organisations such as incubator facilities (p. 280).

Carayannis and Campbell (2009) suggest a "'fourth helix' that we identify as the 'media-based and culture-based public'. This fourth helix associates with 'media', 'creative industries', 'culture', 'values', 'lifestyles', 'art', and perhaps also the notion of the 'creative class' (a term, coined by Florida, 2004)" (p. 206).

This concept has been pushed further by Elias and David (2010), who introduced the quintuple helix with the addition of the natural environment to address sustainable development and social ecology, which are key considerations when innovating in the aerospace industry.

Such collaborations have received lots of attention in the literature; however, there is a "lack of integrative frameworks for the management of research collaborations" (Philbin, 2008, p. 488). Philbin proposes a practical process model for university-industry research collaborations, described as a logical model:

> 1) terrain mapping;
> 2) proposition;
> 3) initiation;
> 4) delivery; and
> 5) evaluation.
>
> The model has been generated in order to provide a practitioner-oriented "route map" for the development and operational management of university-industry collaborations (p. 498).

There are several academic, government, and not-for-profit reports on the challenges in industry-university partnerships, for example, different goals and cultural norms, as emphasized by Frølund and Riedel (2018):

> it is tempting to say that to have successful partnerships we must strive to take away the differences between universities and corporations. This would be a mistake. As John Stuart Mill mentions, one of the primary sources of progress is placing dissimilar people in contact with each other. We must be aware of the differences and the challenges they create for successful collaborations, but we must at the same time acknowledge that successful industry-university collaboration is not about taking away the differences, but managing them in a way so that the differences becomes an opportunity and not a problem (p. xxi).

2.4.2 Collaborative research projects in Open innovation settings

Chesbrough (2003) points out that "MOST INNOVATIONS FAIL. And companies that don't innovate die" (p. xvii). He affirms that innovation is difficult to manage, but it is key to the success and advancement of firms in a constantly changing world.

Chesbrough (2003) highlights the shift in innovation paradigms from the concept of closed innovation, where companies control the innovation cycle from ideation to commercialization within the firm's boundaries. He introduces a new paradigm, open innovation, where companies reach outside their boundaries to innovate. In the past the right way to innovate was closed innovation but now open innovation is a new sustainable mode in a constantly changing world. Chesbrough describes the open innovation paradigm as a concept wherein firms use both external and internal ideas, as well as internal and external market pathways, to advance their technology. He explains:

> Open Innovation combines internal and external ideas into architectures and systems whose requirements are defined by a business model. The business model utilizes both external and internal ideas to Create value, while defining internal mechanisms to claim some portion of that value. Open Innovation assumes that internal ideas can also be taken to market through external channels, outside the current businesses of the firm, to generate additional value (p. xxiv).

Another key insight is that, when companies adopt the open innovation paradigm and move away from the traditional closed innovation paradigm, the processes of innovation itself must also change (Chesbrough, 2003).

Gassmann and Enkel (2004) discuss the growing importance of open innovation, where several factors come into play, including the need for a faster time to market, that is, a shorter innovation cycle, but also the increasing cost of R&D and the scarcity of resources to achieve and support R&D. Additionally, the authors highlight that new pathways outside

the firm are required to bring ideas to market and that both knowledge and innovation or exploitation do not have to be found within the firm. The firm boundaries become "semi-permeable", allowing innovation to move in and out of the firm. The authors present three open innovation processes that firms can adopt based on capabilities and characteristics:

> (1) The outside-in process: Enriching a company's own knowledge base through the integration of suppliers, customers, and external knowledge sourcing can increase a company's innovativeness.
>
> (2) The inside-out process: The external exploitation of ideas in different markets, selling IP and multiplying technology by channelling ideas to the external environment.
>
> (3) The coupled process: Linking outside-in and inside-out by working in alliances with complementary companies during which give and take are crucial for success (Gassmann & Enkel, 2004, p. 1).

Key insights from Gassmann and Enkel (2004) are that "the locus of knowledge and the locus of innovation need not necessarily be the same" (p. 15), and although opening the innovation process allows for innovation success, firms must consider a flexible innovation strategy. This strategy may combine several approaches which require collaboration within and outside the firm, including: "outsourcing ventures, reintegrating new businesses, scanning and integrating new technologies, commercialising patents, connecting external sources to the internal innovation process and launching new collaborations during the required period" (Gassmann & Enkel, 2004, p. 15).

2.4.3 Collaborative R&D advantages

As R&D resources and knowledge are critical to firms experiencing rapid technological change, where advanced technologies cannot be created in isolation, organizations must form horizontal and vertical linkages to succeed (Veugelers, 1998). Faems et al. (2005) highlight numerous benefits of interorganizational collaboration including "spread[ing] the costs of research and development (R&D) among different parties, resulting, at the same time, in a considerable reduction of the risks associated with R&D-intensive innovation projects" (p. 240).

Al-Laham et al. (2010) state that

> alliances have advantages over contracts or markets, since drafting contracts governing the sale or licensing of tacit knowledge is difficult due to the non-explicability of the characteristics and performance of that knowledge. Alliances are considered to be especially fruitful for the development and transfer of tacit knowledge, which forms the basis for a firm's knowledge-based advantage (p. 791),

which supports the notion that alliances are conducive to accelerating innovation based on the development and transfer of knowledge.

Schilling and Phelps (2013) reaffirm the importance of alliances, which "enable firms to pool, exchange, and jointly create information and other resources" (p. 3). They argue that close networks enhance knowledge creation. As "firms tend to interact more intensely or frequently with other firms with which they share some type of proximity or similarity, such as geography or technology, this tends to result in a high degree of clustering" (p. 3), which increases the information transmission capacity of a network. They suggest that networks can be shaped to enhance innovation, through, for example, government policies or research consortia. Research indicates that close networks enhance knowledge creation resulting in increased patenting; however, the authors suggest that "firms do not quickly realize the innovation benefits of collaboration" (p. 36).

In their study of pharmaceutical firms, Jenssen and Nybakk (2009) recognized the importance of collaborative R&D alliances with universities and small research firms to reduce costs and increase innovation.

Hagedoorn et al. (2000) studied why governments encourage research partnerships, realizing their competitive advantage. The authors examined non-tournament and tournament models through industrial organization. The former emphasizes innovation, cost reduction, and product differentiation, and the role of knowledge spillovers in defining the efficiency of cooperative and non-cooperative setups. They found that R&D cooperation leads to higher investment and output with greater knowledge spillovers. The authors also examined tournament models, where timing of innovation is prioritized, and the winner gets the entire reward. To incentivize information sharing among winners, government subsidies may be needed, which could influence research partnership policies.

Since the early 1980s, governments have been adopting policies favouring partnerships and innovation, for example, in the United States, European Commission, and Japan, to "arrest

the relative decline in the international competitiveness of high technology sectors" and address the "anxiety over the perceived gradual loss of competitiveness and the effects of globalization in high-technology industries … and change in the global forces affecting R&D and innovation" (p. 581).

Wu (2012) hypothesizes that "the positive effect of technological collaboration on product innovation is weaker at high levels of market competition, and the negative interaction of technological collaboration and market competition is positively moderated by high-tech sectors." This implies that technological collaboration is related to product innovation, in particular, in high-tech sectors, regardless of the relative strength and moderating effects in these relationships. Wu (2012) reaffirms previous research that shows strategic alliances have a positive effect on innovation performance. However, he suggests there are several caveats, which question whether or not strategic alliances have negative effects on product innovation, given opportunistic behaviour, learning races, collaborative arrangement cost and structure, and knowledge leakage. He also questions the effect of the external environment, such as market competition and sectoral technology, on the relationship between strategic alliances and product innovation. Through these questions, he confirms that intense market competition has a negative effect on technological innovation. However, these effects are offset in high-tech sectors.

The competitive advantage of collaborations is widely accepted in the literature. But the advantage is not automatic; it requires nurturing the collaboration process and efficiently managing project execution. Otherwise, transaction costs may become prohibitive and erode expected advantages.

2.4.4 The complex aerospace industry

This section is dedicated to complex project ecologies, particularly aerospace projects, where "the production of knowledge and outputs rely on significant interdependencies in task activities and knowledge flows across multiple projects" (Newell et al., 2008, p. 34). Davies and Hobday (2005) and Prencipe et al. (2007) consider aerospace products, such as aircraft, full flight simulators, defence systems, IT systems, and trains complex products and systems (CoPS) defined as high-value capital goods, and developed and produced in unique one-off or in low volume customized batches to meet the requirements of businesses

or governments. Davies et al. (2003) describe a complex system as a collection of humans and technologies working together to fulfill a specific function, with the entirety of the system being too intricate for any single individual to fully comprehend. Complex products, such as aircraft and full flight simulators are highly customized and require extensive R&D in the defence sector. They involve users and their requirements and inputs, while their components and interfaces are complex and require a wide range of knowledge and skills to design, develop, and produce. Moody and Dodgson (2006) outline CoPS:

- High costs with long product cycles
- Involvement of several firms in design, development, and production
- High product complexity and emerging and unpredictable properties
- Being of a one-off kind to meet requirements of individual business users
- Involvement from policy and other regulatory sources
- Being user driven rather than market driven, with a high degree of user involvement
- Project based, rather than product based
- Markets typically characterized by oligopolies
- Requirement of distinct management capabilities (p.569)

They emphasize that the nature of CoPS implies that a project based production of units is most appropriate, which is also supported by Prencipe et al. (2007). For example , a flight simulator comprises highly specialized components and necessitates expertise in areas such as mechanical, electromechanical, and precision engineering, as well as software engineering, systems integration, materials, electromechanical interfacing, automated data exchange, human-computer interaction, and pilot training (Davies & Hobday, 2005). In the context of R&D collaboration, in particular applied research, a flight simulator also requires organizations with symmetrical and complementary knowledge and the ability to address concurrent development of tightly coupled and interrelated systems. This is reflected by Davies et al. (2003) as they highlight that the emergence of large-scale, complex systems in the middle twentieth century which has presented important systems integration challenges for engineers, especially in the aerospace and computing sectors.

Because such products are complex and different than standardized mass production consumer goods and services, their development and production inform many project management techniques. Development cycles are long and may span many years. For example the Australian FedSat satellite project spanned over four years (Moody &

Dodgson, 2006), adding challenges to the IOR. Also, as most CoPS design, development, and production processes are unique, they can be considered firms within firms. Davies and Hobday (2005) point out Mintzberg's (1983) observation that the project-based organizational structure is often employed for new product development in consumer goods, particularly in low-volume and customized production systems. Mintzberg notes that many organizations adopt adhocracy due to the dynamic nature of frequent product changes, with the most distinct example being the unit producers, where a manufacturing firm that customizes each product to order, such as an engineering company that produces prototypes. In these cases, each customer order represents a new project.

They reconfirm the tendency of projects to extend beyond the boundaries of the organization. This is typical of the aerospace industry with its primes, multi-tier suppliers, customers, and alliances for the design, development, and production of systems and subsystems. The authors emphasize that such projects play a key role in shaping business strategy and innovation due to the flexibility granted to certain project entities. These entities may be entire firms or units within firms that use projects to accomplish significant business objectives, encompassing all firms involved in designing and producing CoPS.

In the aerospace sector, along with other sectors where CoPS are prolific, outsourcing through its strategic and relational aspects fostering cooperation and collaboration according to Holcomb and Hitt (2007) is seen as a way for firms to minimize transaction costs and access complementary capabilities, continues to significant in this sector as it was in the past decades, where also (Davies & Hobday, 2005) assert that the ability to integrate these complex systems systems has emerged as a critical factor in the operations, strategy, and competitive advantage of leading companies in this sector. As an engineering task originating in the military in the early 1950s, systems integration is now a strategic capability (Davies et al., 2003) concerned with internal and external integration of knowledge and systems, components and subcomponents from partners and firms including competitors for production. Systems integration extends beyond engineering and permeates business management, including senior management decision-making (Davies et al., 2003). This is particularly important for aerospace firms and their complex products.

End-user and intermediate customers are involved with the innovation process from the idea phase to the maintenance phase, which is long for CoPS given initial investments (Davies and Hobday, 2005). Developed countries lead in CoPS (Davies & Hobday, 2005) and must maintain this lead through innovation, increasing competitiveness and collaboration, which is promoted by local governments.

The concept of project-based business or unit is crucial for firms producing CoPS, and when collaborating with partners, the primary challenge lies in managing and reconciling potentially conflicting corporate cultures, goals, and business systems as the project progresses (Davies & Hobday, 2005). The project-based business becomes more challenging with distributed project teams requiring “organizational support, ICT, project manager leadership, and the flexibility and commitment of team members” (Daoudi, 2010, p. vii). Producers must learn from collaborations to increase their competitive advantage and reduce their transaction costs through operational efficiencies.

Engineering, and the development of CoPS in the aerospace industry, in particular, are subject to rigorous processes and rules imposed by the industry, regulators, and customers. These vary from deploying capability maturity model (CMM) developed by the Carnegie-Mellon Software Engineering Institute to the practices of improving software of complex products which are designed to be approved by regulators such as the Federal Aviation Authority (FAA). Davies and Hobday (2005) bring an interesting view on the deployment of CMM suggesting that relying on CMM only is inadequate for enhancing software quality, as it fails to address the human or 'soft' aspects of an organization's capability. While the CMM approach to software development emphasizes engineering discipline, rigorous business processes, working procedures, and management toolkits, these soft factors can significantly influence the outcomes of major projects in complex environments. The authors suggest that the competitive advantage of industry leaders is derived from product innovation and robust customer relationships, rather than economies of scale and scope. This notion aligns with the importance of establishing strong interorganizational relationships for fostering innovation and collaboration.

Aerospace products and systems continue to grow in complexity and become more receptive to technology, where the expectation for costs savings when integrating new

technologies may be faced by high initial costs of R&D. The technical risk is high, and highly qualified and specialized labour is decreasing, thus posing challenges to innovation and collaboration. “The range of disciplines contributing to new developments in aeronautics includes mechanical engineering, mathematics, computer science, physics, chemistry, biology, electrical engineering, materials science, thermal dynamics, and digital communications and control systems” (Prencipe et al., 2007, p. 3)—and this is a non-comprehensive list that does not include design with interfaces and user experience.

> Mowery and Rosenberg [1981] emphasized this point specifically: “Central to an understanding of the innovation process in the commercial aircraft industry is the high degree of systemic complexity embodied in the final product. The finished commercial aircraft comprises a wide range of components for propulsion, navigation, and so on, that are individually extremely complex. The interaction of these individually complex systems is crucial to the performance of an aircraft design, yet extremely difficult to predict from design and engineering data, even with presently available computer-aided design (CAD) techniques. … This pervasive technological uncertainty has been and remains an important influence upon producer structure and conduct in the industry. Such uncertainty also introduces an additional dimension to the innovation process “learning by using” (Prencipe, 2007, p. 12).

Prencipe introduces the term “production-centred innovation” based on Vincenti (1984), where, generally in the aerospace industry, “new findings in technology per se have often led science” (p. 13).

Given the complexity of the context of the study, highlighted above, with fast-changing technology and organizational and social environments, IORs must continually improve. As Huxham and Vangen (2005) state, collaboration is “a world filled with frustrations” and because of “collaborative inertia”, they recommend to not collaborate unless it’s necessary: “unless you can see THE POTENTIAL for real collaborative advantage (i.e., that you can achieve something really worthwhile that you couldn’t otherwise achieve)” (p. 37). In the aerospace industry, the stakes are high and so is the potential, and not collaborating or not collaborating efficiently is a path to demise. A key messages of Huxham and Vangen (2005) is “that managing to collaborate involves actively managing (in order) to collaborate” (p. 4). The proposed research requires a comprehensive view of collaboration and an understanding of its enactment and dimensions throughout its life

cycle which spans from initial contact to delivery of project artefacts and further to maintaining, nurturing, and growing relationships.

2.5 Critical analysis of the literature and a pathway to a preliminary conceptual framework

This literature review was an ongoing agile endeavour due to the inductive nature of the research and continued throughout the study. It is "likened to an upward spiral" as described by Saunders et al., where literature reviews are in themselves an important research activity.

> If … you are working inductively (that is, from data to theory) your literature review may serve the purpose of illuminating and enriching your conclusions. … It may be that your literature is reviewed in more than one chapter. This would be the case, for example, where you were using more than one body of literature in your research." (Saunders et al., 2009, p. 534).

As previously highlighted, an important gap in the available research is the lack of IOR management studies and in-depth understanding of the day-to-day enactment of collaboration. Although current project management practices may seem suitable to manage IORs, collaborative project stakeholders face several issues that traditional managerial practices cannot address (Calamel et al., 2012).

Addressing this lack of research is the core interest of this study, using a multidisciplinary approach through an exploration of collaboration enactment and stakeholders. A lot of attention is given to the different phases and levels of collaboration relationships, whereas the overall understanding of collaboration is a black box that this study explores to unravel and understand the day-to-day activities of collaboration projects. The literature is rich with research on what collaboration is, what it does, and how it works at the higher levels of collaborative relationship governance, whereas the day-to-day actions and concepts of collaboration are left to project managers and teams to improvise. Collaboration facilitators, whether internal to the organization or independent outside bodies strive to bring collaborating partners to the table. However, bringing collaborators together, keeping them engaged, and maintaining relationships is ad hoc for project teams to manage using standardized methodologies and tools. Therefore, the key theme of this study is to increase

awareness and understanding of—and design sustainable—collaboration project relationships.

As most literature on IOR gives little attention to the day-to-day management of IOEs, and because the area is “devoid of comparative assessments of management practices issues” (Cropper et al., 2010, p. 406), this study must assess collaboration practices not only from a top-down perspective but also from a bottom up approach based on the day-to-day interactions of collaboration stakeholders.

Cropper et al. (2010)describe the relationships between core building blocks (attributes of organizations and relationships) and other building blocks (macro- and micro-contexts and processes). where core building blocks, as described by Cropper et al., will allow one to “differentiate organization or relationship to be able to make comparisons and arrive at explaining the phenomena of interest” (p. 10), whereas the other building blocks allow for “specifying factors and processes that constrain and enable IORs, and better understand the properties of organizations, their relations, and related outcomes [to] enrich the precision of IOR theorizing” (p. 10). All these dimensions are of interest for this study and are helpful for understanding collaborations and related frameworks, from recognition of collaboration opportunities to the specifics of the enactment of collaboration. These dimensions will be further considered in the next paragraphs in relation to the analysis of the contexts and processes of collaboration, as well as the preliminary conceptual framework proposal.

Furthermore, Cropper et al. (2010) list the two major building blocks around which IOR research is focused: organizations involved in IORs at the individual and collective levels, interactive relationships (exchange of information or resources), and non-interactive relationships (e.g., identity and core technology). Macro- and micro-contexts as well as Macro- and micro-processes are considered by Cropper et al. (2010) as dimensions that help "understand the properties of the organizations participating in an IOE, their relations, and related outcomes" (p. 10). Where the micro (groups and individuals) and macro-contexts (legal [e.g., IP protection], environmental, economical, industrial, national, cultural, and historical) are dimensions of the IOR that may change over time and include conditions that facilitate and constrain the emergence, functioning, evolution, and dissolution of IORs. Furthermore, in the dimensions and attributes of processes, the authors, refer to the macro- and micro-dimensions of these processes, where the macro processes are generally concerned with evolution of the interorganizational situation over time, this can be studied through e.g., phases of the life cycle of the IOE, its evolution and dissolution, and inter-partner learning (p. 14). Whereas at the micro-scale, underlying the macro-scale processes, the focus is on the "processes experienced by individual participants attempting to negotiate, facilitate, or interrupt larger-scale processes, where attributes include, trust dynamics, leadership, sense-making, innovation processes, and evaluation and intervention processes related to IORs. These micro-level process include formal and informal processes of sense-making, understanding, committing, and enacting. "*They relate to what is lived as process in grappling with the everyday, continually varying challenges that participants face*" (p. 14).

Using a holistic multidisciplinary approach, the goal is to study the day-to-day enactment of collaboration at the macro and micro scales, the enablers that impact collaborative practices and processes, and their management among partners. This study does not result in prescriptions or a recipe; it is exploratory, evolving, and thought provoking to augment collaboration stakeholders' understanding of collaboration by providing "handles for reflective practice" (Cropper et al., 2010, p. 409).

A starting point for proposing a conceptual framework is to look into collaboration process model as illustrated in Table 2.4 and explore the process black box and its key concept that

provides an overview of collaboration constructs, and its multi-dimensional framework. The black box multidimensional framework guides the intentional work of collaboration managers and facilitators such as “boundary spanners” defined as “individuals who have the skill to build and manage interpersonal relationships…. [Who have] the ability to play an ‘honest broker role’ among contested power structures, and the ability to manage interdependency” (Thomson & Perry, 2006 based on William, 2000, p. 25), and conveners who are considered facilitators of alliances and whose role in collaboration is “to identify and bring all the legitimate stakeholders to the table” (Wood and Gray, 1991, p. 150). As systemic “innovations whose implementation requires knowledge integration by the network of firms assembled to complete the project” is difficult because of structural misalignment (Alin et al., 2013, p. 78), organizations try to adapt intra-firm processes to an IOC project without considering the complexity of managing IOCs, and particularly, complex collaborative R&D projects in the aerospace industry.

Process theories relevant to this study have been addressed in previous sections and reflect intentional design efforts of collaboration processes. Additionally, this study considers the usefulness of cross-boundary objects and artefacts for adoption, which may be readily understood by collaborators (Levina & Vaast, 2005), to further augment the enactment of collaboration . Process theories and cross-boundary objects may be intentionally designed through deliberate and intuitive actions drawing from practice, which is explored using a design thinking concept included in the proposed preliminary framework.

The basic principles of design thinking as described in previous sections is leveraged, where the user must be at the start of the design process (Ulrich, 2011). The design efforts can be composed of several activities, starting with sensing the gap by the user or observer, then defining the problem based on the gap, following with the designer exploring alternatives, to finally selecting a plan from the alternatives or reiterating the evaluation until a plan is selected.

Agile methodologies and design principles in software artefact development can potentially facilitate collaborations and elevate the quality of collaboration process artefacts, where collaboration is a wicked problem with solutions that can benefit from interactions and feedback from stakeholders.

As discussed, wicked problems are those that are not well understood and are therefore difficult to explain. Collaborations present similar characteristics. Therefore, the more that stakeholders immerse themselves in the collaboration and empathize with the user, the more likely the problem will be understood. Close interactions between stakeholders across group and organizational boundaries, iterative and incremental progress, prototypes and feedback on prototypes from stakeholders are key to agility (Hirschfeld et al., 2011), and are important in creating collaboration artefacts.

Design thinking and agile development allow for exploration, insights, and progress on alternative solutions. Prototyping allows to recognize misconceptions and biases, and also helps better understand the problem given its wicked nature, whether it is a software system, or a contractual agreement in the context of a collaboration project set-up, and finally exchanging of these prototypes allows to evaluate their adequateness in real situations with users and stakeholders' feedback (Hirschfeld et al., 2011). Figure 2.1 illustrates a typical industry adopted design thinking process framework.

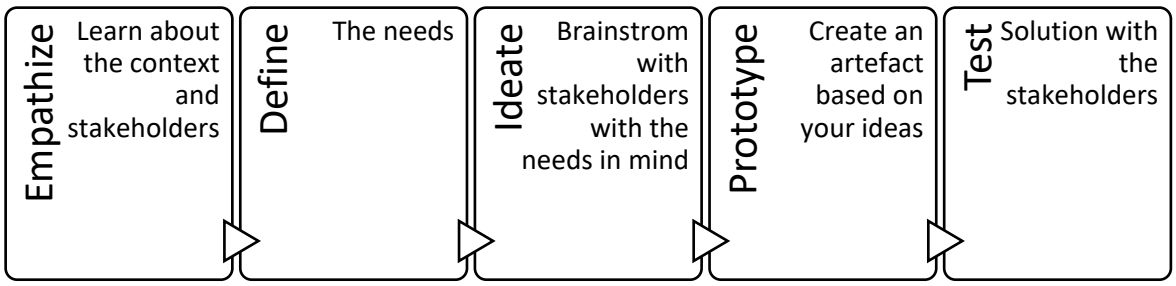


Figure 2.1 Typical Design Thinking Process Model (Based on the Stanford D-School model)

The proposed preliminary framework also integrates a high-level project management process framework based on Bourgault (2012) and change management concepts to address the evolving nature of IOCs including project stakeholders, plans, and learning. This study explores the enactment of collaboration through a change management process model for baseline themes for the selected cases. The starting themes are inspired from Kotter's eight-step model described in section 2.3.5.

The framework should consider organizational environments in which collaborative research projects occur, thus this framework will consider collaboration projects in the aerospace industry, as a science-based industry highlighted by Armellini (2013), and where sources of knowledge are due mainly to internal R&D activities (Archibugi, 2001).

2.5.1 A themes framework for qualitative analysis

(Hibbert, Huxham, & Ring, 2011) state that research approaches which address the challenge of managing collaboration are classified into three categories:

- Micro-scale which focuses on the managers actions in their day-to-day management practices of collaborations

- Macro-scale which focuses on external factors and systems impact the management of collaborations, these factors are beyond the control of managers and are oriented toward collaboration structures

- And finally, an intermediate scale which focuses on the collaboration management processes and challenges evolutions over time.

Hibbert et al. list several theories that research tends to rely on when studying IOEs and their management, such as co-evolution, resource dependence, and others from several disciplines, as discussed in previous sections. They categorize collaboration into two groups, further broken into six categories as illustrated in Table 2.8. The first group is on the nature of collaborations as a management challenge, and the second group is on managerial collaboration practices and challenges responses. They also describe a seventh new category, which is key to this study, as “the themes approach and reflective practice” (p. 404).

Table 2.8 Relationships between Categories of Insight on the Management of Collaboration and Problem Conceptualization (Adapted from Hibbert et al, 2011).

	Practice oriented, relatively micro-scale	Process oriented, usually of intermediate scale	Structurally oriented, relatively macro-scale
Categories where the research is usually used to help conceptualize the nature of collaboration as a management challenge	Category III: success and failure factors Category VII: themes	Category I: life-cycles, phases, and stages	Category II: analytic conceptualizations, such as typologies, models, and diagnostics
Categories where the research is usually used to describe (or prescribe) responses to the management challenge of collaboration	Category IV: competencies, behaviours, and tasks Category V: guidelines and process steps Category VI: tools and facilitation Category VII: handles for reflective practice	Category V: guidelines and process steps Category VI: tools and facilitation	Category IV: competencies, behaviours, and tasks Category V: guidelines and process steps

The authors critique the six categories presented as "not always … a straightforward translation for those managers seeking to convert them into meaningful action" (p. 405). Instead, they reference Huxham and Vangen's (2004, 2005) collaborative advantage theory as an approach that is not prescriptive: "collaboration is too complex and idiosyncratic for precise prescriptive remedies" (p. 405). Collaborative advantage theory provides "handles for reflective practice" and focuses on micro-level practices, while taking macro and intermediate level practices into consideration:

> These are formulated as conceptualizations of collaboration practice, which focus the user's attention on aspects of practice situations that have to be managed, but which expect the user to formulate the managerial action in the light of their own circumstances and competencies. Each conceptualization is thus used as a framework or tool for aiding what Bardach (1998) refers to as managerial craftsmanship (p. 405).

These conceptualizations of collaboration practice serve as tools to focus on specific aspects of practice situations that need management, allowing users to create appropriate actions based on their unique circumstances and competencies. Hibbert et al. describe the

similarities between this approach and success and failure factors, as it emphasizes areas causing challenges and rewards. The theory offers rich conceptualizations for various collaboration aspects such as aims, power, trust, identity, and structures. By dividing these aspects into themes, managers can focus on specific concerns while maintaining awareness of other factors influencing their decisions. A reflective practice approach can incorporate insights from various categories and should be used as a stimulus for constructive thought in practice situations, allowing for adaptation and reconstruction based on context.

> A reflective practice approach, as a mode of use, is consistent with many of the tools of category VI and it is possible to incorporate any of the types of insight from categories I–V within such a mode. Doing so, however, requires that neither descriptions nor responses are taken too literally. Operating within this mode, each insight is seen as a stimulus for constructive thought in the practice situation and as such is likely—and necessarily—to be challenged and reconstructed in that context (p. 406).

Hibbert et al. highlight how the literature on collaboration is abundant with how to manage collaborations, however, it is

> “clear that relatively little attention has been paid to the day-to-day management IOEs and there is much scope or (micro- and intermediate scale) research that investigates and conceptualizes how IOE managers spend their time. Furthermore, the area is largely devoid of comparative assessments of managerial practice issues, and this is a serious shortcoming that cries out for resolution. There are few cross-sector assessments of how managers treat issues such as “partner” selection or trust building (p. 406).

They list other omissions:

> There is little that focuses on the emotions that may be at the heart of these issues of relational concepts such as trust, power, and mutual understanding. Clearly there is the potential for managerial challenges to arise out of emotions such as fear, surprise, regret, etc. Actors in an IOE are social and socialized beings with traditions and values that may differ markedly between individuals (Hibbert and McQuade, 2005) (p. 407).

The authors express skepticism about precise prescriptions but see value in better conceptualizations and models. They suggest focusing on using these insights as "handles for reflective practice," (p. 409) allowing users to apply their expertise and judgment to craft appropriate actions. This would require reframing the presentation of insights, using less assertive language and providing alternative options instead of force-fitting. Analytical

models would become a subset of thinking tools, requiring only a shift in perspective regarding the presentation of research output:

> We remain sceptical about the possibility of precise prescription. While we nevertheless see value in pursuing ever better conceptualizations and models, we suggest that a sensible parallel—or, better still, integrated—research thrust should be a focus on development of the use of these insights in a "handles for reflective practice" mode (Huxham and Beech, 2003). Insights in all categories could be viewed as providing users with research-justified areas to direct their thinking rather than as precise prescriptive remedies. The expectation would be that users would then invoke their own expertise and judgement to craft a course of action (Bardach, 1998). The implication would be a reframing of the way that the insights are presented. Success factors, guidelines, and task lists would need to be couched in less assertive language and offered as key issues that often need to be managed life-cycle models might offer alternative "phase" descriptions that could be compared with, rather than force-fitted into. Analytical models, currently in category III, would become a subset to the thinking tools of category VI. Serious progress in this direction requires only a shift of perspective about acceptable forms of presentation of research output (p. 409).

As discussed in previous sections, collaboration would benefit from many disciplines that could be applied to particular substantive areas. The conflicting view of managers as technicians versus managers as craftsmen, where in this second view, management is considered an art that is not only about rules and theories (SCHÖN, 1983).

> "Forty-five years ago, in what is now seen as a seminal article, Evan (1965) noted the "widespread neglect of problems of inter-organisational relations" (IOR) by scholars who had focused on the internal structure and functioning of organisations, although, he observed, "managers are greatly preoccupied with IOR" (B-218). Indeed, we now understand that, for participants in inter-organisational relationships (IORs), the management task is formidable; quality of performance is difficult to assure and failure rates for IORs are high (Parise and Casher 2003; Büchel 2003). Evan's proposal to develop a 'theory of IOR' laid down a fundamental challenge to those exploring organisational phenomena, which he later described as an effort to "break out of the prevailing research paradigm" [Evan, (1976), p.12]. Research into relationships between and among organisations has since proliferated, and has started to document The significance of the 'inter-organisational' in an increasingly wide variety of contexts (see, e.g., Barringer and Harrison, 2000; Vlaar, 2008). **Yet, reviews of IOR research suggest that it has proved difficult to accumulate knowledge about IOR that is adequate in its coverage, detail and practical significance** (Barringer and Harrison, 2000; Brass et al., 2004). (Cropper, Ebers, Huxham, & Ring, 2011, p.155)

The preliminary conceptual framework presented in Table 2.9 is a baseline that provides handles and a priori themes for qualitative analysis of the cases in this study. The conceptual framework consists of four interconnected themes: collaboration, design thinking, change management, and project management in the context of open innovation. This framework aims to provide a comprehensive overview of the relationships among these themes while considering the collaboration processes within their organizational contexts. The preliminary framework also provides a structure that highlights the role of the individual in creating artefacts and solutions and tackling challenges within collaboration projects.

The components of the framework, as inspired by the first phase of the extensive literature review for this project, including collaboration, design thinking, change management, and project management processes are proposed as interconnected themes with the aim to individually and collectively contribute to effective interorganizational management of collaborative R&D projects. Where collaboration is essential for interorganizational project management, as it involves the project stakeholders working together to achieve their announced common goals. We also saw in the literature review that design thinking fosters collaboration by encouraging stakeholders to engage in problem-solving behaviors, creating value, addressing complex issues, and promoting iterative approach to problem-solving. It also enhances decision-making processes and supports successful collaborations. Whereas change management ensures that organizations can effectively adapt to changes in project scope, requirements, internal and external factors, enhancing the efficiency of project work and increasing the likelihood of success. In the context of interorganizational R&D collaboration projects, relationships between stakeholders are also key to develop and transfer knowledge, and robust change management practices are important to maintain these relationships when uncertainty is high. Finally, the four proposed components provide a structured framework to potentially enable interorganizational collaboration, resource allocation, and knowledge sharing, as well as to potentially achieve better outcomes in a wide range of project collaboration contexts.

Table 2.9 Preliminary Conceptual Framework

INSIDE THE COLLABORATION PROCESS COMPONENT, THE "FIVE DIMENSIONS THAT COMPOSE THE BLACK BOX OF COLLABORATION PROCESSES" THOMSON AND PERRY (2006)				
Governance How collaborative decisions are made, power is shared, and problems are solved within a group. Participative decision-making, where all parties have a say, and the power is distributed.	Administration The necessary structures and systems to manage the collaborative effort. It involves establishing an administrative capacity that balances the coordination and hierarchical elements with the social capacity to maintain relationships and communication within the collaboration.	Organizational autonomy Balancing individual goals and accountability with organizational and common goals. "This reality creates an intrinsic tension between self-interest — achieving individual organizational missions and maintaining an identity that is distinct from the collaborative — and a collective interest — achieving collaboration goals and maintaining accountability to collaborative partners and their stakeholders." (Thomson and Perry, 2006, p. 26)	Mutuality Forging mutual benefits that arise from collaboration, where organizations have interdependencies based on complementary or shared interests. It occurs when the parties exchange unique resources in a way that all parties find beneficial.	Norms of trust and reciprocity Establishing and building social capital through trust and reciprocity, which are critical for collaborative action. Trust is seen as a belief in the commitment and honesty of others, reducing complexity and transaction costs. Reciprocity involves a willingness to interact and share costs and benefits in a faire manner, with an expectation that this will be reciprocated over time and lead to stable long-term relationships.
Change Management themes; Kotter (1995)				
Establish a sense of urgency. Form a powerful guiding coalition, assembling people who can work well together.	Create a vision.	Communicate the vision. Empower others to act on the vision, change unhelpful structures and experiment.	Plan for and create short-term wins. Consolidate improvements and produce still more change. Promote and reward people. Energize the process of change.	Institutionalize new approaches and evangelize on how new behaviours lead to corporate success.
Design thinking themes; (Stanford D-School model)				
EMPATHIZE: Work to fully understand the experience of the user for whom you are designing. Do this through observation, interaction, and immersing yourself in their experiences.	IDEATE: Explore a wide variety of possible solutions through generating a large quantity of diverse possible solutions, allowing you to step beyond the obvious and explore a range of ideas.	DEFINE: Process and synthesize the findings from your empathy work in order to form a user point of view that you will address with your design.	PROTOTYPE: Transform your ideas into a physical form so that you can experience and interact with them and, in the process, learn and develop more empathy.	TEST: Try out high-resolution products and use observations and feedback to refine prototypes, learn more about the user, and refine your original point of view.
Project management analysis framework; Bourgault (2012)				
Mobilisation	Direction	Structuring	Implementation/Execution	Appropriation
Choosing actors; Maintaining adhesion to the group, Promote cooperation, etc.	Set-up, explain, justify, lead, defend, report, etc.	Functional Framework set-up: roles, coordination mechanisms, decision gates and processes, etc.	Project; initiation, planning, execution, control, closure Goal: produce, integrate, deliver	Lessons learned, transfer and insert knowledge, etc.

2.5.2 Overview and next steps

In this section we present a critical analysis of the literature and a pathway to a preliminary conceptual framework. The literature review conducted for this study was an ongoing and agile endeavor, with the aim of augmenting and enriching the study's conclusions. This ongoing review of the literature persisted throughout this research project and was considered important in understanding collaboration and addressing the additional insights on inter-organizational relationship (IOR) management and collaboration.

The literature review showed that while there is a significant amount of research on collaboration at higher levels of governance, there is a lack of understanding of day-to-day enactment of collaboration and the challenges faced by project managers and teams. Traditional managerial practices are insufficient in addressing these challenges, leading to the need for a better understanding of collaboration project relationships. This study adopts a multidisciplinary approach to explore the enactment of collaboration and the involved stakeholders. It aims to open the black box of collaboration by focusing on the day-to-day activities and concepts of collaboration. The dimensions and sub-dimensions of collaboration building blocks are considered in order to understand the relationships between the core and other building blocks described in previous sections.

We also underline the need for better conceptualizations and models that provide "handles for reflective practice" rather than precise prescriptions. Where we suggest incorporating context and experience insights into a reflective practice approach to enable stakeholders to craft appropriate actions based on their unique circumstances.

We propose a preliminary conceptual framework that integrates the collaboration process dimensions presented in Table 2.9 and which incorporates a high-level project management process framework, and design thinking and change management concepts. The framework aims to address the evolving nature of IOCs and considers the organizational environments in which collaborative research projects occur, with a specific focus on the aerospace industry. It also incorporates elements of macro and micro dimensions related to IORs, macro and micro contexts, and macro and micro processes. These dimensions help in

understanding the properties of organizations, their relations, and related outcomes as well as emphasizing the importance of reflective practice.

The preliminary conceptual framework and the themes framework proposed for the qualitative analysis provide a baseline for the study's analysis of the enactment of collaboration and management processes. The framework considers the role of individuals, organizational contexts, and collaborative project processes, aiming to enhance collaboration stakeholders' understanding and provide insights for reflective practice.

Overall, this section presents a critical analysis of the literature, identifies gaps in research, and proposes a preliminary conceptual themes-based framework for qualitative analysis which serves as baseline tool for the subsequent analysis and exploration of collaboration projects in the study.

CHAPTER 3 RESEARCH DESIGN, METHODOLOGY, AND PLAN

In this chapter, we introduce the research objectives and questions which draws on the literature presented in the previous chapters and in alignment with the framework that stem from an extensive review of existing studies on IOC. There is much to learn about the day-to-day management of these collaborations. To address this shortcoming in the current IOC literature, we propose a multidisciplinary approach to leverage literature from different fields including project management and design thinking and have proposed a framework which include relevant dimensions from these fields. Through the proposed framework we will endeavor to capture the intricacies of the day-to-day management of IOC and overarching enactment of collaborative efforts, spanning from the macroscopic objectives of the participating organizations to the microscopic interactions within and across teams. This approach will guide the extensive examination we intend to undertake, to study individuals, processes, and organizational interactions within interorganizational collaboration ventures.

Furthermore, this chapter describes the methodology and its theoretical and philosophical bases used in this study. Baseline themes for analysis were presented in the previous chapter; this chapter also presents the baseline and the motivation for the methodology, as well as the research design including reasoning for the choice of case studies and method, as well as the data collection strategy.

3.1 Research objectives

Although this study has matured during its life cycle due to new information, knowledge, and learning, the objectives of exploring IOC R&D projects in the aerospace sector remain:

- study the enactment of interorganizational R&D collaboration through the lens of a preliminary conceptual framework which leverages a multidisciplinary approach
- identifying the dimensions and attributes inside the backbox of collaboration management; what is lived day-to-day in interorganizational R&D project collaborations

- exploring stakeholders' interactions, behaviours, relationships, and practices in the context of R&D collaboration projects

These objectives have been further refined following the extensive literature review. They enable a comprehensive and well-suited approach for exploring the complexities of IOC projects. By leveraging a multidisciplinary approach and the proposed preliminary conceptual framework, we aim to provide a detailed analysis of the interorganizational R&D project collaborations we developed for this research project. Where we also expect to capture various perspectives on the interactions within these projects. Furthermore, we focus on unveiling the day-to-day experiences inside the "black box" of collaboration management at the micro and macro levels, and we hope, we can offer insights into the factors that contribute to collaborative projects outcomes. Lastly, through examining the stakeholders' interactions, behaviors, relationships, and practices, the analysis will explore the human element of collaboration and aim to identify the underlying motivations and actions that drive project outcomes. These combined objectives form a solid foundation for investigating the complex world of interorganizational R&D collaborations in the context of the aerospace sector.

Based on the above objectives, we propose the following research questions:

- How does the proposed conceptual framework enhance our understanding of the processes and practices of interorganizational collaboration?
- What are the day-to-day practices and interactions that are lived inside the "black box" of interorganizational R&D collaboration projects management?
- What are the stakeholders' interactions, behaviors, relationships, and practices which impact interorganizational R&D collaboration projects?

3.2 Research strategy

This section describes the research strategy framework, the philosophical approach, the paradigms anchoring this research, and the corresponding research design.

According to Crotty (1998), the four basic elements of the research process are methods, methodology, theoretical perspective, and epistemology. He defines them as:

- Methods: the techniques or procedures used to gather and analyze data related to some research question or hypothesis.
- Methodology: the strategy, plan of action, process or design lying behind the choice and use of particular methods and linking the choice and use of methods to the desired outcomes.
- Theoretical perspective: the philosophical stance informing the methodology and thus providing a context for the process and grounding its logic and criteria.
- Epistemology: the theory of knowledge embedded in the theoretical perspective and thereby in the methodology. (p. 12)

Guided by Crotty, we address the following questions:

1. What methods do we propose to use?
2. What methodology governs our choice and use of methods?
3. What theoretical perspective lies behind the methodology in question?
4. What epistemology informs this theoretical perspective? (p. 2)

Although Crotty proposes that the four basic elements are sufficient and that introducing ontological issues can complicate them, we have opted to include ontology to inform our philosophical posture of this study as addressed below.

Furthermore, the research plan for this study follows the pragmatic recommendations from Onwuegbuzie and Leech (2005) on research methodologies, the majority of which converge and include the following common steps:

1. formulate a research problem and research objective
2. develop research purpose, research questions(s), and hypotheses
3. select a research design/method
4. collect data
5. analyze data
6. interpret/validate data
7. communicate findings

Moon and Blackman (2014) define ontology as “the study of being, what actually exists in the work about which humans can acquire knowledge” (p.1170), what is reality, and how we understand it, what is a fact. Also (Crotty, 1998) defines ontology as the study of being, what constitutes reality, and what is. Epistemology is “the study of knowledge” (p.10), how do we know what we know, how do we create knowledge, and what is possible to know.

Additionally (Osterwalder, 2004) describe ontology as “the philosophical discipline that deals with the nature and the organization of reality” (p.39), stating also that epistemology is the discipline that “deals with the nature and sources of our knowledge” (p.39). Ontology, as the nature of reality, and epistemology, as how to discover new knowledge, impacts the methodology and the methods used for this study.

Although two ontological perspectives were examined for this study, namely, realism and relativism, we have opted for a relativist ontological stance. The critical realist assumes that one reality exists but can never be understood perfectly because of “basically flawed human intellectual mechanisms and the fundamentally intractable nature of phenomena” (Guba & Lincoln, 1994, p. 110) and as such “claims about reality must be subjected to the widest possible critical examination” (Moon & Blackman, 2014, p. 1170) to understand reality as closely as possible. There are two dimensions in critical realism: the reality independent of what we think of it, and our knowledge of reality (Wikgren, 2005). While the perspective of Relativists, who claim that reality is a product of the mind and unique to each individual, is intriguing, we favor the perspective of a bounded relativist. This view maintains that a shared reality exists within a specific group, such as cultural or moral, while different realities can exist across groups. For instance, a particular moral stance like anthropocentrism, which prioritizes human-centered values, may define a particular reality, but it could differ when viewed from an alternative moral position, like ecocentrism, which prioritizes nature-centered values (Moon & Blackman, 2014).

The epistemological perspective for this study is constructionism, which “asserts that social phenomena and their meanings are continually being accomplished by social actors” (Bryman, 2016, p. 30), and also where “meaning is created by the interplay between the subject and object, where the subject constructs the reality of the object” (Moon & Blackman, 2014, p. 1169).

As philosophical perspectives represent researchers’ values and beliefs, and thus impacting the research design, methodology, and methods, as well as data analysis and interpretation:

> Philosophical perspectives, also called paradigms (Guba & Lincoln, 1994; Morgan, 2007), perspectives (Patton, 2002), and worldviews (Creswell, 2009), can be defined as “a basic set of beliefs that guide action” (Guba, 1990, p. 17). So, where epistemology is about beliefs around knowledge, philosophical perspectives can be

> considered a set of assumptions that structure the approach to research. A philosophical perspective is something personal that drives the way research is conducted; it is underpinned by ontological and epistemological leanings and influences how a researcher creates knowledge and derives meaning from their data. For example, the mere choice of what to study in the sciences imposes values on one's subject (Ruse, 1988). Philosophical perspectives are shaped by the discipline of the researcher, their beliefs, and past experiences (Creswell, 2009), and are applied to the purpose, design, methodology, and methods of the research (see Newman et al. [2003] for a typology of research purposes), as well as to data analysis and interpretation (Slife & Williams, 1995) (Moon & Blackman, 2014, p. 1173).

The pragmatist paradigm most reflects our stance as it relates to this research topic, which posits that all necessary approaches required to understand research problems can be used, where the value of derived knowledge is judged by how useful it is to humans. "Pragmatists agree that research should be contextually situated without being committed to any one philosophical position, instead using a diversity of methods to understand a given problem" (Creswell, 2009 in Moon & Blackman, 2014, p. 1175). Therefore, research is impacted by interpretivist and social constructivist perspectives. Interpretivists seek to understand, through qualitive analysis, the development of phenomena (Moon & Blackman, 2014), where reality is socially constructed and subjective (Mark Saunders, 2009). Social constructivists "study the multiple realities constructed by people and the implications of those constructions for their lives and interactions with others" (Patton, 2002, p. 96 in Moon & Blackman, 2014, p. 1174), and they construct meaning as they interpret their world, which is different for different individuals.

Deductive, inductive, and abductive approaches, presented in the following sections, are used to guide data collection efforts, data analyses, and interpretation in our multi-method analysis approach. Confirming an existing theory was not the goal of this study, but the extensive literature review guided the study purpose and inspired the baseline themes for the multi-method approach, where, we started with a top-down deductive approach, leveraged inductive reasoning by studying "patterns, consistencies, and meanings" (Gray, 2009, pp. 17–18), and then used abductive reasoning to generate new insights from previous phases of the analysis.

This study describes and interprets the actions, views, and experiences of individuals with a qualitative methodological approach, where research findings fall on a continuum with overlapping and borderline studies between typologies. Where being closest to the data

amounts to no findings or survey data, but not qualitative research, whereas on the right end of the continuum indicates the more descriptive, interpretive and explanatory nature of findings and the highest transformation of data, which is where this study lies.

To summarize the previous paragraphs, Table 3.1 provides and overview of this research design approach including the theoretical and philosophical underpinnings of this research approach.

Table 3.1 Philosophical underpinnings of this study research approach

RESEARCH PLAN	INSPIRED BY CROTTY, AND STEPS FROM ONWUEGBUZIE AND LEECH (2005)
Ontology	Bounded relativist
Epistemological	Constructionism
Paradigms	Pragmatist; interpretivist and social constructivist
Research approaches	Deductive, inductive, and abductive

3.3 Research methodology and methods

Qualitative research allows for refinement of open research questions as the research progresses. Although theory plays a role in this approach, it is "a starting point, but no more than that. The systematic search for new insights is central to the research activities" (Jonker & Pennink, 2010, p. 78).

Qualitative research methods align with a constructivist paradigm and relativist ontology. The findings are not fixed but rather emerge from the researcher's interaction with the research area. The researcher interprets the data and constructs arguments through dialectic reasoning (Guba, 1990 in Walker, 2006).

Reasons for choosing a qualitative study are "to emphasize the researcher's role as an active learner who can tell the story from the participants' view rather than as an expert who passes judgment on participants" (Walker, 2006, p. 41), and:

> The conviction of the researcher based on research experience; the nature of the research problem; to uncover and understand what lies behind any phenomenon about which little is yet known; to gain novel and fresh slants on things about which quite a bit is already known; and to give intricate details of phenomena that are difficult to convey with quantitative methods (Strauss & Corbin, 1990, p. 19 in Walker, 2006, p. 48).

Furthermore, qualitative research offers a range of warrants for exploration, and regardless of the theoretical underpinnings, one of its primary appeals is the intellectual adventure it provides. The interest is this research lies in navigating the complexities and challenges of the project, where initial ideas are often challenged by unexpected observations and patterns. The result is a theoretical framework that can illuminate broader perspectives, extending far beyond what could have been imagined at the outset. This intellectual stimulation sustains researchers as they spend months or years immersed in their work, searching for inspiration to guide their theorizing. In particular, abductive reasoning seeks to revive the intellectual stimulation of discovery in qualitative work by emphasizing the process of theorizing (Tavory & Timmermans, 2014).

> "Whatever other reasons motivate our research, this excitement allows us to stick to it, to spend months and years poring over observations and looking for diverse sources of inspiration through which to theorize it. This excitement does not emerge automatically. To experience it, we must organize the research project in particular ways. Neither the reification of methods in grounded theory nor a focus on one's favourite theory in extended case method does justice to this excitement. We have spoken to grounded theory practitioners who were dutifully coding mountains of data with no end in sight, and deductive researchers who were mildly annoyed by the fact that it took so long to get interviewees to come out with "the right quote." Abductive analysis is an attempt to both do justice to the process of theorizing and to revive the excitement of discovery in qualitative work (Tavory & Timmermans, 2014, p. 7).

3.3.1 Abductive reasoning, deduction, and induction

> The abductive approach stems from the insight that most great advances in science neither followed the pattern of pure deduction nor of pure induction (Kirkeby, 1990; Taylor et al., 2002). While most sources quote Charles Sanders (Santiago) Peirce for coining the term "abduction" (see, for example, Danermark, 2001; Taylor et al., 2002), Peirce (1931) himself traces it back to Aristotle (Kovács & Spens, 2005, p. 135).

Pierce reintroduced abduction, deduction, and induction approaches originally from Aristotle to uncover the logic through which ideas are born: "Peirce called this stage abduction and described it as the first stage of inquiry where new ideas or hypotheses are invented to explain meaningful underlying patterns of selected phenomena" (Mirza et al., 2014, p. 1982). Hypotheses can be further explored through deductive or inductive reasoning. Abduction overcomes the lack of clarity when selecting theory in a deductive

approach, and the challenge of theorizing through empirical data (Dudovskiy, 2016). They go on to say that abduction is a creative process that includes inferences to create new knowledge, and that these inferences involve integration and justification of ideas.

Timmermans and Tavory (2012) argue that abduction is more appropriate for empirical based theory construction than induction. They state that abduction as an inferential process based on surprising phenomena arising during an analysis and the researcher's social and intellectual goals to produce new hypotheses and theories, and that the process can be aided by methodological data analysis.

> While abductive reasoning allows one to conceive ideas from vague, possible, or potentially possible phenomena, deductive and inductive reasoning allow for the consequent processing of those ideas (Raholm 2010a). This process can be explained as such:
>
> 1. Surprising phenomena emerge and require an explanation because they do not follow an accepted hypothesis;
>
> 2. a new hypothesis that predicts these phenomena is adopted through abduction;
>
> 3. necessary and probable experimental consequences of the hypothesis are traced out through deduction;
>
> 4. when tests verify prediction after prediction, the hypothesis is stationed among scientific results through induction (Haig 1999, Raholm 2010a, Lawson & Daniel 2011) (Mirza et al., 2014, p. 1982).

Abductive reasoning is also referred to as "retroduction", "abduction", "abductive thinking", and "abductive inference" (Mirza et al., 2014, p. 1984). A case model in Table 3.2 illustrates the comparison of deduction, induction, and abduction described by (Niiniluoto, 1999). According to the author, deduction, induction, and abduction are three distinct types of reasoning. Deduction starts with general principles and applies them to specific cases, whereas induction starts with specific observations and generalizes them to broader principles. Abduction, on the other hand, begins with surprising or anomalous observations and seeks to provide the best possible explanation for them. (Niiniluoto, 1999) sees abduction as a creative and critical process that involves selecting the most plausible hypothesis based on a variety of factors, including explanatory power, simplicity, and coherence.

Table 3.2 Comparison of deduction, induction, and abduction (Adapted from Niiniluoto, 1999)

Deduction	All the beans from this bag are white.	These beans are from this bag.	These beans are white.	Used for the analysis illustrated in Chapter 4.
Induction	These beans are from this bag.	These beans are white.	All the beans from this bag are white.	
Abduction	All the beans from this bag are white.	These beans are white.	These beans are from this bag.* *Plausible abductive inferences.	Used for the analysis illustrated in Chapter 5.

When using an abductive approach, researchers aim to identify the most suitable explanation among multiple options to account for unexpected observations or inconsistencies encountered during the research process. To achieve this, researchers may employ both numerical and cognitive reasoning to develop a theoretical framework that fits the data (Dudovskiy, 2016).

According to Timmermans and Tavory (2012), abductive inferences involves preliminary guessing when anomalies arise, which is based on existing theory and data, which then requires the inductive development of new concepts, followed by potentially other surprises during this recursive process of double fitting data and theory. The authors argue that abductive analysis has a recursive aspect, which can be understood in two ways. First, sharing research within a community of inquiry helps refine theoretical constructs, emphasizing collaboration over isolated thinking. Second, abductive analysis initiates both inductive and deductive reasoning, which may be repeated as new findings arise. Induction seeks to corroborate generalizations and patterns, while deduction prompts reanalysis or additional data collection.

Additionally,

> The creative-intuitive aspect of abductive research (Taylor et al., 2002) along with its ability to distinguish between the general and the particular (Danermark, 2001) makes it very suitable for the first phase of research, which is concerned with the formulation and selection process of H (Hypotheses) or P (Propositions) (Kirkeby, 1990). In this context, abductive research will help to derive H/P that can later be tested in a deductive phase of research. (Kovács & Spens, 2005, p. 138).

And, “it is argued that case studies and action research (Alvesson and Skoldberg, 1994; Dubois and Gadde, 2002; Wigblad, 2003) use abductive reasoning very commonly.” (Kovács & Spens, 2005, p. 139.)

“Qualitative researchers navigate treacherous waters” (Tavory & Timmermans, 2014, P. 1). In some instances, despite having ample data and themes, researchers fail to produce valuable summaries, resulting in unpublished or incomplete research, due to an inability to think theoretically. Conversely, researchers may attempt to force-fit ideas into predetermined theoretical frameworks. (Tavory & Timmermans, 2014) further discuss the challenge of constructing theories in qualitative research, which involves reducing data while extending it to other phenomena and research subjects. The authors advocate a pragmatist approach inspired by Charles S. Peirce, in which researchers iterate between observations and theoretical generalizations. They argue that theory generation requires creative inference and abduction, which involves forming an opinion without complete evidence about data that does not fit existing theories to produce new hypotheses. The authors do not accept the distinction between discovery and justification, arguing that creativity is inherent in the research process, and emphasize the importance of theorizing as a craft that can be improved through community involvement. Ultimately, the craft of theorizing in research involves solving practical problems by making sense of data.

The following sections illustrate some of the analysis methods used for this study, which influenced the analysis process. In particular, the following sections explain why case studies were selected as one of the research methods for this study. It will allow for thorough and context specific textual data to be analysed through an in-depth exploration of the artefacts and the interactions within the cases within their real-life context. Furthermore, we used content analysis as the first method to deductively code the a priori themes, followed by a general inductive analysis method, which allowed for a comprehensive examination of the codes and allowed for new codes and themes to be inspired by the textual data of the cases.

Adopting this multi-method approach we believe provides comprehensive and richer insights from the cases.

3.3.2 Case studies

Case studies are appropriate to study complex phenomena within the phenomenon context. The method must be based on sound logic that supports the methodology (Walker, 2006). It is also important to select a method that considers its impact on the research and its outcomes. The method should be feasible with no major risks to the execution of the study. Therefore, case studies were deemed most appropriate for this project.

A case study is an "intensive description and analysis of a singular unit or bounded system such as an individual program, event, group, intervention, or community" (Merriam, 2002, p. 8).

Also,

> According to Yin (2003), case studies are the preferred method when:
>
> - How or why questions are being posed "such questions deal with operational links needing to be traced over time, rather than mere frequencies or incidence"
> - When the investigator has little control over events
> - When the focus is a contemporary phenomenon within some real-life context
> - When very little is known about a topic" (Petit, 2012, p. 86).

And "a case study is an exploration of a bounded system or a case (or multiple cases) over time through detailed, in-depth data collection involving multiple sources of information rich in context" (Creswell, 1998, in Walker, 2006, p. 61).

As mentioned in the previous sections, the research design for this study is based on a qualitative approach and a pragmatist, interpretative/constructivist paradigm. As a qualitative case study research method, it is appropriate for complex and dynamic contexts related to interorganizational collaboration based on Calamel et al. (2012): "Following Söderlund's (2005) recommendations, we argue that process oriented qualitative methodologies may prove more effective than survey research in revealing the deep structures and the dynamic nature of complex human systems such as interorganizational project collaboration" (p. 51). Case studies are also preferred due to availability of research artefacts from interorganizational collaboration management projects in the target organization we plan to study. The case studies are retrospective and include comprehensive written communication artefacts among stakeholders, which provide a better understanding

of the context. Case studies can be studied qualitatively, quantitively, or through mixed methods, and their use is based on what is expected to be studied (Petit, 2012).

Morton et al. (2006) discuss an appropriate method for studying complex manufacturing organizations and product development, which is similar this study's context. They state that a case study approach is highly appropriate for this type of context and justify its advantage as

> This approach is thought to overcome the bias inherent in a single method approach (Gill & Johnson, 1991). It is particularly useful when the research phenomenon is not easily distinguishable from its context (Yin, 1993). It also helps to isolate individuals and organizations to study their situation in greater detail, affording an accurate understanding of the experiences, perceptions, and interactions between those involved in product development and the way this affects its success. Moreover, given that Yin stresses that the importance of case study research is to generalize to theory and not to the wider population (Yin, 2003), case studies also provide detailed, rich, and often anecdotal accounts of complex events and situations (p. 3233).

During the case analysis it is important to be cognizant of intimacy paradox, in which although being embedded within an organization may give one access to privileged information and a wide spectrum of actors, the employee/researcher needs to balance the tension between having close access for richer insights and maintaining a professional stance to ensure an objective analysis. The researcher must strike a delicate balance to ensure an ethical and rigorous research analysis. (Arnoux, 2013) suggests that the more a researcher develops a close relationship with the participants, the more likely they are to disclose information. However, as the researcher becomes more involved in the studied cases environment, they may tend to agree with the participant by offering a reciprocal level of intimacy.

A case study is "a vehicle for in-depth description and analysis" (Merriam, 2002, p. 8) and can be combined with other methods to further analyze data. Case study is selected because it is a "bounded system" (Merriam, 2002, p. 8) that describes a phenomenon or social unit which are well defined in scope and boundaries and allows the research to focus on the particular context and for the analysis to remain relevant given the complexity and the intricacies of the cases to be studied.

Allred et al., (2011) also used case studies to study collaboration, the issues of which they describe as complex and not well understood. They highlight the work of Yin (1981), Meredith et al. (1989), and McCutcheon and Meredith (1993) to underline the appropriateness of cases studies "to explore the complex what, why, and how questions associated with organizational conflict, dynamic capabilities, and performance outcomes" (p. 137). Case studies allow for in-depth investigation of complex issues of collaboration in real-life contexts and is "the process of learning about the case and the product of our learning (Stake, 1995)" (Roets & Maritz, 2017, p. 53).

In addition to case study, this study also uses a general inductive analysis method, a combination of methods and approach similar to the proposal by Halaweh (2008) of integrating case studies and grounded theory as a research method (Halaweh, 2008). Grounded theory is illustrated by specific and systematic coding, looking for relationships between categories through axial coding, and integrating categories through selective coding, leading to theoretical saturation when no new insights emerge from the data (Saunders et al., 2009).

3.3.2.1 Content analysis of the cases

Krippendorff (2004) defines content analysis as "a research technique for making replicable and valid inferences from texts (or other meaningful matter) to the contexts of their use" (p. 18). It is a scientific analysis tool used by researchers, which is independent from researchers' authority, that describes phenomena and informs action. Techniques used are reliable, which is demonstrated by replicability of valid results by different researchers, and which are upheld through independent evidence; however, context must be provided to guide replicability (Krippendorff, 2004).

This study uses Krippendorff's (2004) definition, which is that content emerges in the analysis processor relative to the context. Krippendorff provides the following definitions based on the literature:

1. definitions that take content to be inherent in a text
2. definitions that take content to be a property of the source of a text
3. definitions that take content to emerge in the process of a researcher analyzing a text relative to a particular context (Krippendorff, 2004, p. 19).

Krippendorff's definition does not ignore the researcher's contribution into what counts as content, and that this content is not only meaningful to the researcher but also to others. He stresses that the essential element of his definition was paraphrased by Merten (1991): "Content analysis is a method for inquiring into social reality that consists of inferring features of a nonmanifest context from features of a manifest text" (p. 24). Mayring (2000) also states that content analysis is not only concerned with the manifest content of data.

Krippendorff (2004) argues that context is constructed irrespective of the efforts to objectify it, and that theories from different disciplines (hermeneutics, semiotics, and communications) reflect processes of moving from text to the use of the text:

Every content analysis requires a context within which the available texts are examined. The analyst must, in effect, construct a world in which the texts make sense and can answer the analyst's research questions. A context renders perceptual data into readable texts and serves as the conceptual justification for reasonable interpretations, including for the results of content analysis (p. 24).

And finally, regarding abductive reasoning, Krippendorff (2004) contends that the "whole enterprise of content analysis may well be regarded as an argument in support of an analyst's abductive claims" (p. 38), where phenomena may not be directly observable thus statistical knowledge, theory, and experience can be used as research objectives.

Mayring (2000) suggests that content analysis follows inductive and deductive reasoning, which may be combined with other qualitative procedures. Mayring's approach to content analysis emphasizes the importance of both deductive and inductive reasoning in analyzing textual data. He cites Krippendorf (1980) regarding how categories are developed: "How categories are defined ... is an art. Little is written about it" (p. 76), which suggests that abductive reasoning is implicit in the analysis. Elo and Kyngäs (2008) describe inductive and deductive content analysis as having three phases: preparing, organizing, and reporting. They confirm that concepts can be inductively derived from the data when the phenomena is new, whereas a deductive approach can be used if the analysis is based on previous knowledge. This study will use deductive, inductive, and abductive approaches to leverage previous knowledge as a starting point, infer new knowledge from the data, and develop categories based on theory, data, experience, and intuition.

For reliability, replicability is ensured through a detailed record of analysis steps (Mackey & Gass, 2005). Additionally, validity is ensured by more than one coder agreeing on the codes—discrepancies are reconciled through discussion based on contextual knowledge (Campbell et al., 2013). Given that, in this study, the coding exercise includes themes analysis, particular attention is given to ensure the first coder does not "train(s) another to think as she or he does when looking at a fragment of text" (Vaismoradi et al., 2013, p. 403). Interestingly, there is potential for triangulation through the analysis of codes of different cases (codes that were coded at different times by the same coder), although standard reliability checks as suggested by Mackey and Gass (2005) were not done, "inter-case agreement" is established on the latent and manifest meaning of these codes. To this end, Potter and Levine-Donnerstein (1999) posit that

> content analyses need not be limited to theory-based coding schemes and standards set by experts. When researchers are clear about what kind of content they want to analyze and the role of theory in their studies. they are in a better position to select the most appropriate strategies for demonstrating validity and reliability (p. 258).

Campbell et al. (2013) are skeptical of reliability in qualitative research; however, they specify that the quality of the findings reflects the quality of the research if new insights are provided. Given the qualitative nature of this study, the next section addresses trustworthiness in case studies.

Kohlbacher (2006) argues that the use of qualitative data analysis in case study research to interpret text is a strong method and a comprehensive approach that "respects the credos of openness and theory-guided analysis at the same time" (p. 27), but cites Jick (1979) in cautioning that "[r]eplicating a mixed-methods package […] is a nearly impossible task" (p. 27), nonetheless, he encourages researchers using case study as a strategy to use qualitative content analysis.

Content analysis is contextual and concerned with manifest phenomena—this study uses themes to categorize data based on both latent and manifest content:

> In spite of many similarities between content and thematic analysis, for instance cutting across data, and searching for patterns and themes, their main difference lies in the possibility of quantification of data in content analysis by measuring the frequency of different categories and themes, which cautiously may stand as a proxy for significance (Vaismoradi et al., 2013, p. 404).

3.3.2.2 General inductive analysis of the cases

The general inductive analysis approach is a simple, straightforward, reliable, and valid analysis method that is less complicated than other methods in terms of focused evaluation questions (Thomas, 2006).

The general inductive approach analytical strategy is as follows:

1. Data analysis carried out through multiple readings and interpretations of the raw data, where the findings are induced from the analysis and not from a priori expectations. The research objectives or any a priory framework provide domain focus.
2. Categories are developed from the data inspire a model or framework. The framework includes the themes constructed during the coding process.
3. The evaluator interprets the data multiple times, a process which is influenced by the assumption and experience of the evaluator.
4. The findings may be different and may have components that not overlapping between different evaluators as they are influenced by their assumptions and experience.
5. The trustworthiness can be addressed with techniques used for other types of qualitative analysis (e.g., Lincoln & Guba, 1985) (Thomas, 2006. p. 240).

The approach is similar to grounded theory but does not distinguish between open coding (e.g., finding basic sub-themes in the text from words or parts of the text) and axial coding (comparing and grouping sub-categories into larger global dimensions), and is not a theory building analysis approach (Thomas, 2006). Its theory building is limited to presentation and description of identified categories as the most important in the analysis process (Blais & Martineau, 2006).

3.3.3 Trustworthiness

The four general types of trustworthiness in qualitative research proposed by Lincoln and Guba (1985) cited by (Thomas, 2006), credibility, transferability, dependability, and confirmability, are favourable (Shenton, 2004), and align with this research approach and analysis. Specifically:

- conducting peer debriefings and stakeholder checks for establishing credibility

- auditing the research throughout the analysis phase for dependability by comparing the findings and interpretations to data
- checking inter-coder agreement for codes and themes interpretation throughout the analysis phase (the second coder was also a stakeholder who provided comments on categories and interpretations for the first case, and at checkpoints during analysis to validate findings)

Shenton (2004) proposes that researchers should satisfy these four criteria to establish trustworthiness:

> In addressing **credibility**, investigators attempt to demonstrate that a true picture of the phenomenon under scrutiny is being presented. To allow **transferability**, they provide sufficient detail of the context of the fieldwork for a reader to be able to decide whether the prevailing environment is similar to another situation with which he or she is familiar and whether the findings can justifiably be applied to the other setting. The meeting of the **dependability** criterion is difficult in qualitative work, although researchers should at least strive to enable a future investigator to repeat the study. Finally, to achieve **confirmability**, researchers must take steps to demonstrate that findings emerge from the data and not their own predispositions (p. 63).

In part and to address some of these four criteria, there were numerous exchanges with stakeholders and subject matter experts (SMEs) on the research topic and methodology. In addition to meetings and reviews throughout the learning cycle of this study, during data analysis there were regular meeting and interactions with several stakeholders including the thesis supervisor, the second coder, and other SMEs.

3.4 The aerospace organization

This section provides an overview of the context within which innovation project cases in this study are executed. The Canadian aerospace company Aero1 (Aero 1 is fictive name used to mask the name of the company) is world leader in its sector with annual revenue exceeding several billion dollars and a worldwide presence. This Canadian aerospace company spends over seven percent of its annual revenue on R&D and ranks among the top 10 R&D spenders in the aerospace sector in Canada.

Aero1 has a significant collaborative university research portfolio with millions of dollars spent on collaborations and a history of collaborative research going back several decades.

This rich and varied portfolio provides several cases from major national collaborative projects, which have been tracked over a period of five years.

Seven cases are part of the initial selection process, all at the main Canadian location of the company in Montreal. These cases reflect R&D collaboration projects that aim to develop innovative software components, and which are performed by teams dispersed across the collaborating organizations.

Figure 3.1 illustrates the intra-interorganizational relationships of the complex and connected ecosystem of the cases. The product/project development portfolio requires continuous and quality interactions between ecosystem parties, where the product/project life cycle, from idea to post-delivery, is planned in detail among numerous stakeholders. Internal stakeholders include:

- advanced technologies and innovation
- R&D and portfolio management
- project management and project management office (PMO)
- product management
- engineering and operations
- strategic sourcing and supply chain management
- globally dispersed engineering teams using different development methodologies (ranging from extreme programming and agile to spiral and waterfall)
- sales and operations management
- strategic marketing and communications
- sales and marketing
- quality control and safety
- legal and controlled goods
- intellectual property
- manufacturing, operations, and facilities
- customer services and post-delivery services

Stakeholders must collaborate intra-organizationally and inter-organizationally to execute the project. They review and implement considering the impact on the entire organizational

ecosystem—the project development life cycle. Project development inputs include software components, which are expected to be developed in collaboration with third party organizations (the selected cases), thus adding complexity.

Additional challenges that require close intra-interorganizational collaboration include reconciliation of the product and project development life cycles, including the collaborative research project development life cycle and required continued alignment with the corporate R&D strategy. This reconciliation involves several internal multidisciplinary teams, external collaborators, vendors, and customers. Any action taken at different levels in the organization may impact product/project performance, thus affecting the performance of the whole portfolio including delaying the development and introduction of new products. Other impacts may include intellectual property right challenges that directly impact the portfolio if not addressed early in the process by the appropriate stakeholders.

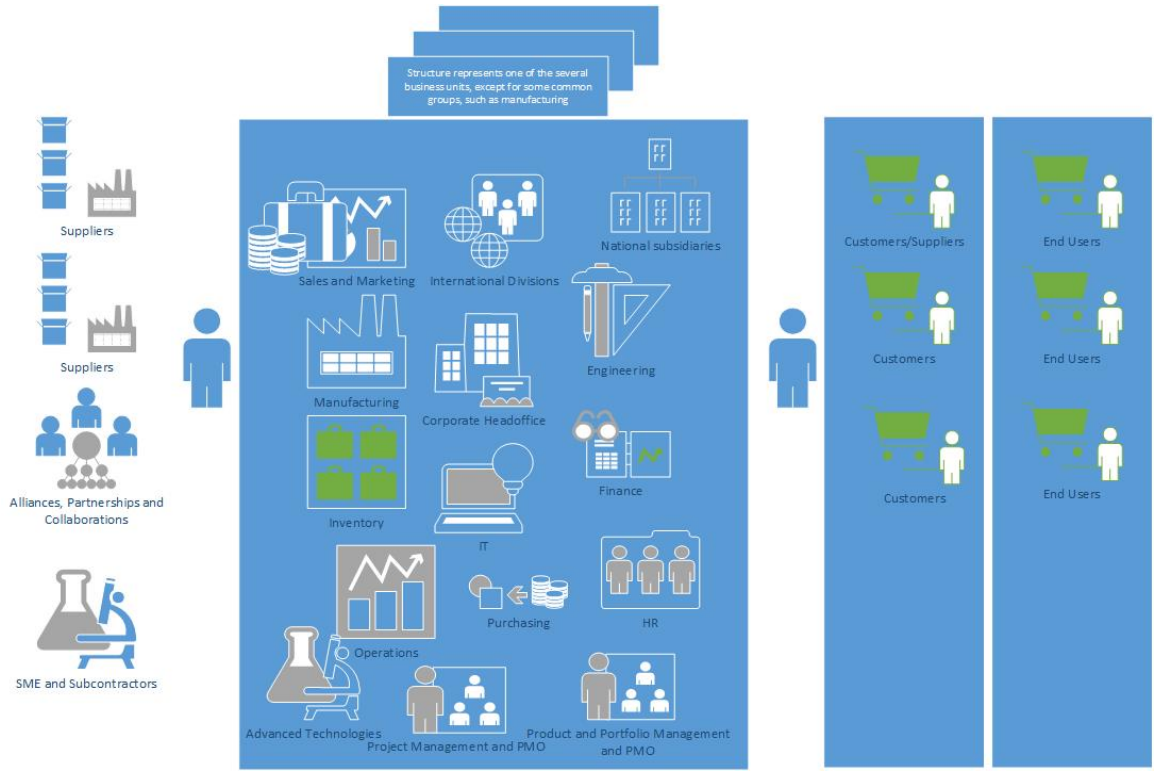


Figure 3.1 An example of an intra-interorganizational ecosystem

The need for close interorganizational collaboration, due to the impact of such collaboration on innovation, cannot be understated. (Davies et al., 2003) highlight how innovation management has highly encouraged close collaboration and communication between product design and production operations, where relying on personal interactions to address the tacit aspects of both design and successful manufacturing transfer has been critical to the success of the development process. Emphasizing the significance of mostly informal processes in facilitating effective feedback between product and process design.

Additionally as we have seen in previous sections, aerospace products and services are complex systems (Hobday, 1998), where they present a unique challenge for the dynamics of innovation and collaboration processes. For example, the complexity of a flight simulator is is illustrated by several critical dimensions describing this complex product, such as, high unit costs, high degree of customization of components, architecture, and final system (Hobday, 1998).

Another interesting reality facing this ecosystem is the digital transformation of these organizations, a trend that is proliferating across the industrial economy “there is a push to compete through new services and service innovation, creation of knowledge, products and services enabled through technological advancements, online communities of companies and consumers, and adoption of distributed co-creation; all of which are still in their infancy—And so is their project management” (Sankaran & Agarwal, 2012, p. 2).

Users’ involvement throughout the life cycle of complex products is crucial, in addition to regulators who must be involved at critical phases of design, development, validation, and commissioning. These dynamics have a significant impact on collaborative research projects and provide inputs to product development processes.

Davies, and Hobday (2005) propose that CoPS products are project centric and often resemble a separate firm with its own structure functioning in a larger organization. Innovation driven by project collaborators and stakeholders is an essential aspect of these projects. These projects are situated within production networks, where formal alliances are established to organize and coordinate innovation. These products are typically developed individually, customized, and produced in small batches or unique projects for specific

customers. Transactions tend to be infrequent, high in value, and extended in duration. For instance, the design and implementation of a power network control system may span a decade, as might the development lifecycle of an aircraft from conception to first flight. Davies and Hobday (2005) assert that the Project-Based Organization (PBO) exemplifies a concurrent, outward-facing approach to project management capable of fostering innovation in collaboration with clients and suppliers, making it the prevailing model in the aerospace industry for managing collaborative research projects.

The following paragraphs will explore the interorganizational collaboration and innovation practices used by Aero1. Faems et al. (2005) suggest there are benefits of organizing and categorizing interorganizational collaborations into portfolios aligned with innovation strategy. The PMI standard defines a project portfolio as: "a collection of projects or programs and other work that are grouped together to facilitate effective management of that work to meet strategic business objectives" (Petit, 2012, p. 1). The focus being on doing the right work, as opposed to doing the work right; these portfolios must be aligned with the organizational strategy at all levels including short- and long-term, as well as including resource prioritization, whether human, financial, or capital, ensuring the operational capacity of the organization and its priorities. The management of these portfolios becomes more complex in organizations with complex structures producing complex products and being involved in R&D projects. Petit makes an analogy to

> financial portfolios but the primary focus of PPM [project and portfolio management] is on how to select and prioritize projects to ensure that risks, complexity, potential returns, and resource allocations are balanced and aligned to the corporate strategy in order to provide optimal benefits to the enterprise (p. 1).

He further argues "that it is no longer sufficient to develop unique resources or capabilities to gain a strategic advantage but that these resources and capabilities must be constantly re-allocated and re-optimized to adapt to changing environments" (p. 4). Thus, properly managing project portfolios (collaborative, hierarchical, or market) requires efficient intraorganizational and interorganizational collaboration to ensure strategic alignment and resource coherence across organizations as illustrated in Figure 3.2 for company Aero1.

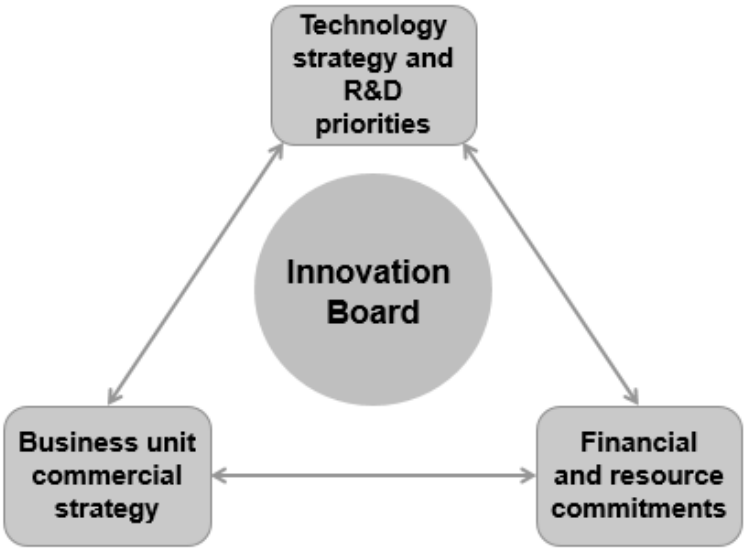


Figure 3.2 Aero1 Innovation Portfolio Management Overview

One of the measures of innovation portfolio performance used by Aero1 is R&D intensity, which is an important indicator of companies' ability to convert research into innovative goods and services and further strengthen the organizations' propensity to collaborate (Tidd, 2001). Additional measures include number of patents and products announcements.

3.5 The interorganizational collaboration cases from the aerospace organization

As presented earlier, retrospective case studies have been deemed suitable and will be used in this study. Also, given the topic of interest, the study will include collaborative R&D project cases from an aerospace company in Canada.

The next sections provide an overview of the cases, as well as the specific organizational context where data is collected. Due to the types of questions asked before, during, and after the literature review, and to avoid researcher bias, an inductive approach is most appropriate for this study to make sense from this data. Although a predetermined hypothesis is not posited, the baseline of predetermined codes is inspired from the literature review based on the preliminary conceptual framework and its dimensions, which is then used deductively as the starting point during the overall analysis for the validation of the framework and the inductive coding process. This hybrid approach was presented by Saunders (2009) to

interpret data during analysis: “It is also likely that this (inductive) approach will combine some elements of a deductive approach” (p. 490).

To interpret and make sense of the data is a hermeneutic activity—a mental construction of an experience in comparison to previous experiences.

> How does meaning emerge? Most of the time, meaning in action appears "in hindsight." It is not immediate but attributed retrospectively through interpretation. Assigning meaning is therefore a hermeneutic activity: meaning is a mental construction that occurs during an experience, which is related to previous experiences. By simplifying and generalizing, it is possible to identify some characteristics of the meaning-making process (Barbier & Galatanu, 2000): it can be both cognitive and affective; it is based on a certain interpretive tradition; it involves connecting prior representations with new ones; it also requires qualifying new experiences or interpretations in light of old ones; it leads to a transformation of representations, ultimately resulting in a change in the identity of the actor who constructs meaning. The researcher, in their analytical approach, is tasked with uncovering the meaning that the actor has built from their reality. As Savoie-Zajc (2000) points out, the value of qualitative research largely depends on the researcher's ability to make sense of the data. Extracting this meaning allows, in a way, to go "beyond" what the raw data initially suggest (Denzin, Lincoln et al., 2005). (Blais & Martineau, 2006)

The next section describes the selected cases at Aero1, and are summarized in Table 3.3. It is of note that the same organizational units including engineering and program management departments at company Aero1 were involved across the selected cases.

Table 3.3 The seven cases

Case Number	Number and types of organizations	Organizations Location	High level project description
1	2 universities 2 industrial partners	Same city	Mid-TRL application specific software technology
2	1 university, 1 industrial partner	Same city	Software technology aimed at facilitating applications development
3	1 university, 1 research center, 1 industrial partner	Same city	Software technology which has hardware specific dependencies
4	2 universities, 1 industrial partner	3 different Cities in Canada	Developing higher-TRL software technology standards
5	1 university, 1 national research center, 1 industrial partner	2 different cities in Canada	Developing higher-TRL subject specific processes, practices and methodologies
6	1 university, 1 industrial partner	Two different cities in Quebec	Developing a proof of concept which has the potential to be integrated in a new product currently in a mid-TRL phase of development
7	1 university, 1 industrial partner	Same city	Integrating research software and hardware into a research lab at a public institution

3.5.1 Cases data, analysis, and description

This study uses secondary data from the cases specific contexts. However, this is data was originally collected for uses other than this research project. Saunders (2009) states that this type of naturally generated data is most frequently used for business and management research, in particular case studies or surveys.

> Secondary data include both raw data and published summaries. Most organisations collect and store a variety of data to support their operations: for example, payroll details, copies of letters, minutes of meetings, and accounts of sales of goods or services. … Trade organisations collect data from their members on topics such as sales that are subsequently aggregated and published (Saunders, 2009, p. 256).

In this study, the secondary data is documentary written materials. Other sources of secondary data, such as multiple source and surveys, were available but they were mainly used to better understand the context before, during, and after data analysis.

The documentary data for the research project were gathered at the Aero1 Canadian location and included emails, meeting minutes, memos, reports, draft and final agreements, and other

project documents from stakeholders at various hierarchical levels, sponsors, and executives including technical leads, engineers, professors, students, technology portfolio managers, legal professionals, and IP representatives across collaborating organizations.

The study started by identifying case study artefacts including emails and memos used to communicate other artefacts, such as meeting minutes, project plans, strategy documents, internal and external presentations, contractual documents, and other formal and informal communications with stakeholders. Over 10,000 artefacts were in project folders and 20 projects were down selected as potential case studies. Following high-level project reviews, a further in-depth review resulted in selecting the seven cases with corresponding 2,944 artefacts. The in-depth review was enabled by the daily involvement of the researcher in the projects throughout their phases.

The final seven cases were selected to reflect diverse collaborations. The in-depth review included consultations with an SME on the collaboration process at Aero1. These cases focus on mid-TRL collaboration projects, which are defined by the NASA standards for technology maturity as projects that allow for collaboration given the distance required for commercialization. Additionally, stakeholders are more willing to share information on development in the knowledge discovery domain in lower-TRL projects than the higher-TRL projects, or near-market developments, given the commercialization potential. Additionally, the cases were selected based on the availability of complete artefacts from across the lifecycle of these projects, as well as having at least one academic partner, and partners from outside of the home city of company Aero1. The choice of cases is purposive, where “theoretical sampling” explores relationships between concepts and further develops theory based on those relationships (Saunders et al. 2009, p. 509). The selected cases for this study offer diverse contexts of interorganizational R&D collaborations in the aerospace sector, including a variety in structure, duration, technological focus, and stakeholder involvement. This diversity was an important factor in the choice of the cases, as it is important for understanding the complex dynamics of collaboration. As seen from the choice of the cases and their description in the following section, they were selected to present different levels of technology readiness, project scope and duration, negotiation challenges and funding mechanisms, geographic locations, and interactions and cross sector partners. The purposive choice of these cases is expected to allow for a comprehensive

examination of day-to-day practices, stakeholder behaviors, and the underlying motivations within the aerospace industry's collaborative projects, providing rich data and relevant contexts to inform this research objectives.

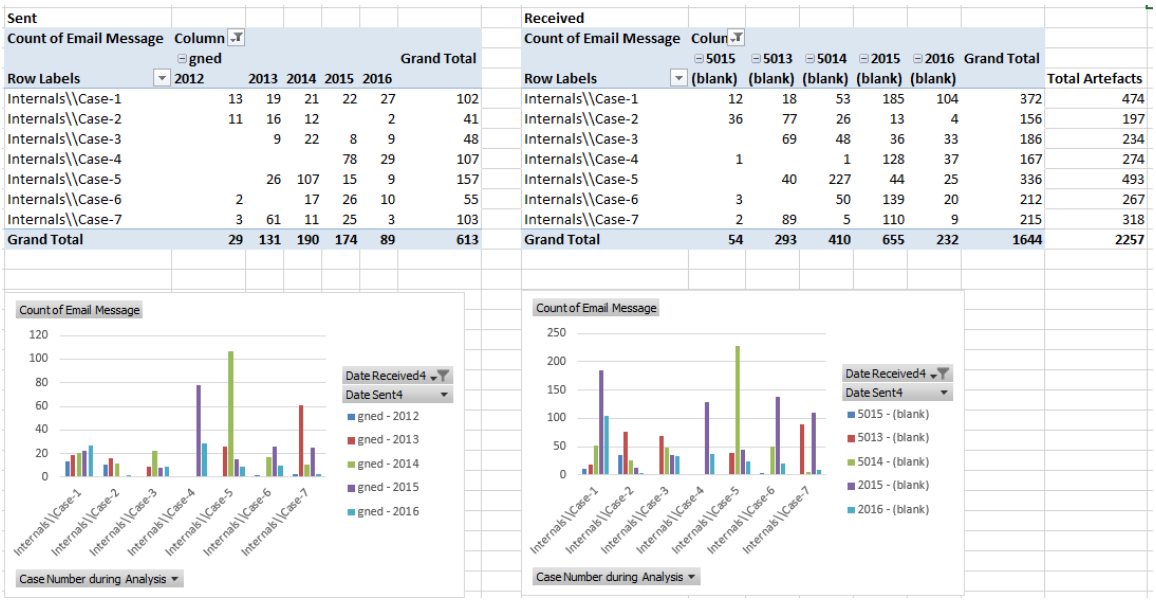
The number of artefacts collected is shown in Table 3.4 and reflects the period over which the projects were developed, as shown in Figure 3.3..

Existing documents are strong research data because they contain insights and clues related to the phenomenon, and because they

> already exist in the situation; they do not intrude upon or alter the setting in ways that the presence of the investigator might. Nor are they dependent upon the whims of human beings whose cooperation is essential for collecting data through interviews and observations (Merriam, 2002, p. 13).

Table 3.4 The seven cases and related artefacts

Case Number	Number of Main Artefacts (Emails, including Meeting Minutes, Project Information, Agreements)	Additional Artefacts Attached to Emails or Referenced by the Main Artefacts (Emails, Meeting Minutes, Project Information, Agreements)
1	474	126
2	197	50
3	234	58
4	274	124
5	493	153
6	267	110
7	318	66



Sent						
Count of Email Message	Column gned					Grand Total
Row Labels	2012	2013	2014	2015	2016	
Internals\\Case-1	13	19	21	22	27	102
Internals\\Case-2	11	16	12		2	41
Internals\\Case-3		9	22	8	9	48
Internals\\Case-4				78	29	107
Internals\\Case-5		26	107	15	9	157
Internals\\Case-6	2		17	26	10	55
Internals\\Case-7	3	61	11	25	3	103
Grand Total	**29**	**131**	**190**	**174**	**89**	**613**

Received							
Count of Email Message	Colun 5015	5013	5014	2015	2016	Grand Total	
Row Labels	(blank)	(blank)	(blank)	(blank)	(blank)		Total Artefacts
Internals\\Case-1	12	18	53	185	104	372	474
Internals\\Case-2	36	77	26	13	4	156	197
Internals\\Case-3		69	48	36	33	186	234
Internals\\Case-4	1		1	128	37	167	274
Internals\\Case-5		40	227	44	25	336	493
Internals\\Case-6	3		50	139	20	212	267
Internals\\Case-7	2	89	5	110	9	215	318
Grand Total	**54**	**293**	**410**	**655**	**232**	**1644**	**2257**

Figure 3.3 Periods over which cases artefacts were collected

3.5.1.1 Case 1

Case 1 is a multi-year collaborative R&D project to develop mid-technology readiness level (TRL) application specific software technology. The project required SMEs and researchers from two universities, SMEs from Aero1, and an industrial partner from an affiliate multinational company to report to the same department. The project was funded by Aero1 with additional funding from a government organization. Project agreement negotiations were between SMEs and research facilitators from the four organizations supported by their respective legal and contractual services.

3.5.1.2 Case 2

Case 2 is also a multi-year collaborative R&D project to develop software technology for applications development. The project required SMEs and researchers from one university and SMEs from Aero1. The Aero1 SMEs reported to different departments and supported PhD students in their departments. The project was funded by Aero1 with additional funding from a government organization. Project agreement negotiations were between SMEs and research facilitators from the two organizations supported by their respective legal and contractual services.

3.5.1.3 Case 3

Case 3 is a multi-year collaborative R&D project to develop mid-TRL software technology with hardware specific dependencies. The project required SMEs and researchers from one university, SMEs and researchers from a research centre, and SMEs from Aero1 reporting to the same department. The university researchers were experts in software systems and were interested in disruptive technology use in research, whereas the research centre researchers approached research problems traditionally and systematically. The project was funded by Aero1 with additional funding from a government organization. The project agreement negotiations were between SMEs and research facilitators from the three organizations supported by their respective legal and contractual services.

3.5.1.4 Case 4

Case 4 is a multi-year collaborative R&D project to develop higher-TRL software technology standards. The project required SMEs and researchers from two universities in different provinces, including a university researcher affiliated with a university research network. The SMEs from Aero1 reported to different groups and were not geographically collocated. The project was funded by Aero1 with additional funding from a government organization. The project agreement negotiations were between SMEs and research facilitators from the three organizations supported by their respective legal and contractual services.

3.5.1.5 Case 5

Case 5 is a multi-year collaborative R&D project aimed to develop higher-TRL subject specific processes, practices, and methodologies. The project required SMEs and researchers from one university and a national research centre located in different provinces, including a university researcher affiliated with a university research centre. The SMEs from Aero1 reported to different business units and were not geographically collocated. The project was funded by Aero1 with additional funding from a government organization. The project agreement negotiations were between SMEs and research facilitators from the three organizations supported by their respective legal and contractual services.

3.5.1.6 Case 6

Case 6 is a one-year collaborative R&D project to develop a proof of concept that could be integrated in a new product under mid-TRL development. The project required SMEs and researchers from one university and SMEs from Aero1. The SMEs at Aero1 reported to two departments: technology development and project execution. The project roadmap required that Aero1 lend hardware to the university for proof-of-concept testing and integration. The project was funded by Aero1 with additional funding from a government organization. The project agreement negotiations were between SMEs and research facilitators from the two organizations supported by their respective legal and contractual services.

3.5.1.7 Case 7

Case 7 is a multi-year collaborative project to integrate research software and hardware into a public institution research lab. The project required SMEs and researchers from one university and SMEs from Aero1. The SMEs at Aero1 reported to different departments, and the SMEs supported master's students in their departments. The project was funded by Aero1. The project agreement negotiations were between SMEs and research facilitators from the two organizations supported by their respective legal and contractual services.

3.6 Ethical considerations

Given the sensitive nature of R&D collaboration projects, and to preserve the confidentiality of stakeholders, case study data were collected under a non-disclosure agreement (NDA) and remained on company servers and computing assets and were not shared with any third party. Therefore only a few examples of verbatim texts from the corpus of artifacts were made available for presentation in the thesis. Also, only the researcher and the second coder had access to the raw data. Stakeholders' names and individual names are also not used in this thesis. Coded themes are used instead of direct quotations and verbatim from the artefacts. The verbatim textual passages of the codes resulting from the analysis of the cases include confidential information, consequently these detailed reports were saved on an Aero1 company computing platform in NVivo and Excel. Additionally, the university ethics committee approval was obtained and renewed.

3.7 Analysis strategy overview

The following paragraphs describe the case analyses, during which a second researcher with a PhD independently coded and analyzed the themes for the first case. Throughout the analyses the context was top of mind. The second researcher had access to the data and was familiar with the context of the cases.

> An analytical note from Miles et al. (2014) warns that data should never be stripped from its context. We asked the following questions throughout the analysis: "What does this mean?", "in what context did this take place?" and "what are the implications?" (Roets & Maritz, 2017, p. 53).

The analysis phases illustrated in Figure 3.4 include extensive and continuous literature review, starting from the original research proposal conceptual framework, on which Phase 1 was based, throughout the case analyses, and further through the abductive reasoning phase which is referred to as Phase 2.

Coding of the first case started with a priori codes and themes based on the first phase of the literature review; the first case was carefully coded by two coders: the researcher and the second coder. The subsequent cases were coded by the researcher until saturation. Following is an overview of analysis steps:

1. Collected data from project folders and common data repositories spanning several years, long enough to allow for an in-depth study of the cases.
2. Reviewed the collected data files and categorized and structured them into appropriate case folders. Any data that is not related to the cases were removed.
3. Exported the data into NVivo where the seven cases and their related structures and notes were created.
4. Created memos based on the original conceptual framework to guide the coders during the first phase of analysis. Included the framework as a separate data file to ensure its availability readily when required during analysis.
5. Started with a priori codes, based on the preliminary conceptual framework and inspired from the literature on collaboration processes, change management, design thinking, and project management processes.

6. Illustrated in Figure 3.4, for Case 1:
    a. Coded Case 1 using the initial a priori codes, whose meaning was validated through common understanding of Coder 1 and Coder 1 based on the literature review. During coding, the coders added new codes inspired and induced by the case content.
    b. Created higher-level category codes from the original codes independently by Coder 1 and 2 after the coding of Case 1. These codes were exported spreadsheets for further analysis by coders.
    c. Validated mutual understanding of the resulting codes and higher-level category codes, which provided additional understanding of the baseline codes, through several working sessions between Coder 1 and 2.
7. Continued coding subsequent cases (Coder 1). The basic codes and category codes from the first case became the a priori codes for subsequent cases, an iterative deductive/inductive process that continued until saturation which was reached during the analysis of Case 4.
8. Triggered a second abductive analysis phase from analysis of the first phase and resulting additional literature review that inspired new themes, which the initial literature review did not address.
9. Continued the literature review and analysis through the second abductive phase, which increased understanding of the themes and inspired new concepts and themes as discussed in Chapter 5.

The codes in NVivo were exported to a master Excel workbook for each of the cases when they were finalized. OneNote was used to maintain memos and notes on the analysis and literature inspired by the analysis to pursue for new concepts and themes.

According to Vinit (2016), qualitative research may go through a period like the bottom of a U curve, where a feeling of lack of accomplishment overshadows confidence that something will eventually emerge. When the researcher accepts this uncomfortable position, suddenly something emerges and guides the researcher. It is as it should be, in other words the researcher does not run the process, the process embodies the researcher. This is

“recherche sur l’action” (Vinit, 2016, p. 288), where there is no explanation or application but rather understanding. Dumez (2013b) (cited by Vinit, 2016) highlights progressive abstraction with case studies and systematic case comparisons. Vinit (2016) also references feeling the interpretation process through the body and senses an initial process that provides clues regarding the research and signals that something will eventually emerge from the text.

> There is significant uncertainty whenever the mind feels overwhelmed by itself; when the researcher themself is the obscure territory, they must explore and where all their knowledge will be of no use. To search? Not just that: to create. They face something that does not yet exist and that only they can bring to life, and then introduce it into the light [...]. I ask my mind to make an additional effort, to capture the fleeing sensation once again. And, to ensure nothing breaks the momentum it will use to grasp it, I remove all obstacles and foreign ideas, shielding my ears and attention from the noises in the neighboring room. However, as I sense my mind exhausting itself without success, I force it to accept the distraction I had denied it and to think of something else (Vinit, 2016).

The analysis process was also an exercise in reflection-in-action (Schön, 1983), it is a sensemaking exercise with questions such as:

> What features do I notice when I recognize this thing?
>
> What are the criteria by which I make this judgement?
>
> What procedures am I enacting when I perform this skill?
>
> How am I framing the problem that I am trying to solve? (p.50).

During this sensemaking process, the practitioner

> reflects on the understandings which have been implicit in his action, understandings which he surfaces, criticizes, restructures, and embodies in further action.
>
> It is this entire process of reflection-in-action which is central to the “art” by which practitioners sometimes deal well with situations of uncertainty, instability, uniqueness, and value conflict. (Schön, 1983, p. 50).

The practitioner

> may reflect on the tacit norms and appreciation which underlie a judgement, or on the strategies and theories implicit in a pattern of behaviour. He may reflect on the feeling for a situation which has led him to adopt a particular course of action, on the way in which he has framed the problem he is trying to solve, or on the role he has constructed for himself within a larger institutional context (Schön, 1983, p. 62).

Coping with troublesome “divergent” situations has the “art” of reflection-in-action at its centre (Schön, 1983, p. 62), which is applicable to this sensemaking process of wicked R&D

collaboration projects: “When someone reflects-in-action, he becomes a researcher in the practice context” (p. 68).

3.7.1 Definitions applicable for the coding and analysis phases

In this section we provide definitions of the terms and concepts used throughout the analysis phases to help better follow and understand the analysis and results proposed in the next chapters. For instance, "coding references" refer to specific textual passages observed in the studied artifacts to which we have assigned a code based on their content. Here are some of the key terms used in the following sections:

1. A priori codes: A priori codes are the pre-determined coding categories or themes that we have established based on the preliminary conceptual framework. These codes are based on existing theory and the in-depth literature review which inspired the framework. They were used to guide the initial stages of coding process.
2. Text passages: Text passages are sections, paragraphs, sentences, or phrases within the textual data that were relevant to analysis. These passages were analyzed and coded in order to identify codes, patterns, themes, and relationships within the textual data.
3. Coding references: Coding references are specific textual passages from the studied artifacts that are assigned a code based on their content. These references allow linking relevant passages to particular codes or themes.
4. First-level themes: First-level codes are the initial themes that emerged during the coding process in addition to the a priori codes. They represent the first level of data analysis and were derived directly from the coding references.
5. Second-level themes: Second-level codes are more focused and refined themes that emerged from the first-level codes during the coding process. They are a higher-level abstraction of the first-level codes and were used to further condense the themes into categories, and which led to identify additional trends, patterns, and themes from the artifacts.

6. Nodes: In the qualitative data analysis software NVivo used for the analysis, nodes are the containers for coded data. Nodes can represent codes, themes, categories, concepts, or cases, and are used to organize and manage the coding structure in the software.
7. Codes: A code is a label which we assigned to specific textual passages based on its content, themes, or concepts. We started the analysis with a deductive analysis of the a priori codes, whereas additional codes have emerged through inductive analysis.
8. Artifacts: Artifacts are the documents that were collected, analyzed, and used as sources of data in this thesis. These artifacts include emails, meeting minutes, reports, contracts, or other relevant documents exchanged between the collaborating organizations.

3.7.2 Concluding remarks

In this chapter we have established a solid methodological foundation for examining complex interorganizational R&D collaboration within the aerospace sector. The research objectives and questions as derived from an extensive literature review and through a multidisciplinary approach aim to explore the complexities of IOC management. Through a qualitative analysis of the selected cases starting with the proposed preliminary conceptual framework a priori dimensions, we seek to shed some light on the everyday practices and stakeholder interactions that are important but contained in the "black box" of collaborative projects. The selected cases which have diverse structures and contexts enable a rich exploration of the day-to-day interactions within these collaborations. The proposed methodology supported by the theoretical and philosophical underpinnings of pragmatism and constructionism provides a comprehensive strategy for a qualitative analysis that is both methodical and reflective. We proposed a deductive, inductive, and abductive approach to be used to guide the analysis of data in our multi-method analysis approach.

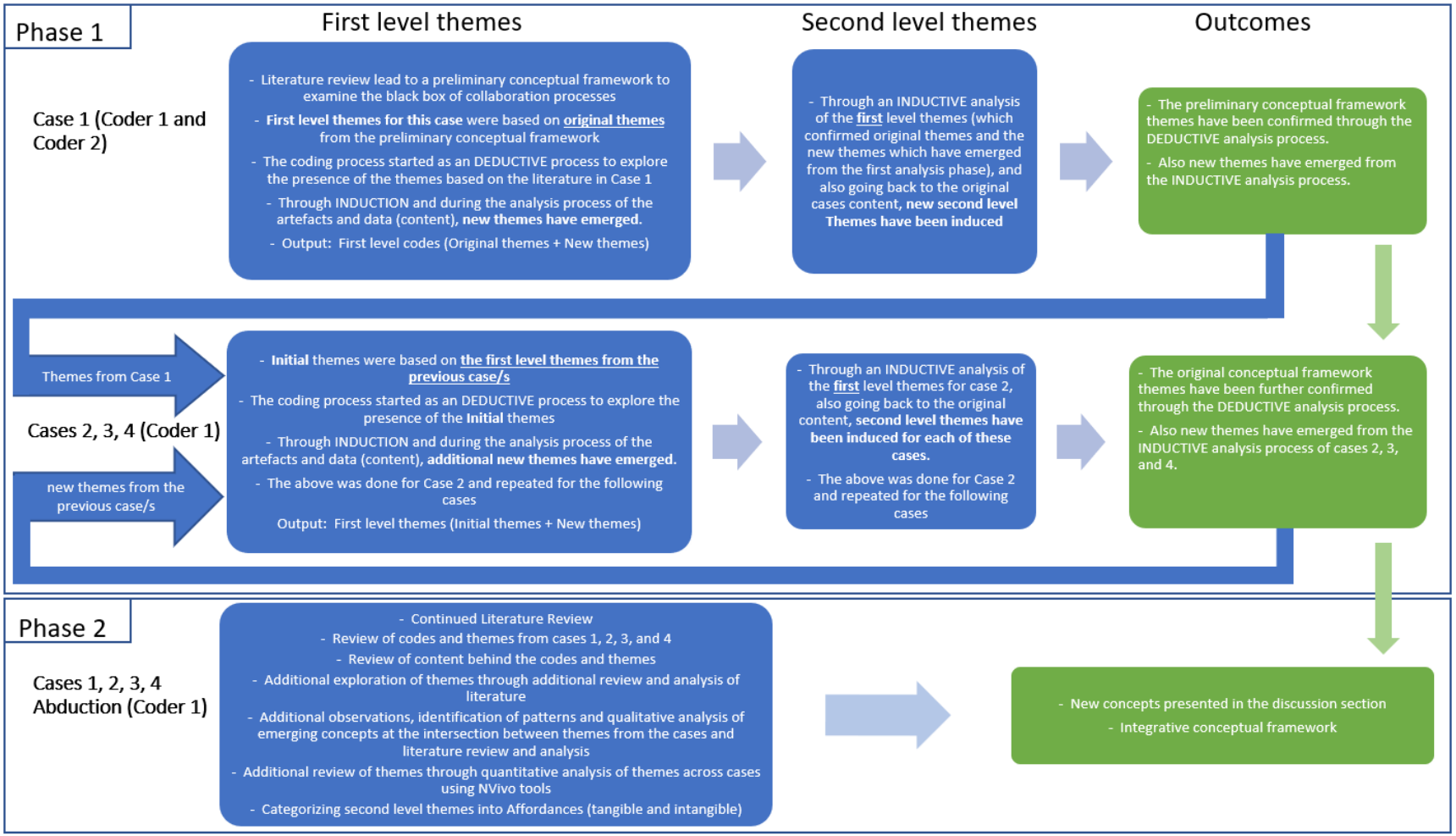


Figure 3.4 Overview of the analysis strategy

CHAPTER 4 ANALYSIS AND FINDINGS

This chapter presents the findings of the first phase of the analysis through deductive and inductive analysis. Chapter 5 illustrates outcomes through abductive analysis, referred to as phase two of the analysis. Figure 3.4 provides an overview of the analysis strategy which was accomplished in two phases, each involving the four cases and coding activities aimed at developing themes and concepts for this study. Specifically, in Phase 1, which involved Coder 1 and Coder 2 for the first case begins with a literature review to identify original themes from a preliminary conceptual framework. The coding process is both deductive and inductive. The output of the first case analysis is the first level of themes, which is a combination of the a priori themes and new induced themes. Cases 2, 3, 4 were coded by Coder 1 who used the themes from Case 1 as the basis of the deductive inductive analysis which continued for these cases where the output is also first-level themes comprising the initial codes plus new induced themes. Second-level themes were induced from the analysis of the first-level themes through an iterative process which included consulting the coding references and related artefacts. Phase 2, which is the abduction phase, involved continued literature review and re-evaluation of codes and themes from all cases. Coder 1 continued to engage in additional exploration of themes, observations, pattern identification, and qualitative analysis, which inspired the themes proposed in Chapter 5. The procedure was iterative and dynamic and integrated continuous literature review with an in-depth data analysis through the detailed coding of the artefacts selected for the cases. For an overview of the in-depth analysis of four cases, Table 4.1 demonstrates the level at which the artefacts were reviewed, which resulted in 1522 First-level themes including 1378 First-level themes from the researcher, and 144 First-level themes from the second coder for Case 1. These themes reflect the latent and manifest content of the artefacts that were collected for the four cases. We analyzed textual data from these artifacts to ensure a comprehensive understanding of the data, where we distinguish between manifest and latent content. The manifest content codes reflect explicit meanings of the words and phrases, where we captured the literal statements made in these artefacts. Given our familiarity with the cases

and the stakeholders, we also endeavored to capture the latent content which delves deeper into the underlying, implicit meanings, and contextual understanding to propose new themes and uncover implicit patterns. By examining both manifest and latent content, we aimed to provide a holistic analysis which accounts for both the surface-level expressed intentions and the more subtle, nuanced aspects of the interactions. As for Cases 5 to 7, although they were part of the case selection review, and a preliminary analysis during data collection, their detailed analyses were not pursued because saturation was reached with Case 4.

Table 4.1 Total number of First-level themes and coding references per case

	First-level themes-coder 1 (Researcher)	Coding References for coder 1 (Passages in text)	First-level themes-coder 2 (SME)	Coding References for coder 2 (Passages in text)
Case-1	469	1740	144	4509
Case-2	145	1045		
Case-3	367	740		
Case-4	397	844		
Case-5				
Case-6				
Case-7				
Total	1378	4369	144	4509

4.1 Case 1 analysis

The first case was the longest and most demanding to learn NVivo, and to convert initial documents from different formats to PDF for coherent representation in NVivo. The first stage of artefact analysis was a deductive coding exercise, where reading and interpreting the artefact contents informed the appropriate a priori category, while considering context. As the analysis advanced, it was clear to both coders that the a priori codes were not sufficient to capture the emerging themes and the phenomenon under study; therefore, in addition to deductive analysis, open and inductive coding was conducted to capture the new themes. The coders communicated regularly through this coding process: discussions focused on methodology, methods, process, and logistics related to coding. This exercise spanned several weeks.

The result of the coding efforts of the first case was also a sensemaking exercise, where it was realized that some of the meanings originally latent in the text became manifest through this coding exercise. Also, as the researcher and the SME were both originally involved as practitioners in the studied projects, attributes that were latent during project execution became manifest themes. For example, codes which reflected the amount and types of communications between stakeholders were manifest in nature, whereas some codes which label situations where stakeholders empathize with each other were induced latent codes based on the textual data and the retrospective review of the context and related artefacts.

Typically, best practices for qualitative research recommend showing the data via verbatim excerpts of the original text (raw data), rather than sharing codes and themes (e.g., Charmaz, 2006; Charmaz & Thornberg, 2021; Pratt, 2009, Tracy & Heinrichs, 2017); however, to gain access to the dataset (which is viewed as confidential and proprietary information by the organization involved), the researcher, second coder, and advisor signed an NDA to not share and preserve the confidentiality of verbatim text passages, while also providing a way to validate that the codes developed in a reliable, credible way from the data corpus. Consequently, the findings focus more on interpreting, understanding, and sensemaking of how the verbatim text passages are represented by the first and second level codes and how they combine to create high-level themes that inform everyday enactments of collaboration.

Table 4.1 also illustrates the number of coding references for Coder 1 and Coder 2. As this is qualitative research, the number of coding references illustrate the depth, details, and extent of the analysis. The analysis covered the artefact texts and passages extensively where, for 600 artefacts, there were 6249 coding references (text passages in the case artefacts). The researcher's analysis of the first case yielded 469 codes of 1740 coding references in the artefacts. Through a deductive analysis of the textual data, we were able to confirm the presence of a priori codes inspired from preliminary conceptual framework themes as shown in Table 4.8.

Table 4.2 presents the Coder 1 results, where 23 second-level themes reflect the content of the text in the original artefacts using 469 first-level codes that include original codes from the preliminary conceptual framework and new codes that emerged from inductive analysis.

Table 4.2 Coder 1 Case 1 Second-level Themes

SECOND-LEVEL THEMES CODER 1: RESEARCHER	NUMBER OF CODING REFERENCES
Communicating, Designing, Adapting, Emphasizing through Artefacts	195
Proposal, Artefact, Communicating, Clarifying, Understanding, Negotiating	187
Plan and Planning Dynamics	176
Discovering, Challenging, Selecting, Negotiating Partnerships	168
Empathy, Transparency	162
Acknowledgment, Communication, Reception of Message or Artefact, Value	118
Emotional Intelligence	108
Information; Requesting, Communicating, Clarifying, Sharing	102
Urgency dynamics	82
Guidance, Support, Directions, Mobilization	68
Process, Practice, Communication, Negotiation	59
Designing, Strategy, Negotiations	50
Highlighting and emphasizing key issues in communication, artefacts	42
Set, Communicate the vision	34
Facilitator; Sharing, Informing, Setting Expectations, Recommending, Leading	29
Seeking Advice, Support	28
Invitation, Negotiation	27
Internal, External, Multi-party, Negotiating	22
Leadership, Coordination	19
Offering Support	19
Designing, Strategy, Negotiations, Practices	15
Approval	12
Understand and Understanding	10

Table 4.3 presents second-level themes from Coder 1 and corresponding preliminary conceptual framework components. Table 4.4 presents First-level themes behind an example Second-level themes selected from Table 4.3: “Plan and Planning Dynamics”, which corresponds to 25 First-level themes and 176 coding references of the First-level themes. To illustrate the text coding references behind this example, one of the first-level codes is “Affirmative tone for a forward looking plan” that reflects 34 text references. In addition, four text references out of 34 references are provided (redacted) in Figure 4.1.

Table 4.3 Coder 1 Case 1 Second-level themes and corresponding preliminary conceptual framework components and dimensions

3	**Communicating, Designing, Adapting, Emphasizing through Artefacts**	**195**	Artefact, Empathy, ideate, define, prototype, test, mobilize, direct, structure, autonomy, mutuality, trust, reciprocity, goverance, urgency, vision, communication, facilitate, new approaches,....
59	**Proposal, Artefact, Communicating, Clarifying, Understanding, Negotiating**	**187**	Ideat, prototype, negotiate, administration, mutuality, trust and reciprocity, new approaches, defining, testing
100	**Plan and Planning Dynamics**	**176**	Planning, Direction, structuring, execution, Ideating, test, mutuality, administration, testing,
126	**Discovering, Challenging, Selecting, Negotiating Partnerships**	**168**	Empathy, Ideating, Define, prototyping, test, autonomy, mutuality, trust, and reciprocity
208	**Empathy, Transparency**	**162**	Empathy, Governance, administration
234	**Acknowledgment, Communication, Reception of Message or Artefact, Value**	**118**	Administration, mobilizing, Empathy, mutuality, trust and reciprocity, appropriation
251	**Emotional Intelligence**	**108**	Norms of trust, emotions, mobilization, energizing,
268	**Information; Requesting, Communicating, Clarifying, Sharing**	**102**	Structuring, Executing, Informing, Ideate, Administration
295	**Urgency dynamics**	**82**	Sense of urgency, mobilize, direct, structure, administration
312	**Guidance, Support, Directions, Mobilization**	**68**	Empathy, Direction, Strucutring, Mobilize, Define, empower, guidance, mutuality, Organizational autonomy, Trust, Governance
328	**Process, Practice, Communication, Negotiation**	**59**	Communicate, direction, structure, clarifying, emotions, guidance, ideate, energize, Trust and reciprocity, Governance
346	**Designing, Strategy, Negotiations**	**50**	Communicating, Vision, Ideating, Direction, Mobilization, Structuring, prototyping, Organizational autonomy, Mutuality
373	**Highlighting and emphasizing key issues in communication, artefacts**	**42**	Mobilizing, Ideating, Communmicate issues, Celebrating wins, empathy, testing
385	**Set, Communicate the vision**	**34**	Persuading, Communicating Vision and objectives
392	**Facilitator; Sharing, Informing, Setting Expectations, Recommending, Leading**	**29**	Facilitator; Sharing, Informing, Setting Expectations, Recommending, Leading
410	**Seeking Advice, Support**	**28**	Mobilize, Direct, structure, ideate, mutuality, norms of trust and reciprocity, administration
420	**Invitation, Negotiation**	**27**	Mobilize, Direct, structure, sense of urgency, plan
426	**Internal, External, Multi-party, Negotiating**	**22**	Negotiation dynamics, Direction, Structuring, Define, Prototype, and Test
441	**Leadership, Coordination**	**19**	Governance, Administration, Direction, Mobilize, Lead, coordinate
451	**Offering Support**	**19**	Empathize, Mutuality, Normes of trust and reciprocity, Empower, Support
457	**Designing, Strategy, Negotiations, Practices**	**15**	Governance, Administration, Organizational autonomy, Mutuality, Norms of trust and reciprocity
466	**Approval**	**12**	Administration, Governance
470	**Understand and Understanding**	**10**	Empathize, Appropriation, Testing

Table 4.4 Coder 1 Case 1 the First-level themes behind the selected Second-level themes in Table 4.3 above

100	**Plan and Planning Dynamics**	**176**	Planning, Direction, structuring, execution, Ideating, test, mutuality, administration, testing,
101	Affirmative tone for a forward looking plan	34	
102	Invitation to meet,call and discuss project plan	30	
103	Initiation and Planning	26	
104	2-Planning	26	
105	1-Initiation	12	
106	Plan for and create short-term wins	8	
107	Structuring	5	
108	Proactive follow-up on project of interest by technical lead	5	
109	My part, your part	5	
110	Proactive follow-up on project by NSERC	5	
111	Inviting others to join in on the project plan and create allies	4	
112	Plan the creation of an alliance	2	
113	Providing precision on project plan timeframe to NSERC (Nodes)	2	
114	Portfolio Planning	2	
115	Proposing a project plan after many iterations	1	
116	Providing precision on project plan timeframe to project team	1	
117	empower others to act on the vision and plan	1	
118	Requesting confirmation of partner engagement per written plan	1	
119	Yet another iteration of the project set-up following review by specialized resource	1	
120	Others have agreed, what about you	1	
121	Requesting precision on plan timeframe	1	
122	Adding to internal proposal of project plan and confirming agreement with overall plan	1	
123	Internal Not my action, it is your action	1	
124	Projecting and planning outcome if successful	1	
125	Create project structure	0	

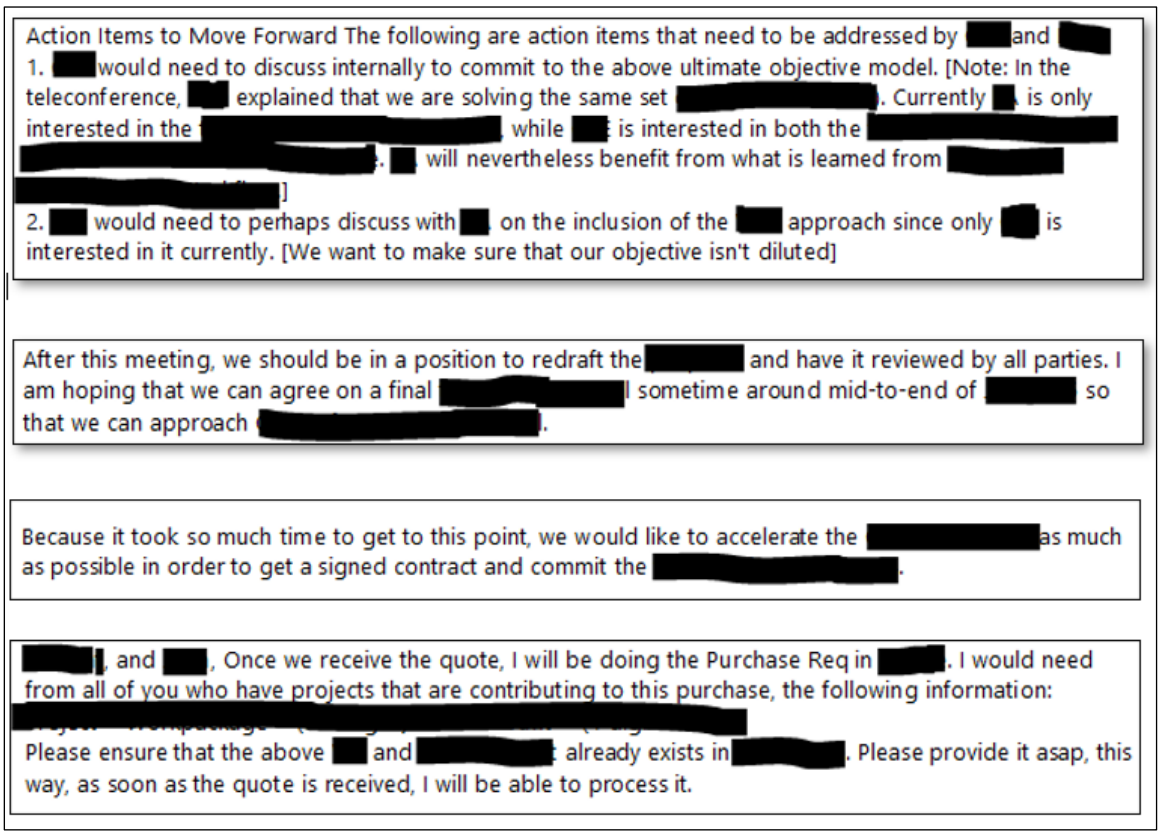


Figure 4.1 Four text references of the First-level themes “Affirmative tone for a forward looking plan”

Table 4.5 presents second-level themes of Coder 2 and corresponding number of coding references. Table 4.6 presents the first-level themes behind an example second-level theme selected from Table 4.5: “Act by empowering others” that corresponds to four first-level codes and 291 coding references of the first-level codes. To further illustrate text coding references behind this example, one of the first-level codes is “Mobilizing and creating wins and synergies” that reflects 51 text references, and 4 text references out of 51 references (redacted) are provided in Figure 4.2.

Table 4.5 Coder 2 Case 1 Second-level themes

SECOND-LEVEL THEMES CODER 2: SME	NUMBER OF CODING REFERENCES
Act unilaterally	765
Communicate information to advance the project	562
Express sentiments to motivate	531
Act by empowering others	291
Communicate/exchange/discuss	256
Request answer	230
Confirm information to enable action	225
Act by exchanging with others	206
Express sentiments	146
Enable others to act	144
Request information	139
Create new ideas	116
Request support/action	112
Emphasize importance	109
Emphasize schedule	101
Prototype	99
Express commitment to advance the project	87
Commit to act	57
Send information	55
Propose help	52
Suggest	51
Create working conditions	36
Send request	34
Confirm to enable communication	27
Suggest to advance the project	19
Emphasize understanding	16
Answer to advance the vision	9
Confirm involvement	9
Propose new framework	5
Answer to emphasize	5
Suggest to act	4
Commit to communicate	3
Infirm information to stop action	2
Confirm conditionally	2
Emphasize risk	2
Suggest ideas	1
Propose additional ideas	1

Table 4.6 Coder 2 Case 1 Second-level themes and corresponding preliminary conceptual framework components and dimensions

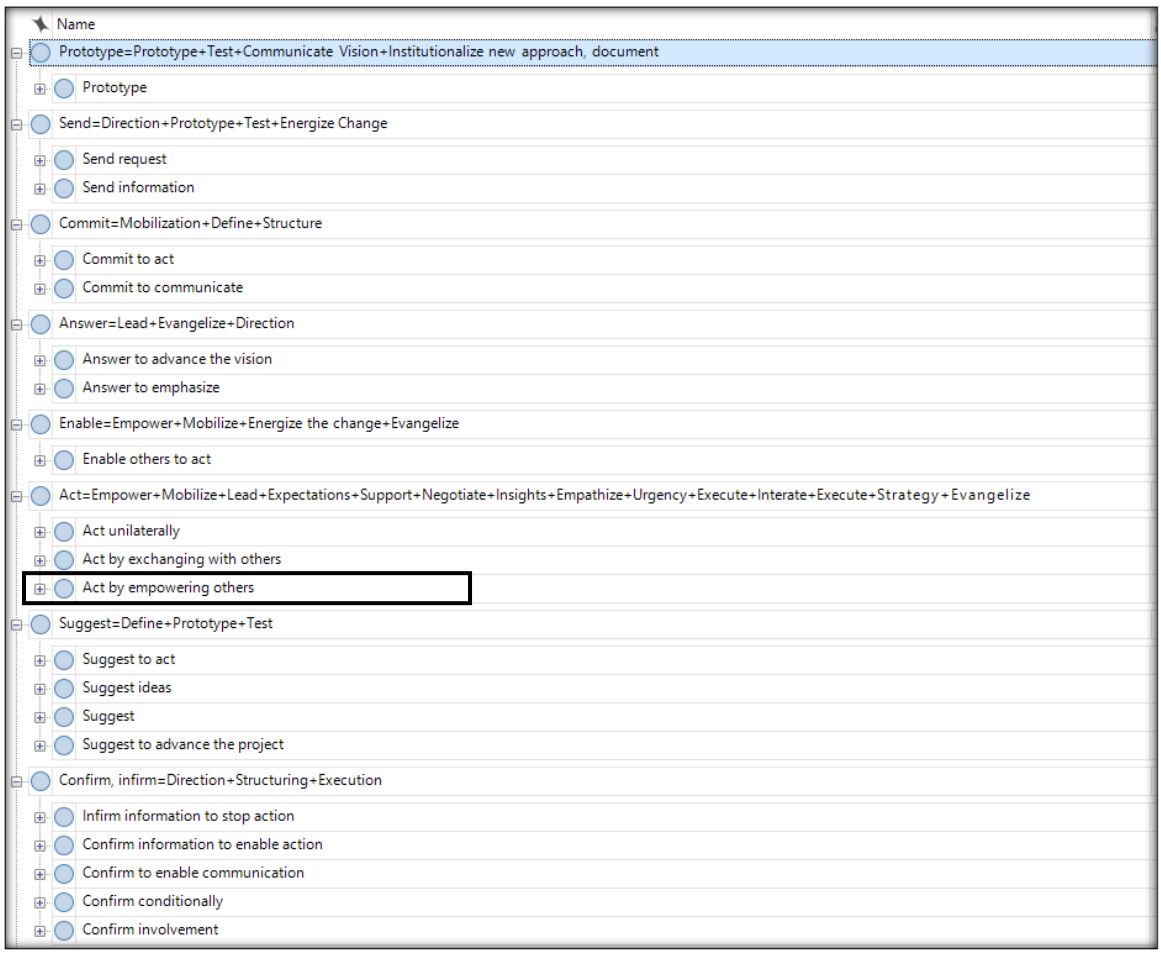


Table 4.6 Coder 2 Case 1 Second-level themes and corresponding preliminary conceptual framework components and dimensions (cont'd and end)

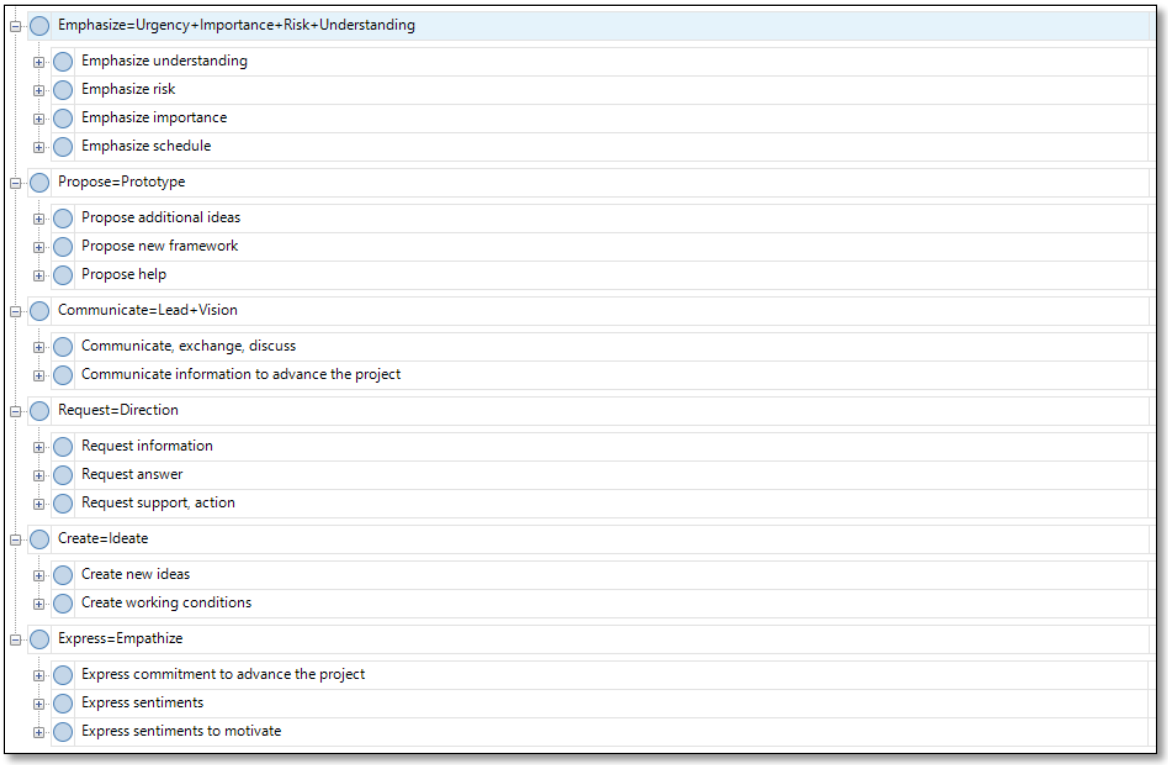
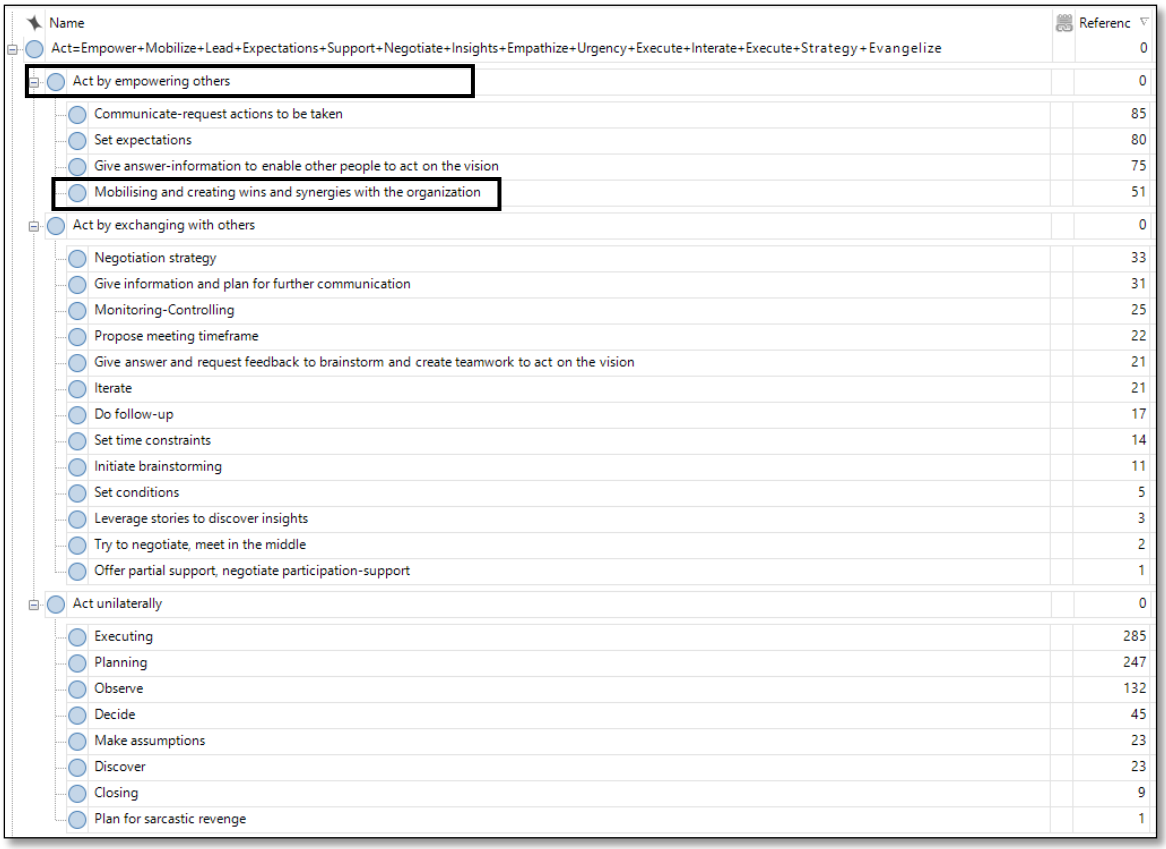


Table 4.7 Coder 2 Case 1 the First-level themes behind the selected Second-level themes in Table 4.6 above



Name	Referenc
Act=Empower+Mobilize+Lead+Expectations+Support+Negotiate+Insights+Empathize+Urgency+Execute+Interate+Execute+Strategy+Evangelize	0
Act by empowering others	0
Communicate-request actions to be taken	85
Set expectations	80
Give answer-information to enable other people to act on the vision	75
Mobilising and creating wins and synergies with the organization	51
Act by exchanging with others	0
Negotiation strategy	33
Give information and plan for further communication	31
Monitoring-Controlling	25
Propose meeting timeframe	22
Give answer and request feedback to brainstorm and create teamwork to act on the vision	21
Iterate	21
Do follow-up	17
Set time constraints	14
Initiate brainstorming	11
Set conditions	5
Leverage stories to discover insights	3
Try to negotiate, meet in the middle	2
Offer partial support, negotiate participation-support	1
Act unilaterally	0
Executing	285
Planning	247
Observe	132
Decide	45
Make assumptions	23
Discover	23
Closing	9
Plan for sarcastic revenge	1

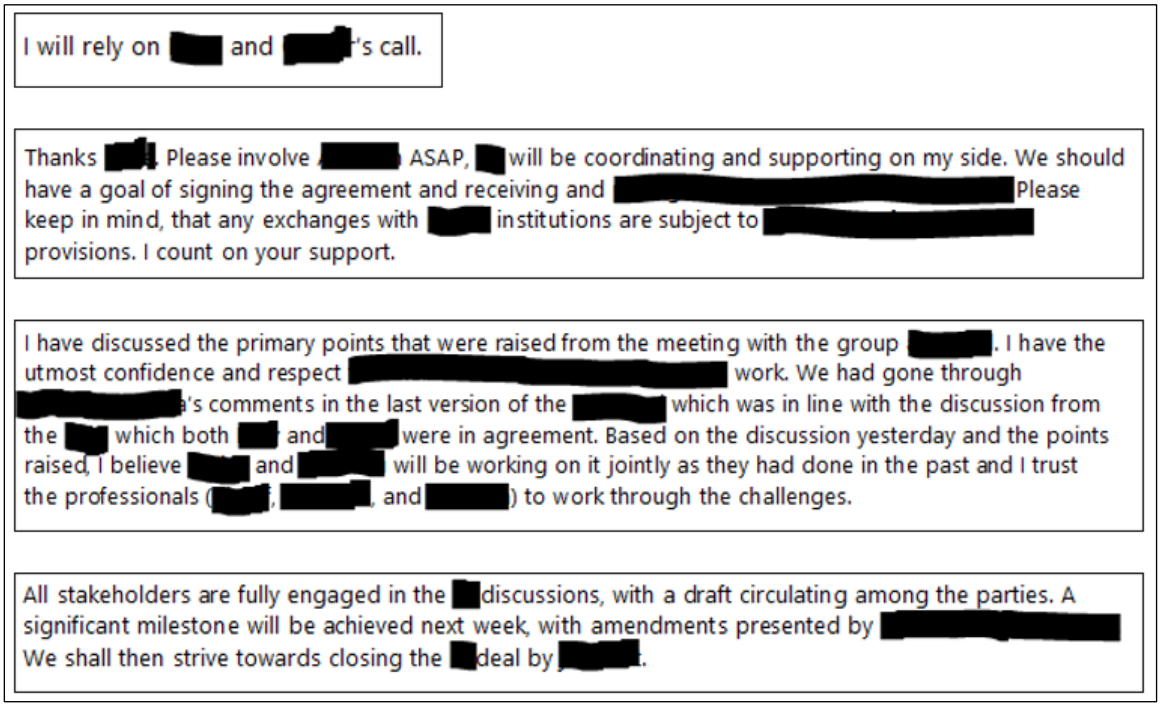


Figure 4.2 Four text references of the first-level code "Mobilizing and creating wins and synergies"

Given the size of the first-level codes, 469 codes for Coder 1 and 144 for Coder 2, they are included in Appendix B and Appendix C, respectively. Although the qualitative value of the codes and themes is priority, during the study we also performed quantitative operations in NVivo on the original codes for synonyms and used NVivo's auto-coding feature for additional potential qualitative findings. Furthermore, understanding of the themes occurred during extensive review of the codes and allowed for consideration of further latent findings in the text, in particular social values, emotions, and communication skills, which are not in the preliminary conceptual framework. These new codes and themes allowed the identification of codes and themes that describe actions, artefacts, behaviours, cognitive and emotional states and sentiments, thoughts, and social values—themes that were not considered a priori for this study. Additionally, rhetoric emerged from the analysis: ethos, logos, and pathos, which was complemented by kairos (Greek for here and now/urgency) and kano (Greek for make/commit) that also emerged. In other words, the interpretation of

this phenomenon is “walk the talk” and take action to build collaboration and define a project.

The depth of familiarity with the project artefacts differed between coder 1 and coder 2, which we believe is one of the reasons which explain the variance in the number of codes and coding references during the analysis. Coder 1 was more involved in the selected projects with a deeper understanding of the history and progress of these projects. This knowledge and overall understanding of the cases have influenced a more nuanced approach to coding the texts in the project artefacts as well as the number of the first-level codes and coding references. Coder 1 coding may have focused more on the explicit and latent content with the rigour of ensuring that all perceived relevant information is captured from the texts illustrated in a high number of first-level codes and coding references. Whereas Coder 2 induced themes influenced by the preliminary conceptual framework themes, however with focus on the explicit text references, thus the resulting higher number of coding references. This difference in coding results reflect these different but complementary analytical approaches, which we believe enriches the research and provides a detailed view of the analysed artefacts. It is of note that this coding process involved iterative discussions between the coders to compare and contrast the identified codes and references, ensuring a comprehensive understanding of the textual data, and ensuring the full contribution of the coders without interfering with the analysis approach. The different perspectives of the Coders could have led to both an advantage and a potential drawback, where the subtle nuances would have been captured by Coder 1 in the first-level codes but at the same time there could have been potential confirmation bias. This was addressed by ensuring that both coders reflected on their postures as independent researchers questioning their assumptions and interpretations throughout the process and leveraging each others perspective to reduce the potential for bias and add the value that both coders perspectives brought to the analysis. Ultimately, the agreement between the coders on the codes did not result in reducing the number of codes, where in addition to codes that intersected and were common to both coders, in particular the a priori codes based on the preliminary conceptual framework, new themes were agreed to be complementary and enriched the findings by introducing themes that were not discovered separately by the coders during analysis and coding. The agreement

between the coders was qualitative at the second-level themes levels where the new themes agreed were related patterns and insights from the cases highlighting:

- Communication intensity, information exchange, and feedback
- Mobilization, empowerment, recognition, and support
- Initiating action, planning and commitments,
- Negotiation and strategic actions
- Adaptation, designing, problem solving, and creativity
- Decision making and leadership
- Emotional Intelligence.

The Case 1 analysis was concluded by reviewing common and complementary themes from both coders, and in addition to the original conceptual framework, these new findings enriched the analysis of subsequent cases.

4.2 Cases 2, 3, and 4 analyses

As illustrated in Figure 3.4, the coding and analysis of cases continued following the same method for Case 1; however, the richness of the findings from Case 1 prompted further literature review in design science, social sciences (psychology), learning sciences, philosophy, and information systems. This iterative literature review prompted the use of themes that were not previously recognized. Coding followed the same method as Case 1, where Case 1 codes and themes were available for subsequent cases through deductive and inductive analysis of artefacts while ensuring that new codes and themes reflected the new cases textual and contextual data. As more codes emerged, codes, themes, concepts, and knowledge from previous cases, as well as the continued iterative literature review further enriched the analysis, and new themes and phenomena were recognized in the manifest and latent content of subsequent cases.

As we can see from Table 4.1, the total number of additional first-level codes for Cases 2, 3, and 4, is 909 first-level codes and 2629 corresponding coding references. This is in

addition to the 613 first-level codes of Case 1 and its corresponding 6249 codes which were coded by Coder 1 and Coder 2. The total number of code references across the four cases is 8878 corresponding to a total of 1522 first-level codes.

4.3 Cases analyses discussions

The study also analyzed the original 1378 first-level codes of the 4 cases (Coder 1) in addition to the 144 codes of the first case (Coder2), a total of 1522 first-level codes, including the corresponding textual data through the auto-code feature and the word frequency explorer in NVivo to inspire additional perspectives. In Table 4.8 provides the total number of text references in the analyzed artefacts based on the preliminary conceptual framework, which confirms the applicability of this framework for interorganizational collaboration projects. From the analysis, in relation to the preliminary conceptual framework we can also posit that the:

- Collaboration process dimensions are present throughout the collaboration projects phases and can be referred to by collaborators at any time.
- Change management, design thinking, and project management, which may also be perceived as linear processes, are iterative; stakeholders iterated within and between the phases of the projects.

As we can see in Appendix E and summarized in Table 4.8, the preliminary conceptual framework included components of the collaboration process dimensions, change management, design thinking, and project management. The concepts analyzed and as shown by the codes shared several principles and practices which collaboration, communication, stakeholder alignment, and iterative problem-solving. The links between these concepts may therefore be leveraged effectively to guide managing collaboration projects, drive change, and develop innovative solutions in interorganizational collaboration settings.

Specifically, the process components dimensions of collaboration, namely, governance, administration, autonomy, mutuality, trust, and reciprocity, are integral to the successful implementation and management of projects. These components help establish a foundation

for effective collaboration among stakeholders, ensuring that all parties are aligned on objectives, roles, and responsibilities. Trust and reciprocity, for example, are crucial for establishing open communication and for enabling both change management and design thinking processes.

We saw that change management focuses on creating a sense of urgency, communicating the vision, and planning for short-term wins, while the project management framework addressed the broader project aspects such as scope, resources, and risk. In both cases we had codes which highlight the importance of clear communication and alignment among stakeholders to drive collaboration outcomes. Additionally, we also noted, the frequency of the codes for design thinking process themes namely, empathizing, ideating, defining, prototyping, and testing, which were part of project management actions taken by the stakeholders during the collaboration process in order to ensure that projects are user-centric, support the uncertainly in innovation projects, and that they are adaptable to the context of collaboration. Design thinking in the context of the evolving environment of interorganizational collaboration projects, we've seen from the codes, includes an iterative approach to problem-solving, focus on understanding stakeholder needs, and collaborating in order to address specific project context effectively. Furthermore, we saw that change management and design thinking share a focus on understanding stakeholders' perspectives, creating a shared vision, and fostering collaboration to achieve desired outcomes. Common themes, include promoting an iterative approach to problem-solving, emphasizing the importance of empathy, communication, and continuous improvement.

The codes for the studied interorganizational collaboration projects show the prominent presence of strong communication, detailed planning and careful execution, acknowledgment and engagement with stakeholders, adaptability of the practices, and the focus on building relationships and encouraging teamwork. Table 4.8 summarizes the key trends from the codes analysis for each of the preliminary conceptual framework components, whereas Appendix E, provides the list of codes associated with the dimensions of the framework. Finally, some of the key take aways from the analysis of the framework are proposed as follows:

- Communication is key: Codes related to initiating and accepting communication, exchanging information, and discussing project plans are highly frequent. This highlights the importance of open, transparent, and continuous communication among the parties involved in the collaboration projects.
- Planning and execution: Codes related to planning, strategizing, and executing are also frequent. This trend indicates that these collaboration projects required clear and well-thought-out plans, as well as the ability to execute and adapt the plans as needed.
- Acknowledgment and engagement: Codes that involve acknowledging efforts, good or bad news, and action items are among the most frequent codes. This demonstrates the significance of recognizing and valuing the contributions and progress made by the collaborators, as well as maintaining engagement of the stakeholders throughout the collaboration.
- Adaptability and flexibility: Codes related to exploring optimal plans, providing guidance, and adjusting based on new information or challenges are present in the codes. The frequent presence of these codes underlines the importance of being adaptable and flexible in response to evolving circumstances.
- Building relationships and teamwork: The frequency of the codes that emphasize creating a sense of urgency, fostering teamwork, and inviting others to join the project plan indicate the significance of building strong relationships among the stakeholders and developing a sense of shared purpose and commitment to the success of the projects.

It is of note that the new themes inspired through this extensive analysis, and which were induced from the data, inspired additional themes related to actions, artefacts, actions on artifacts, emotions, values, and qualities and attitudes such as empathy, politeness, hope, and apology. These themes will be further explored in Chapter 5.

During the analysis of the cases, the decision to concentrate on the initial four cases was made after reaching data saturation, many of the themes were repeating and no unique

insights were emerging. The themes that emerged across these cases were found to be rich and indicative in response to the research objectives of the broader IOC context across various technological readiness levels and cases contexts and structures. Studying the cases across the broader concept of mid to high TRL cases was a choice made by the research which may have its limitations and impact on this study, however, it may be an interesting research venue to pursue for future research. This strategy was also influenced by richness of the first initial four cases results, and the depth of analysis undertaken by the researcher. In addition, practical considerations including time constraints led the researcher to invest in a more in-depth exploration of the results of the cases instead of a continued wider analysis across all other cases which had been selected from the same human centric context, being one of the main subjects to explore in this study.

Table 4.8 Confirmed components and dimensions of the preliminary conceptual framework. First-level themes provided in Appendix E for each dimension.

INSIDE THE COLLABORATION PROCESS COMPONENT, THE "FIVE DIMENSIONS THAT COMPOSE THE BLACK BOX OF COLLABORATION PROCESSES": THE CODES WITHIN THESE DIMENSIONS EMPHASIZED THE IMPORTANCE OF COMMUNICATION, TRUST, TRANSPARENCY, AND DECISION-MAKING IN THE STUDIED INTERORGANIZATIONAL COLLABORATION PROJECTS. ORGANIZATIONS WERE ACTIVELY ENGAGING WITH ONE ANOTHER AND THEIR INTERNAL STAKEHOLDERS, SEEKING APPROVALS, AND WORKING TOGETHER TO DEVELOP HOLISTIC APPROACHES AND ACHIEVE MUTUAL BENEFITS. APPRECIATION AND GRATITUDE PLAYED A CRUCIAL ROLE IN FOSTERING POSITIVE RELATIONSHIPS BETWEEN THE COLLABORATING ORGANIZATIONS, AND EFFECTIVE DECISION-MAKING PROCESSES.				
Governance: The codes in this dimension showed that the stakeholders tended to seek approval or input from other project stakeholders, including internal decision-makers, specialized experts, and partner organizations, before moving forward with project decisions. Emphasis was placed on involving key players in the decision-making process, ensuring that the right people are engaged and informed, and securing buy-in from all relevant stakeholders.	Administration: The most significant theme in this dimension is the importance of expressing appreciation and gratitude. This behaviour appears in various forms, such as appreciation for efforts, partner communication, and seeking approval for ideas. Other codes included internal approval administration, providing information to facilitate decision-making, and explaining the reasoning behind actions and decisions.	Autonomy: Codes in this dimension highlighted the importance of communication, decision-making, and taking a holistic approach to collaboration projects. Organizations were actively consulting internal experts, sharing information, and seeking approvals as needed. Additionally, there was a focus on developing holistic approaches to collaborations and ensuring that projects are interconnected and add value to stakeholders involved.	Mutuality: The emphasis in this category was on shared decision-making, transparency, and collaboration. Organizations were working together to make informed decisions and providing relevant information to support decision-making processes. There is also a focus on ensuring the right people are involved in discussions and negotiations to accelerate decision-making and achieve mutually beneficial outcomes.	Trust and Reciprocity: The codes in this category revolved around building trust and maintaining reciprocal relationships. Examples include seeking approval from various stakeholders, agreeing to disagree and working together to find the best approaches to addressing challenges, and making decisions based on mutual trust. There is also an emphasis on clear and transparent communication, with parties informing each other of decisions and the reasons behind them.

Table 4.8 Confirmed components and dimensions of the preliminary conceptual framework.

First-level themes provided in Appendix E for each dimension (cont'd).

CHANGE MANAGEMENT THEMES: THE CODES WITHIN THE THEMES OF CHANGE MANAGEMENT EMPHASIZED THE IMPORTANCE OF URGENCY, VISION, COMMUNICATION, PLANNING, AND WIN-WIN OUTCOMES. WE NOTED STAKEHOLDERS FOCUSING ON SHARING INFORMATION, EMPOWERING OTHERS, AND ADOPTING NEW BEHAVIORS TO ENSURE SUCCESSFUL COLLABORATIONS, AS WELL AS CELEBRATING SUCCESSES AND MAINTAINING A POSITIVE OUTLOOK.				
Urgency: The most significant themes in this category were the emphasis on creating a sense of urgency. Organizations were focused on developing and maintaining a sense of urgency to keep projects on track and motivate progress. This was achieved through communication, promoting the value of short-term wins, and highlighting the urgency of timeframes.	Vision: In this category, the primary themes highlighted the importance of communicating the vision. Organizations were actively sharing their project visions to align teams and keep everyone focused on the same goals. Creating and illustrating the vision, as well as reminding team members of the project vision, were also present in the codes.	Communicate Vision: The themes in this category emphasized the need for information sharing, feedback, and confirmation to enable others to act on the vision. Organizations were actively requesting information, brainstorming together, and seeking confirmation to ensure everyone can move forward on the shared vision.	Plan and create wins: The focus in this category was on empowering others to act on the vision and plan. Organizations were working on changing unhelpful structures, experimenting, and creating plans that allow others to take action in alignment with the project vision. Organizations were also striving for win-win outcomes and demonstrating flexibility in their scope. They worked outside standard practices to promote win-win solutions and acknowledged the value of win-win proposals internal to their organizations. The emphasis was on finding solutions that benefit all parties involved.	Institutionalize new approaches and behaviours: The themes in this category revolved around celebrating success and expressing satisfaction for team and project achievements. Wishing success and suggesting success were also present in the data, highlighting the importance of a positive outlook and support for successful outcomes. Codes in this category included themes focusing on adopting new behaviors and practices that contribute to the overall success of the collaboration.

Table 4.8 Confirmed components and dimensions of the preliminary conceptual framework.

First-level themes provided in Appendix E for each dimension (cont'd).

DESIGN THINKING THEMES: THE CODES WITHIN THESE DIMENSIONS EMPHASIZED THE IMPORTANCE OF EMPATHY, IDEATION, DEFINING ACTIONS, PROTOTYPING, AND TESTING. STAKEHOLDERS FOCUSED ON UNDERSTANDING THEIR PARTNERS, GENERATING AND EVALUATING IDEAS, ITERATING ON PROTOTYPES, VALIDATION, AND CREATING SHORT-TERM WINS TO MOTIVATE AND ADDRESS THE SPECIFIC PROJECTS CONTEXTS.				
Empathize: The main theme under this category is the action of seeking empathy and demonstrating an understanding and appreciation for partners' efforts and perspectives. Stakeholders were actively demonstrating empathy, exchanging information informally to create goodwill, and creating allies to strengthen the collaboration culture. Disagreement with proposed actions, ideas, or suggestions also appeared under this theme, potentially indicating a need for empathy in these situations.	Ideate: In the Ideate category, the main codes were ideation itself, with organizations actively brainstorming and generating ideas to address collaboration challenges. The data showed a focus on proposing alternative ideas, inviting others to join in on project planning, and being creative with exchanged collaboration artifacts. There was also an emphasis on seeking approval for proposed ideas, agreeing with proposals, and highlighting challenges or doubts about proposals on hand.	Define: The Define category highlighted the importance of creating a sense of urgency and defining and communicating the next actions. Stakeholders were focused on mobilizing and creating synergies within their organization, as well as creating working frameworks, visions, and project structures. The data also revealed a focus on reframing mutual understandings as a question for validation.	Prototype: The main codes in this category were related to prototyping itself, with organizations actively sending and sharing preliminary project artefacts to enable each other to act. Creating non-standard artifacts and sending prototypes for review were also present in the codes, indicating a focus on experimentation and iteration on the artefacts in the collaboration process.	Test: The codes related to the Test category emphasized seeking validation, requesting clarifications, and approving proposed ideas. Stakeholders were looking for confirmation of their understanding, evaluating inputs from experts and non-experts, and planning for short-term wins. The codes suggested a focus on ensuring that ideas and proposals are thoroughly evaluated and validated before moving forward in the collaboration process.

Table 4.8 Confirmed components and dimensions of the preliminary conceptual framework.

First-level themes provided in Appendix E for each dimension (cont'd and end).

PROJECT MANAGEMENT ANALYSIS FRAMEWORK: THE CODES INDICATED THAT PROJECT MANAGEMENT PRACTICES WITHIN THESE IOC INCLUDED THE FIVE KEY ASPECTS OF THIS FRAMEWORK.				
Mobilisation	Direction	Structuring	Implementation/Execution	Appropriation
Mobilizing actions were focused on creating a sense of urgency, fostering teamwork, and initiating communication. The codes emphasized the importance of forward-looking plans, brainstorming, and building relationships. codes suggested that interorganizational collaboration relies heavily on establishing a strong foundation for communication and cooperation.	Direction actions codes included acknowledging efforts, recognizing actions, and providing guidance. These codes highlighted the importance of recognizing and supporting the work being done by the stakeholders. The codes indicated that effective collaboration projects require clear communication and acknowledgment of the contributions made by all parties involved.	Structuring actions codes emphasized the need for creating working frameworks, project structures, and strategic plans. These codes suggest that successful collaboration projects require a clear plan and structure that all parties can follow. The codes underlined the importance of establishing a framework that enables all participants to work together effectively.	Implementation and execution actions codes were centered around planning, executing, initiating discussions, and acknowledging information. These codes suggest that effective collaboration projects rely heavily on active engagement, communication, and follow-up. The codes highlight the need for continuous action and communication throughout the entire collaboration process.	Appropriation action codes included acknowledging and providing guidance, initiating involvement, and exploring optimal plans. These codes demonstrate the importance of understanding the context, being adaptable, and considering alternative approaches in interorganizational collaboration projects. The Appropriate codes underscores the need for flexibility and adaptability to achieve desired outcome throughout the phases of management of collaboration projects and not only after project closure. It is proposed as a feedback loop internal and omnipresent throughout the collaboration project.

CHAPTER 5 ABDUCTIVE ANALYSIS, DISCUSSION AND PRESENTATION OF NEW CONCEPTS, THEMES, AND PROPOSITIONS

Themes that emerged from the case analyses prompted the exploration of new multi-faceted views of interorganizational collaboration. These new themes which are presented in this chapter stem from an abductive reasoning lens through which we analyzed project artefacts, codes and themes, as well as the continuous process of literature review. These additional observations and identification of patterns combined with qualitative and quantitative review confirmed new themes related to design thinking and dynamic capabilities, affordances, Higher-order thinking (HOT), and entrepreneurship which we present in this chapter.

The second-level themes provided in Table 5.1 and in more details in Appendix F, as well as the first-level themes provided in Appendix B and Appendix C inspired a non-comprehensive list of new concepts further developed through abductive reasoning and presented in this chapter. Although, the new major themes listed below are not comprehensive of all themes inspired by this analysis, they include the basic themes which inspired the final conceptual framework in this study, namely:

1. Collaboration affordances include:
    a. Artifacts that carry meaning and afford action
    b. Action verbs as affordances
    c. Social values and sentiments
    d. Actions, behaviors, thoughts, emotions, and attitudes as affordances
    e. Empathy, emotions, politeness, hope, kindness, and apologies
    f. Action-based collaboration relationship and trust-building
        i. Rhetoric: ethos, logos, and pathos, but also kairos (Greek for here and now/urgency) and kano (Greek for make/commit), in other

words, we extend these concepts into the simple statement of “walk the talk”

ii. Walking the talk, from rhetoric to action to trust in people and processes

iii. Trust affordances

g. Dynamics related to the exchange and communication of information and artifacts

h. Affordances to augment the social construction and management processes of collaborations

i. Action verbs as vocabulary for actions to provide awareness and augment perspectives of reflective practitioners

ii. Vocabulary of general collaboration affordances (tangible and intangible)

2. Design is a human problem-solving dynamic capability

a. Cognitive and affective states affordances enabling design thinking as a dynamic capability

3. Collaboration higher-order thinking and learning

a. Higher-order thinking for setting up collaborations

b. Strategy, intuition, creativity, and decision-making

c. Experiential learning

d. Conversation as experiential learning

4. Entrepreneurial alertness and collaborative alertness

a. Not a one-time transaction view, the potential for many possible outcomes of collaborations, creativity and entrepreneurial mindset

b. Mobilization of individuals and organizations

We have also identified the following phases of collaboration, which do not occur linearly, and where stakeholders iterate between phases as required by collaboration dynamics:

- excitement
- ideation
- formalization of preliminary discussions
- exchange of artefacts proposing common objectives and goals
- negotiation
- acceptance/deception
- agreements/disagreements
- iterations of final formal artefacts
- final acceptance/refusal

Artefacts and their textual contents carry meaning and potentially latent and manifest messages to stakeholders, which is further explored in terms of what role artefacts may have in impacting collaboration where individuals and organizations strive to build relationships. Additionally, artefacts can afford certain actions by individuals and organizations, as we learned from studying the textual data, codes, and themes. The next sections discuss the concept of affordances (Gibson, 1966) and how its meaning evolved. The concept of Collaborative Alertness has also emerged through this analysis, leading to further exploration on entrepreneurship, which is relevant for collaboration initiated by individual stakeholders striving to build collaboration projects and relationships.

Higher-order thinking is inspired by the cases and themes, where collaboration is complex and strategic and requires creativity, adaptability, and agility. These concepts extend beyond the simple applicability of standard processes, practices, and related prescriptions.

Additionally, we will explore the basic tenets of these themes, given the limitations of what can be done in one thesis, and lay the groundwork for future research. As noted in earlier

chapters, the first and second level codes were based on in context textual passages and artefacts data which were gathered under an NDA with the limitation that the raw data only be available to the researcher, the second coder, and the advisor. Therefore the new themes presented in this chapter stem from an abductive reasoning lens based on the interpretation of project artefacts, codes and themes, as well as the continuous process of literature review. Section 5.1 explores tangible and intangible collaboration affordances their role in collaborative relationships. Section 5.2. focuses on design thinking as a dynamic capability for addressing collaboration wicked problems and enabling relationships Section 5.3 explores Higher-order thinking and learning as necessary to collaboration and as an outcome of collaboration. Section 5.4 discusses entrepreneurship, related alertness, and their impact on collaboration: collaboration alertness. And finally, section 5.5 which presents the framework based on this study.

Table 5.1 Second-Level Themes and Action Verbs from the Corresponding First-Level Themes

Second-Level Themes	**Action Verbs**
Initiating Action, Commitments, Facilitating Action	Request, Enable, Communicate, Suggest, Clarify, Prompt, Inform, Emphasize, Ask, Take, Respond, Limit, Rally, Get, Build, Excuse, Commit, Propose, Assume
Facilitating Progress and Moving Forward	Promote, Take, Wait, Move, Realize, Involve, Propose, Ask, Work, Do, Get, Keep, Help, Need, Try, Influence, Give
Accountability, Creative Solutions, and Proposing Alternatives	Take, Provide, Put, Propose, Express, Build, Remind, Explore, Offer, Not Provide, Challenge, Need, Suggest, Try, Understand, Negotiate, Answer, Request, Think, Stall, Scope, Act, Instruct, Complete, Accept, Agree, Communicate, Deflect, Exchange, Inform
Creative Problem-Solving, Partner Engagement, Discovery and Iteration	Offer, Caution, Operate, Highlight, Consult, Need, Leverage, Discover, Provide, Argue, Set, Use, Limit, Observe, Iterate, Volunteer, Give, Request, Offering, Interpret, Open, Justify, Frame, Reframe, Explain
Challenges, Problem Solving, Managing Relations and Change	Give, Take, Lack, Need, Help, Highlight, Provide, Grow, Keep, Inform, Fail, Influence, Make, Have, Assist, Insist, Complete, Prefer, Learn, Change, Hand Over, Come, Celebrate, Maintain, Recommend, Illustrate, Explain, Request, Clarify, Apologize, Use
Suggesting workaround, Proposal and Alternatives	Suggest, Modify, Propose, Offer, Negotiate, Communicate, Overcome, Suggest, Adapt, Invite, Brainstorm
Proposal Development and Evaluation, Influencing	Communicate, Tempt, Adopt, Evaluate, Question, Request, Clarify, Seek, Highlight, Fund
Influencing and Negotiation	Justify, Emphasize, Make, Feel, Communicate, Rally, Offer, Interpret, Provide, Direct, Answer, Clarify, Suggest, Lack, Commit, Request, Understand, Explain, Value, Make Explicit, Lead, Demonstrate, Seek, Build, Have, Work, Influence, Entice, Tempt, Deflect, Soften Suggest, Try, Temper, Clarify, Communicate, Adopt
Interpersonal Dynamics, Influencing, and Resource Management	Request, Help, Demonstrate, Take, Put, Commit, Inform, Keep, Focus, Make, Summarize, Try, Convince, Express, Want, Understand, Need, Share, Introduce, Criticize, Communicate, Build, Involve, Use, Greet, Re-engage, Flexible
Participation and Seeking and Encouraging Involvement	Suggest, Give, Please, Support, Invite, Involve, Solicit, Propose, Request, Offer, Communicate

Table 5.1 Second-Level Themes and Action Verbs from the Corresponding First-Level Themes (cont'd)

Setting and Clarifying Expectations, and Providing Guidance	Emphasize, Set, Brainstorm, Propose, Provide, Explain
Negotiations Dynamics and Strategy, Communication and Discussions	Communicate, Exchange, Share, Disagree, Concern, Request, Clarify, Provide, Direct, Guide, Question, Inform, Run, Highlight, Need, Reassure, Negotiate, Propose, Give, Follow Up, Start, Review, Consider, Commit, Suggest, Promote, Exchange, Facilitate, Think, Express, Retract, Let, Continue, Request, Advise, Get, Respond, Send, Invite
Negotiation and Strategy and Internal Dynamics	Face, Explain, Delegate, Question, Authorize, Spend, Take, Move, Communicate, Influence, Hold, Accountable, Forecast, Try, Understand, Negotiate, Meet, Propose, Facilitate
Communicate, Inform, and Provide Updates	Communicate, Summarize, Share, Provide, Update, Set, Cause, Delay, Prioritize, Constrain, Suggest, Inform, Take, Update, Announce, Follow, Confirm, Commit, Send, Request, Show, Look forward, Invite, Highlight, Play, Reaffirm, Reassure, Propose, Discuss
Informing and Directing, Enable Action through Information and Artefacts	Communicate, Inform, Exchange, Provide, Enable, Act, Demonstrate, Engage, Direct, Keep, Share, Offer, Help, Request, Clarify, Give, Facilitate, Solicit, Rephrase, Confirm, Acknowledge, Receipt
Feedback and Advice on Artefacts, Progress and Updates	Provide, Request, Need, Share, Make, Keep, Inform, Run, Recommend, Ensure, Copy, Meet, Look Forward, Talk, Follow Up
Exploring Constraints, Seeking Clarification and Information	Can, Do, Request, Seek, Understand
Artefacts, Information and Resource Sharing	Communicate, Exchange, Propose, Inform, Request, Suggest, Provide, Clarify, Expect, Involve, Need
Requesting and Providing Information Clarifications and Advice	Justify, Request, Affirm, Send, Seek, Highlight, Make, Coordinate, Provide, Facilitate, Show
Expressing Intentions to Support, Promote Understanding	Seek, Emphasize, Make, Communicate, Clarify, Express, Understand, Summarize, Help, Wish, Advance, Wait, Confirm, Hope, Need, Transarency, Disengage

Table 5.1 Second-Level Themes and Action Verbs from the Corresponding First-Level Themes (cont'd)

Stakeholder Engagement, Building and Demonstrating Trust	Demonstrate, Strengthen, Leverage, Confirm, Guide, Encourage, Request, Promote, Offer, Provide, Extend, Direct, Delegate, Participate, Communicate, Support, Seek, Show, Reassure, Accelerate, Partner, Set, Interpret, Suggest
Emotions and Emotional Intelligence	Express, Partner, Persevere, Feel, Accept, Reassure, Build, Confirm, Clarify, Apologize, Temper, Demonstrate, Elevate, Communicate, Greet, Overcome, Made, Happen
Recognition and Respect	Recognize, Elevate, Respect, Reiterate, Congratulate, Give, Highlight
Challenges and Concerns	Communicate, Send, Follow, Assure, Lack, Highlight, Express, Understand, Seek
Challenges and Conflict Management	Deliberate, Communicate, Blame, Inform, Seize, Facilitate, Introduce, Suggest, Reject, Communicate, Exclude, Express, Lack, Explain, Highlight, Identify, Seek, Negotiate, Propose
Partner and Stakeholder Engagement Dynamics	Communicate, Share, Provide, Request, Take, Move, Inform, Keep
Partnership Dynamics, Design	Design, Discuss, Upset, Exclude, Commit, Build, Facilitate, Contact, Prompt, Inform
Internal Negotiation Dynamics and Accountability	Discuss, Communicate, Provide, Tempt
Feedback, Improving, Follow-Up, and Reminding	Follow, Send, Confirm, Commit, Give, Inform, Complete, Seek, Request, Provide, Explain
Stakeholder Engagement, Mobilizing, Persistence	Set, Need, Communicate, Request, Discuss, Accept, Invite, Show, Finish, Wait, Persist, Demonstrate, Mobilize, Remind, Express,Proactive, Build, Re-engage, Propose, Engage, Respond, Accept, Availability, Support, Request
Accountability, Conflict Management, Coordination, Strategy	Help, Celebrate, Remind, Maintain, Coordinate, Facilitate, Confuse, Discord, Discuss, Prioritize, Intercept, Suggest, Give
Structure, Manage, and Coordinate	Define, Set, Communicate, Propose, Form, Assemble, Request, Provide, Emphasize, Suggest, Make
Facilitating, Logistics and Planning Dynamics	Follow, Set, Kick-off, Lay, Facilitate, Meet, Contact, Request, Define, Negotiate, Send, Offer, Caution, Highlight, Discuss, Accelerate, Exchange, Introduce, Justify, Make, Explain, Inquire, Illustrate, Clarify

Table 5.1 Second-Level Themes and Action Verbs from the Corresponding First-Level Themes (cont'd and end)

Leading, Learning, and Reflecting	Reflect, Learn, Congratulate, Exchange, Guide, Strengthen, Provide, Recommend, Propose, Discover, Prepare, Remind, Aware
Leadership and Parnters Dynamics	Lead, Advance, Meet, Discuss, Communicate, Leave, Need, Exchange, Explain, Expect, Introduce, Take, Own, Delegate, Manage, Empower, Take, Use, Negotiate, Facilitate
Strategy, Leadership, Patners Management, and Risk, Opportunity Recognition	Risk, Emphasize, Set, Commit, Take, Consolidate, Acknowledge, Provide, Facilitate, Coordinate, Demonstrate, Communicate, Introduce, Escalate, Influence, Lead, Advance, Meet, Discuss, Expect, Explain, Need, Recognize
Recognizing opportunity to augment the project with additional resources	Exchange, Explore, Come Up, Agree, Consider, Offer, Perceive, Receive, Disengage, Provide, Engage, Negotiate, Facilitate, Move, Suggest, Expedite, Progress
Proposing, Planning, Negotiation, Influencing, Decision Making	Act, Escalate, Pressure, Negotiate, Offer, Provide, Propose, Decide, Make, Suggest, Explain, Set, Start, Communicate, Accept, Exchange, Justify

5.1 Collaboration affordances: tangible and intangible

The analysis findings show the intensity of tangible and intangible artifacts in collaboration. as mentioned in the previous section, design science “calls for the creation of innovative artifacts to solve real-world problems” (Vahidov, 2006, p. 10). Hevner and Chatterjee (2010) also see design science as the effective means to study “‘wicked organizational problems’, the type of problems that require creative, novel, and innovative solutions” (p. 11) and that natural science is not sufficient to study of these types of problems:

> Scientific theories may explain existing or emergent organizational phenomena related to extant organizational forms and artifacts, but they cannot account for the qualitative novelty achieved by human intention, creativity, and innovation in the design and appropriation of such artifacts. That is, science, the process of understanding "what is", may be insufficient for design, the process of understanding "what can be" (p. 13)

“Design science is concerned with ‘devising artifacts to attain goals” (March & Smith, 1995, p. 253)… Design science consists of two basic activities, build and evaluate” (March & Smith, 1995, p. 254). In this study, the aspect of creating, building and evaluating artefacts extends to collaborations and their management where we explore tangible and intangible collaboration artefacts in order to create awareness and encourage further research on the new concept of intangible affordances in collaboration.

The omnipresence of tangible artefacts exchanged in the cases prompted wider exploration related to the role and meaning of artefacts in general. This study also explores intangible artefacts and their related affordances, which, according to Gibson, represent the “relationship between an agent and its environment” (Sarathy, 2016, p. 637). This study argues, through abductive analysis, that intangible affordances provide the possibilities for action from non-material aspects of our experiences and interactions. These intangible affordances play a significant role in collaboration by shaping human behavior, communication, and relationships. These intangible affordances are important for understanding human behavior, as they influence how we think, feel, and act in various situations. They also influence our decision-making processes, facilitate communication, and contribute to the development of personal and professional relationships during collaboration. In this study we propose to extend the concept of affordances beyond the traditional view of tangible artefacts.

> The word "affordance" was originally invented by the perceptual psychologist J. J. Gibson (1977, 1979) to refer to the actionable properties between the world and an actor (a person or animal). To Gibson, affordances are a relationship. They are a part of nature: they do not have to be visible, known, or desirable. Some affordances are yet to be discovered. Some are dangerous. I suspect that none of us know all the affordances of even everyday objects (Norman, 2004, p. 1).

In support of our argument, we present relevant concepts of intangible artefacts, such as language, cognitive artefacts as “tools of thought”, and affective artefacts as intangible artefacts considered to be affordances.

Suh and Wagner (2017) define affordance, based on Gibson, as the properties of an object. They reference Norman and describe an affordance as “a combination of the ‘actual and perceived properties of the thing, primarily those fundamental properties that determine just how the thing could possibly be used’ (Norman, 1988, p. 9)” (p. 418).

Although Suh and Wagner (2017) and Norman (2004) refer to affordances as the design of tangible artefacts or features, an affordance can also be the relationship between the perceived “properties” by an agent of intangible “artefacts” that offer meaning, and interpretation by the agent provides, enables, allows, and influences their actions. For example, someone makes a statement that prompts another to take certain actions including making a statement in return.

Pe-Than and Herbsleb (2019), when studying hackathons, refer to affordances as “everything about the hackathon environment that contributes to any kinds of interactions occurred” (p. 28) including “overhearing, spontaneous feedback, learning, ad hoc collaboration, shared visual space, and increased members’ familiarity [8, 18] (p. 29), and “Our results revealed how participants made use of affordances offered by hackathons to get their work done, exchange knowledge, extend their social networks, and cultivate skills and practices that they could apply in their day-to-day work” (p. 34).

Chemero (2003) argues that “affordances are relations between the abilities of animals and features of the environment. As relations, affordances are both real and perceivable but are not properties of either the environment or the animal” (p. 181), and first that “affordances are not properties, or at least not always properties” (p. 185), and second that “affordances are not in the environment” (p. 185).

Wheeler (2004) explores the question of language through his paper, “Is language the ultimate artefact?” Although not fully supportive, he finds merit in the concept that contributes to linguistic understanding:

> Andy Clark has argued that language is ‘‘in many ways the ultimate artefact’’ (Clark, 1997, p. 218). Fuelling this conclusion is a view according to which the human brain is essentially no more than a pattern-completing device, while language is an external resource which is adaptively fitted to the human brain in such a way that it enables that brain to exceed its unaided (pattern-completing) cognitive capacities, in much the same way as a pair of scissors enables us to ‘‘exploit our basic manipulative capacities to fulfil new ends’’ (Clark, 1997, pp. 193–194) (p. 693).

Cognitive artefacts are defined as per (Heersmink, 2013, p. 465) as “human-made, physical objects that functionally contribute to performing a cognitive task.” (Jenkins, Salmon, Stanton, & Walker, 2010, p. 617) further add “These, so-called, ‘cognitive artefacts’ (Hutchins 1995a) lessen the burden on the humans in the system, reducing the demands on short-term memory”. Everyday problem-solving heavily relies on cognitive artifacts or tools of thought, which can vary from traditional tools like paper and pen to modern computational systems. These artifacts play an important role in supporting problem-solving (Payne, 2001).

(Piredda, 2020) introduces the concept of "affective artifact," which is inspired by theories of cognitive artifacts and situated affective science. The author defines affective artifacts as objects that can change an agent's emotional state and can play a significant role in defining the agent's self. The author also concludes that “affective artifacts play a key role in the philosophy of cognitive science, the philosophy of technology and in the debate about the self” (Piredda, 2020, p. 549).

Furthermore, the continuous cycle of literature review, codes, themes, and underlying textual data, in addition to continued discussion with multidisciplinary SMEs allowed for categorization of codes into actions as affordances and general collaboration affordances, including tangible and intangible affordances such as behaviours, cognitive and emotional states, and other themes are introduced.

“Action verbs” obtained from analyzing the cases individually are provided in Appendix G; however, they are aggregated, and they illustrate a list of actions inspired from themes and concepts from the analysis. This list may be useful for collaborative research projects practitioners as it

provides examples of "intangible artefacts", which may augment collaborators' awareness when reflecting on their actions and context. Similarly, Appendix H presents a list of tangible and intangible general collaboration artefacts including values, behaviours, thoughts, and emotions. These intangible artefacts are deduced from the themes and contribute to the new concepts, particularly tangible and intangible affordances related to collaboration. We also propose these intangible artefacts as a collaboration familiarization vocabulary in IOC projects.

We finally propose that both tangible and intangible affordances in collaborations can be purposefully designed to facilitate collaboration between stakeholders and contribute to the effective day-to-day management of collaborations.

The following sections elaborate further on the concept of collaboration affordances, which may be tangible, actionable, relational, or affective artefacts. Based on the case analyses, collaborative affordances facilitate collaboration through purposeful design of meaningful tangible and intangible artefacts. The purposeful action of designing collaboration affordances calls for higher order thinking, entrepreneurial alertness, and other concepts introduced in the following sections.

5.1.1 Collaboration Affordances impact on socio-cultural systems

In this section we illustrate the importance of affordances in shaping the socio-cultural system in which collaborations occur. We provide a perspective which acknowledges that affordances, both tangible and intangible, and people are interconnected, and organizational processes and evolution depend on considering theses elements. We recognized through the analysis different affordances through which individuals perceive and interact with their context and environment. We propose an integrated and comprehensive view on affordances and how individual and collective actions, social structures, and internalized cognitive mechanisms influence our interaction within collaborative settings.

Pols (2012) characterizes affordances in four levels namely, opportunity for manipulation, opportunity for effect, opportunity for use, and opportunity for activity, and posits that users need certain knowledge to perceive affordances in these levels:

> Artefacts offer opportunities for action, "affordances", that can be described on various levels, from manipulations ("pushing a button") to social activities ("dialling a friend").

> However, research in design into affordances has not investigated what an "action" is, nor has it distinguished those levels (p. 113).

The concept of perceiving affordances at different level is one which we reflected on when considering collaboration dynamics and the potential role of artefacts, tangible and intangible, for action, as affordances, in the context of the day-to-day management of collaboration projects.

> According to the philosophers Anscombe (1957/2000) and Davidson (1980: essay 1), the things you intentionally do directly, not by doing anything else or by doing multiple things, are actions. Examples are (intentional) blinking, sitting and waving. Actions have consequences, however, and often we describe our actions in terms of their consequences. If I startle a burglar (unintentionally) by turning on the light (intentionally) by flipping a switch by moving my hand, I can be said to do a number of things. However, Anscombe and Davidson hold that there is only one, basic, action here: moving my hand, as I do not (intentionally) do this by doing something else. The other descriptions of what I do are all descriptions of the same action, moving my hand, but in terms of some of its many consequences (Pols, 2012, p. 115).

Artefacts afford actions within a socio-technical system:

> Knowing what an artefact does in itself is good, but no artefact works in isolation. Artefacts are connected to humans and to each other, their use and behaviour regulated by institutions and social procedures. In other words, many artefacts are part of socio-technical systems, systems that themselves have intended functions and need to contain artefactual, human and institutional parts in order to fulfill those intended functions (Kroes et al., 2006, p. 123).

The designer can design the artefact or the socio-cultural system, thus it is important to show what actions or behaviours the artefact can ultimately afford:

> People do not buy modems because they afford modulating and demodulating analog signals to encode and decode digital information, though that could be said to be the technical function of a modem. Rather, people buy modems because they can be made a part of a socio-technical system and then afford emailing, surfing the internet, etc. (Pols, 2012, p. 123).

Fayard and Weeks (2014) propose that research on organizational practices has demonstrated that such practices are invariably situated within sociomaterial environments. To comprehend organizational processes, it is essential to consider the interplay among organizational structure, social practices, material context, and physical artifacts.

Fayard and Weeks (2014) connect practice with perception through affordances, where practice is situated in a sociomaterial environment entangled in organizational structures, social practices, and physical artifacts. "Affordances connect practice with perception. The affordances of an object or

environment are the possibilities for action that it calls forth to a perceiving subject" (p. 238). They state that affordances are both dispositional and relational,

> On the one hand, affordances are dispositional: They are visible and directly linked to practice when perceived, but as suggested by Gibson (1986) there are cases when an affordance is misperceived or not perceived at all. Moreover, "we live in a physical world that has causal effects in the sense that you just can't walk straight through a wall" (Giddens in Giddens & Pierson, 1998, p. 821). Affordances channel behaviour in a specific direction yet they never determine it. Hence, on the other hand, affordances are relational: they arise from the encounter that a person, characterized by certain physical attributes and certain social and biological needs, desires, and intentions, has with a socially and physically constructed material environment. In other words, affordances are also relational: they depend on the relation between an individual's goals, the material properties of a technology, and the organizational context in which the technology is used (p. 243).

They consider Gibson's concept to be complemented by Bourdieu's idea of "habitus" for the social aspect:

> Our claim is that the concepts of affordance and habitus complement and complete each other. Affordance offers a useful way of thinking about how practice is patterned by the social and physical construction of technology and the material environment and habitus offers a useful way of thinking about how practice is patterned by social and symbolic structures (p. 236).

Where habitus is

> an acquired system of generative schemes of perception, thought, and action that tend to guarantee the "correctness" of practices and their constancy over time (Bourdieu, 1990: 53). It is acquired over the lifetime of an individual by virtue of the objective economic and social conditions of his or her existence. It is individual because no two people have exactly the same biography; the habitus of people who live in the same context and share a similar social class will be homologous, though never identical. Habitus tends to generate practices that are positively sanctioned as reasonable and common sense. Such practices are likely, Bourdieu argues, to be adjusted to the objective conditions of existence. Conversely, habitus tends to exclude, without resort to argument or violence, those practices that are negatively sanctioned; that is, those practices incompatible with objective conditions. … Thus, given a set of conditions, habitus affords an actor some thoughts and behaviors and not others, making those thoughts and behaviors seem more appropriate, attractive, and authentic than others (p. 245).

Based on the complementary concepts of affordance and habitus, the authors propose a language for understanding the material and social aspects of organizational practices and technology. This addresses concerns raised about sociomaterial perspectives, by recognizing that both affordance and habitus channel behavior without determining it. Affordance arises from the encounter of a

person's physical attributes, social and biological needs, desires, and intentions with a socially and physically constructed material environment. On the other hand, habitus arises from the encounter of history embodied by a person as second nature with a field. Together, affordance and habitus offer a better way of explaining how social and symbolic structures shape practice. (Fayard & Weeks, 2014).

From the cases analyses, habitus along other intangibles afforded actions when managing collaborations, thus as suggested in the previous section, collaboration affordances includes both tangible and intangible artefacts from the material to the cognitive and behavioural. Fayard and Weeks (2007) assert that “affordances can help clearly and concretely explain how physical attributes and social meaning, together, shape behavior and how, in turn, patterns of behavior shape the physical environment and its assigned meaning (Norman 1988; Gaver 1996; Hutchby 2001).” (p. 17). Additionally, Warf (2001) asserts that social relations are indeed real, even if they cannot be directly observed.

Change in social systems, that is, the social practices of people, is the result of the interaction between human action—human agency with capacity to act—and social structures that reside in human “memory traces” and are dependent on human engagement. Human action and social structures mutually shape each other, thus constituting a “Duality of structure” (Sharma, Barnett, & Clarke, 2012, p. 160), which is "that the properties of social systems are both the medium and the outcome of practices that constitute systems (Giddens, 1979)” (Sharma, Barnett, & Clarke, 2012, p. 160).

Moving from means other than the physical for collaboration affordances, Stahl (2003) proposes that meanings are shared and they persist in linguistic and physical artifacts in cultures and situations; however, because their interpretations are individual, and for individuals to collaborate, they must be able to understand and interpret artifacts: “Meanings are necessarily shared; they persist in linguistic and physical artifacts in our culture and situation” (p. 1). Stahl follows Vygotsky’s definition of artefact to include symbols, physical objects, and cognitive artefacts and recognizes that human activities are mediated by artefacts. He analyzes Hegel et al. and proposes that creating and using artefacts such as products, commodities, or gestures follows three stages:

1. People are involved in some collaborative activity involving their interpersonal relations, social context, physical objects, etc.
2. Some object, bodily gesture or word becomes associated with this meaning and acts as a persistent externalization of the meaning.
3. The artifact can later be used as an embodiment of the meaning that was created in the previous stages.
   In this way, through consistent, intentional use by a group of people engaged in activity together, something—a gesture, a sound, a shaped physical object—becomes a meaningful artifact. Such artifacts intimately combine meaning and physical existence (p. 6).

Stahl (2003) proposes the term “cognitive artifact” to build on the work of Vygotsky in “Mind in Society”:

> However, one can imagine an analysis of human mind as a complex assemblage of what we might call cognitive artifacts: internalized forms of culturally developed artifacts. The term “cognitive artifact”—even in the writings of Norman and Hutchins—is open to a Cartesian reading, where the artifact is a physical object (like a string on one’s finger) that is somehow used by an individual’s mind to accomplish some cognitive action (Norman, 1991; Hutchins, 1999). Here, on the contrary, the term is being used to indicate an “internal artifact” that had its origin in the interpersonal world but has since been internalized as a psychological function (p. 7).

Internalization of symbolic and physical artifacts develops cognitive artifacts through self-reflection and internal speech, which also creates self-consciousness.

Further transformations occur, comprising what Vygotsky calls internalization:

> An operation that initially represents an external activity is reconstructed and begins to occur internally … An inter-personal process is transformed into an intra-personal one … The transformation of an inter-personal process into an intra-personal one is the result of a long series of developmental events … They are incorporated into this system of behavior and are culturally reconstituted and developed to form a new psychological entity … As yet, the barest outline of this process is known (p. 6).

“Vygotsky’s vision reveals a “society of mind” of dynamically developing and interacting cognitive artifacts” (Stahl, 2003, p. 7). Vygotsky believed that the mind is a product of cognitive artifacts that are created and transformed through social interaction. Where a "society of mind" is where individuals dynamically develop and interact with these artifacts. This perspective suggests that our understanding of meaning and interpretation is influenced by the social and cultural context in which we interact and collaborate with others (Stahl, 2003).

“Because shared meaning exists in the observable world and collaborative meaning-making necessarily unfolds there” (Stahl, 2003, p. 10). For collaborators to work together, they must communicate their understandings of the observable world. While not everything needs to be explicitly stated, collaborators give feedback to each other through word choices, inflections, gestures, and other nonverbal cues. When misunderstandings occur, collaborators will have explicit discussions to restore a shared understanding. The learning that took place during collaboration can be found in externalizations and artifacts created during the process (Stahl, 2003).

We also recognize the role of intangible collaboration affordances in the collaboration process where language and conversation are key when designing collaborations. Fleming (1998) emphasizes the important and complex role of language and conversation in the design process:

> Language permeates the design process: it is used in the communication of constraints and requirements; in group problem-solving and decision-making; in designer-client dialogue and negotiation; in inquiry, research, and testing; in naming, specifying, presenting, and elaborating; and in evaluation, application, and interpretation. But such language is also easily overlooked and undervalued. It is only when the design process is approached through the unique, complex, social events that comprise it, and when design artifacts are seen as enmeshed in contexts of production and use; that language takes its place as a constitutive element in the invention of the built world (p. 42).

He quotes Forester who sees

> design as conversation … to better account for ambiguity in design; to appreciate the sense in which design is a "world-making activity;" to be aware that design evolves through communication—through "questioning, stating, answering, reporting, challenging, apologizing, suggesting, qualifying, and so on;" to be open to processes of learning in design, conversations serving to change the very parameters of the problem; to be sensitive to the fact that design takes place in a historical, practical, institutional, and organizational context; to realize that in conversations speakers not only create objects but reproduce their identities and social relations as well; and to recognize that conversations are politically charged, some people allowed to participate and others, not (p. 43).

We propose that intangible affordances within socio-cultural systems, which encompass societal norms, values, language, and roles, have an important impact on collaboration. These affordances set the framework and parameters for how people communicate, make decisions, handle disagreements, use tools, and learn. In essence, they shape the socio-cultural systems within which collaborations exist. We posit that affordances designed in action during collaboration projects facilitate the enactment of collaboration within these socio-cultural systems. We found through this

study that this design effort is intuitive, requires creativity, situational awareness, and alertness. Additionally, we believe that familiarity with collaboration affordances concepts may help mitigate the uncertainty of collaboration and promotes different strategies and actions, informed decision-making, and creativity in collaborative relationship building.

5.1.2 Communication affordances and the enactment of significance

Given the intensity of communication artefacts and efforts in the studied collaboration projects, **one out of eight textual codes touches on communication**, we're interested as were (Beynon-Davies, 2010) in models beyond the standard communication models as proposed by Shannon and Weaver (Shannon, 1949) and where **"communication is treated as an 'engineering' problem. As Shannon himself stated, 'the fundamental problem of communication is that of reproducing at one point, either exactly or approximately, a message selected at another point'** (Beynon-Davies, 2010, p. 392)**.** Beynon-Davies (2010) proposes that this model needs to be augmented so that it goes beyond the physical form or signal used to transmit the message to include the purpose, intention, and meaning; and the relationship between signs uses a common convention or system of signs: "To serve as a satisfactory baseline model for human communication, a number of elements have to be added to form an augmented model, which satisfactorily encompasses matters of pragmatics, semantics and syntactics" (p. 39). This human communication process involves actors, messages, signals and communication channels. The conversational nature of communication is not linear; it is more than a dyadic communication. Group conversations are prevalent in collaboration but seldom there is record keeping. Beynon-Davies argues that "when human communication occurs between more than two people and particularly when messages have to be transmitted across time and space, the persistent record is an essential feature of much human communication" (p. 393).

The authors introduce significance at the intersection of signs and systems. Where they consider their sensemaking (Weick, 1995), "is concerned with enactment of signs through forma (the substance of a sign), informa (the content of a sign) and performa (the use of signs in coordinated action) (Dietz, 2006)" (p. 390).

Beynon-Davies (2015) argues that

> the enactment of significance is central to unpacking the nature of the sociomaterial and that this phenomenon consists of the entanglement of performative, informative, and formative action. Such patterns form resources (affordances) and constraints for performative, informative and formative action (Leonardi, 2011) (p. 320).

The enactment of significance in is presented by the authors as a set of cycles entangled within the cycles of forma, informa, and performa.

(Beynon-Davies, 2010) The authors propose a view on their concept of enactment as one unifies viewpoints from organization science, cognitive science and computer science. They propose

> the patterning of order characteristic of human organization is enacted through three interrelated forms of action. Formative acts amount to the enactment of forma: acts of data representation and processing. Informative acts constitute the enactment of informa: acts of communication involving message making and interpretation. Performative acts constitute the enactment of performa: the performance of coordinated action within human groups (p. 393).

The above roles are encompassed in sign acts that are significant and through which we enact significance. Such sign acts which bridge the social world with the physical world through communication, have intent (pragmatics), expresses meaning (semantics), has structure (syntactics) and has a physical representation (empirics).

Giddens's structuration theory posits that structures are created by humans and are evident only through human action; however, these structures are reproduced and change through human interactions, which are constrained by the use and interpretation of the structures. Structuration theory underlines the relationship between the context, that is, social system, and the human (Sharma et al., 2012). This cyclical interaction between agents and social structure is relevant to sign-systems, which are social institutions and become evident only through sign acts between people.

> People use a sign-system as a resource for representation, communication, and action. This sign-system is produced and re-produced through sign acts. Over time, sign acts may change the structure of the sign-system itself leading to a new basis as a resource. Furthermore, the enactment of significance has much synergy with Boland's conception of information (Boland, 1987). He states that "It is through dialogue that we accomplish and re-accomplish meaning, and thus bring order to the social world. Through dialogue we name objects and give them significance … It is through dialogue that the symbolic order of our shared world is made real. Through dialogue we tell each other what is important and why. We search for the

> purpose, significance and meaning of our institutions and ourselves that is the social order" (Beynon-Davies, 2010, p. 394).

The framework illustrates three levels of enactment:

> within acts of performance, actors may communicate through informative acts. In turn, certain aspects of informa may be given persistence through acts of record-keeping—formative acts. In turn, such records may be used as an important resource within group communication, which in turn may be a resource for the coordination of performance among group members (Beynon-Davies, 2010, p. 394).

Consequently, the relationship between performance, communication, and representation: "what I represent is always less than I communicate; what I communicate is always less than what I do" (Beynon-Davies, 2010, p. 394).

Beynon-Davies defines communicative acts as aspects of human performance designed by an actor to influence another. Collaborations have rich examples of such acts that "arise from the 'game-like' character of human communication. A particular communicative act creates the possibility of usually a limited range of communicative acts as response" (Beynon-Davies, 2010, p. 394).

Furthermore, sociomaterial entanglement asserts that the social and the material are importantly linked, which supports this study's view of affordances as both tangibles and intangibles:

> Orlikowski (2007) argues that " … materiality is integral to organizing … the social and the material are constitutively entangled in everyday life. A position of constitutive entanglement does not privilege either humans or technology (in one-way interactions), nor does it link them through a form of mutual reciprocation (in two-way interactions). Instead, the social and material are considered to be inextricably linked—there is no social that is not also material, and no material that is not also social". Therefore, the sociomaterial is described in terms of constitutive entanglement between technology and humans (Beynon-Davies, 2010, p. 403).

Taking entanglement further, the author argues that "the enactment of significance is central to understanding the nature of the sociomaterial and can be seen to consist of the entanglement of performative, informative and formative action (p. 403).

And

> One particular advantage of the use of records within communication is that the presence of such persistent artefacts facilitates one-to-many and many-to-many communication within a group of actors over a period of time and across space. It turns individual memory into social memory. Such social memory serves to encapsulate objects and events of significance to some group of actors. These records as social memory, combined with

> individual memory, will form the enacted environment for further cycles of the enactment of significance (p. 405).

Furthermore, considering Robert Craig (1999) constitutive view of communication we further strengthen our view of communication affordances and the enactment of significance and emphasize an understanding of communication beyond the conventional transmission model. This theory aligns with the concept of enacting significance through communicative acts, as it views communication not just as a means of information transmission and receiving but as a fundamental process that constructs and transforms social reality. Craig's view reinforces the idea that communication shapes and is shaped by our social contexts and interactions and further highlighting the role of communication in creating shared meaning and understanding within group interactions.

Evans, Pearce, Vitak, and Treem (2016) emphasis the relational nature of affordances in contrast to the common view that affordances are inherent features or outcomes of technology or tools themselves. The authors describe affordances as dynamic and emerge from the interaction between the user and the technology within specific contexts.

Below are the five types of illocutionary acts that Beynon-Davies adapted from Searle (1975) through which actors exchange messages in an appropriate context with certain intentions important for collaboration:

- **Assertives** are communicative acts that explain how things are in the world
- **Directives** are communicative acts that represent the senders' attempt to get a receiver to perform an action
- **Commissives** are communicative acts that commit a speaker to some future course of action
- **Expressives** are communicative acts that represent the speakers' psychological state, feelings, or emotions
- **Declaratives** are communicative acts that aim to change the world through the communication itself (Beynon-Davies, 2010, p. 395).

Following are textual codes from the first-level themes corresponding to the above communicative acts and which are presented in Table 5.2.

Table 5.2 Communicative Acts Themes

Communication Type	Themes
Assertives	Communicate the vision
	Communicate constraints
	Communicate availability
	Give information and plan for further communication
	Communicate Limits and Constraints
	Communicate operating constraints
	Communicating standard practices and standard conditions
	Communicating project scope to hierarchy
Directives	Define-communicate next actions
	Communicate-request actions to be taken
	Communicate-confirm decision taken
	Communicate conclusions of discussions
	Communicate to rally internal support
	Set and communicate project objectives
	Directive communication on preferred project plan
Commissives	Communicate hope of overcoming obstacles in timeframe
	Lead industrial partner communicate their commitment
	Communicating commitment to the project

Table 5.2 Communicative Acts Themes (cont'd and end)

Expressives	Communicating appreciating
	Communicating appreciation
	Communicating frustration with process
	Communicating feelings
	Partner accepting politely bad news and communicating will to continue relationship
	Communicating emotions
	Acknowledging error in leaving out the partner and communicating misleading information
Declaratives	Initiate-accept communication-discussions
	Communicating bad, disengaging news
	Communicating good, engaging news
	Communicating good news
	Communicating bad news
	External project leader communicating bad news on behalf all of the partners
	Not communicating reason behind constraint

Building on the conceptual framework argued by (Beynon-Davies, 2010) and while the concept of affordances is not explicitly mentioned by the authors, we propose that communication affordances are composed of artefacts, which encapsulate the objective nature of information, its subjective nature, and its inter-subjective nature, corresponding to inform, forma, and performa. We argue that affordances refer to the potential actions or possibilities that an object or environment offers to an individual. These affordances enable the enactment of significance process through which meaning and importance are created, communicated, and understood within human interactions. We underline with this concept that communication in the context of collaborations is more than just the transmission of information; it requires a dynamic interplay of various elements such as intention, purpose, and meaning in context for the message to be transmitted.

5.1.3 Contracts as affordances

When setting up collaborations during the case studies, the majority of stakeholder exchanges were related to contract negotiations and exchange of related artefacts, which we believe captures more than the contract doctrine or relational governance (Suchman, 2003). According to Suchman (2003), the drafting of contracts and how social systems impact contract regimes have both technical and symbolic properties: “contract artifacts may best be understood as scripts and signals—collections of symbols designed to yield technically efficacious practical action when interpreted by culture-bearing social actors within the context of pre-existing vocabularies and conventions” (p. 91).

For a contract to qualify as an artefact, it is “a discrete material object, consciously produced or transformed by human activity, under the influence of the physical and/or cultural environment” (Suchman, 2003, p. 98). Contracts can reflect identity, faith, distrust, and goodwill; a negotiation contract can demonstrate mutuality and a preprinted contract can represent oppression (Suchman, 2003). Contracts have symbolic representation, which is observed in the communication artefacts analyzed in the case studies. Even contracts that are unenforceable in court can be viewed as ritual objects in a society’s transaction ceremonies that may evoke mystical beliefs in ideological societies. Contracts as artifacts to communicate messages are ‘‘significant gesture[s]’’ (Mead, 1962, p. 110) and their meaning can vary within countries, communities, or operational sectors. These gestures can include communications on risk preferences, time horizons, and trust, and can be used to identify group members and non-members through clauses that suggest “I know my business”, as well as the formality of contracting that is viewed as a commitment: “throughout the capitalist world, most people perceive that the weight of a commitment changes when the parties ‘put it in writing’ (Stolle & Slain 1997; Hans & Mott 2000)” (Suchman, 2003, p. 113).

In the context of the case studied, we have identified contract negotiation and management textual codes which represent a wide range of contract affordances, over 400 codes were identified. These codes encompass various aspects of contract formation, adaptation, and communication, highlighting the dynamic and collaborative nature of contract negotiation processes. We propose that these affordances, actions and artefacts, facilitate the negotiation process, enabling parties to

structure feedback, review, and collaborate on these documents. These codes also emphasize the importance of creating, modifying, and adapting contract elements to suit the specific requirements and expectations of the involved parties. Furthermore, the codes highlight the importance of approvals, acknowledgments, and follow-ups in managing contracts, ensuring that all stakeholders are informed and engaged in the process. These codes suggest affordances which provide a comprehensive view of the essential elements in collaboration contract negotiations. We categorized some of these relevant codes into the high-level categories presented in Table 5.3 and which emphasize effective communication, collaboration, and alignment among the stakeholders.

Table 5.3 Contract Artefacts Codes

Category	Themes
Artefact Exchange and Sharing	Exchanging artefact
	Promoting exchange of a standard artefact
	Providing an artefact to use to exchange project plans
	Communicating artefacts to facilitate exchange of information
	Exchanging artefacts on adjacent project
	Exchanging artefact to freely share information
	Exchange of artefacts
	Exchanging project artefact forms
	exchanging artefacts with new project team
	partner following up on artefact status
	requesting artefact
	Providing artefact
	Requesting artefacts
	Providing artefact elements
	Invitation to workout project artefacts and logistics
Artefact Feedback and Review	Providing feedback on the artefact
	Request feedback on artefact
	Requesting feedback on the artefact
	Seeking Review of artefact
	Expert Providing feedback on artefact
	acknowledging feedback on artefact
	Systematic feedback on artefact
	Providing feedback on the artefact even after expert agreements
	Communicating artefact with parties inputs and comments
Artefact Creation, Modification, and Adaptation	Suggesting adapting of artefacts
	Proposing an artefact to accelerate progress
	Proposing modification to artefact
	Suggesting modification to artefact
	Creating the collaboration artefact
	Adapting artefact to new project set-up
	Propose an artefact
	Creating a non-standard artefact to get the project going, get engagement
	Creating specialized artefacts
	Offering a useful artefact, info, to help with this and future projects
	Collaborating on completing artefacts
	Collaboration on completing artefacts
	Working with our artefact as a starting point and not yours
Artefact Approval, Acknowledgment, and Follow-up	acknowledging receipt of artefact and informing of process
	Communicating artefact
	Seeking internal approval of artefact to be communicated to partners
	Requesting artefact to use for guidance
	acknowledging receipt of artefact
	Following up on artefact
	Seeking approval of artefact
	Approving artefact
	Leading approval of artefact

5.1.4 Trust indicators as collaboration affordances

Weber and Carter (2003) define trust as a

> socially constructed orientation between two people that is premised upon the belief that the other will take one's perspective into account when decision-making and will not act in ways that violate the moral standards of the relationship. Trust does not exist outside of the real or imagined presence of the Other, and as such, is inherently a social phenomenon (p. 19).

Blomqvist (2002) studies the role of trust in asymmetric technology partnerships, which she defines as "difference in resources, capabilities, and power as well as management and organizational culture of actors" (p. 17). Although these asymmetric organizations theoretically are complementary, there are major challenges related to the uncertainty and complexity of their exchanges. Trust is the "make-or-break" factor in partnerships (Blomqvist, 2002).

Blomqvist (2002) proposes a model of trust, leveraged in this study in the following paragraphs, which consists of four dimensions: capability, goodwill, behaviour and self-reference. She defines trust in asymmetric technology partnership formations as the "Actors' expectation on the capability, goodwill and self-reference visible in mutually beneficial behavior enabling cooperation under risk", where "individuals, teams and organizations may be objects of trust. The components in the definition of trust are valid at all levels. Thus, the capability, goodwill, self-reference, and behavior of an individual or an organization may be evaluated" (p. 175).

Among these components, the signs of goodwill in enabling trust

> are necessary for the trusting party to be able to accept a potentially vulnerable position. Already at the very first meetings the behavioral dimension of trust is present in signs and signals, e.g., what information is revealed and in which manner. Thus, the capability and goodwill become visible in behavioral signals of trustworthiness (Blomqvist, 2002, p. 178).

Trust is "a basis for open and meaningful communication, learning and knowledge creation" (Blomqvist, 2002, p. 178). Blomqvist (2002) describes the two types of trust, "fast trust" or "swift trust" (p. 184), where swift trust, develops quickly in temporary groups such as R&D projects or task forces. It enables team members to take action, maintain trust, and deal with uncertainty, ambiguity, and vulnerability in high-pressure situations. Fast trust is based on general cues and combines intuition and rationality, with individuals continually assessing each other's trustworthiness. Emotions and emotional categories also play a role in judging social relationships

and impacting cooperation, as they help people evaluate trustworthiness. "Swift or fast trust is described as artful making do with a modest set of general cues from which inferences are drawn about how people might care for what we entrust to them" (p.186). On the other hand, incremental trust develops over time and is based on deeper cognitive knowledge and behavioral experience. It incorporates both institutional and personalized trust and involves a more in-depth evaluation of the other party's goodwill. Incremental trust is stronger and more enduring and resilient than fast trust, as it cannot be established quickly through brief interactions. The following description is adapted from a figure in Blomqvist (2002):

Personalized Fast Trust:

- Enables and initiates a relationship
- Creates interest and enables initial investments
- Thin and fragile, conditional

Incremental Trust:

- Makes the relationship more durable
- Enables risk and adaptation
- Thicker and more resilient, even unconditional (p.187)

Fast trust is not an interpersonal trust; it is about doing rather than about relating; it is a cognitive and action form of trust, "If people act through their roles rather than as whole personalities they are more narrow, standardized and easier to evaluate through stereotypical thinking… In the role-based fast trust the expectations are driven by fast inferences based on individual characteristics and the role" (Blomqvist, 2002, p. 187). Whereas personalized individual trust is much more complex to infer as it based on knowledge and expectations which go beyond role of the person.

Having more information on another person allows stronger trust to develop; knowing people beyond their professional roles leads to developing durable trust that allows parties to tolerate uncertainty:

> If the task is challenging (complex, demanding diverse knowledge and speed), staying in a pre-set narrow role may not allow as close and open interaction as would be necessary for information exchange and knowledge creation. Extending the narrow occupational role could allow more full and empathetic information exchange (see also Meyerson et al. 1996, 172) (Blomqvist, 2002, p. 188).

Blomqvist (2002) highlights communication as a key enabler to building trust: "Information enables the exchange of critical information of motivation, future goals, and vision needed for trust to emerge. Values and norms may be transmitted through communication and shared norms may emerge" (p. 191). The same hold for concern and care: "Concern and care are important sources for knowledge creation (Nonaka & Takeuchi 1995 and von Krogh 1998) and also for trust to emerge (O'Brien 1995)" (p. 191). Additionally, emotions are instrumental in the evolution of trust: "to communicate needs and expectations precisely and efficiently, both rational and emotional information is needed. Pure rational information of objective facts lacks the emotional depth ensuring the other party of the commitment and true intentions of the speaker" (p. 191).

Also

> If a communicator is able to be clear and precise about the issue (information) and simultaneously add to and develop the dialogue at various levels, s/he may be able to develop a trusting relationship (see Sydow 1998, 49; Nohria and Eccles 1992, 295) (p. 192).

Blomqvist (2002) references several authors who indicate that when engaging in knowledge creation, intense communication is needed. She references Nonaka and Takeuchi (1995, 222) who note that: "Building trust requires the use of mutually understandable, explicit language and often prolonged socialization or two-way, face-to-face dialogue that provides reassurance about points of doubt and leads to willingness to respect the other party's sincerity" (p. 231).

In the context of collaboration, rhetoric serves to persuade, establish relationships, and build trust.

> Rhetorique is an Arte to set foorth by vtteruance of words, matter at large, or (as Cicero doth say) it is a learned, or rather artificiall declaration of the mynd, in the handling of any cause, called in contention, that may through reason largely be discussed (Wilson, 1560, p. 20)

"Three thinges are required of an Orator: To teach, To delight, And to perswade" (Wilson, 1560, p. 22). Despite the controversies around rhetoric, it plays an important role in society:

> The evolution of rhetoric on the ground of science, philosophy, literature and so on proves us the fact that it plays an essential role in the becoming of the present society. It organises itself into a permanent catalyst of the social-human processes. It is as the "salt in your food" when it comes to configuring and reconfiguring the human existence and knowledge. This field of study reflects, in the most accessible way possible, the evolution of the human spirit. The use of word has always proven man's strength to express, convey thoughts, knowledge, emotional states, attitudes, opinions, and intentions. We may add to the virtue of faith and the virtue of hope the virtue of communication. Today, the rhetoric reorganises and revives the basis for the development of the interpersonal and interdisciplinary relations—communication … Rhetoric has an impact on the effectiveness of communication; it is one of the means of achieving the goals targeted by human actions (Mircică, 2014, p. 591).

And,

> Although, many thinkers from different historical ages are among those that have considered rhetoric a superficial discipline, they have used it in the exercise of persuasion, demonstration, and argumentation … The rhetoric is a model of communication, despite of the fact that it had its share of controversies since the time of the Ancient Greece … Today, rhetoric and communication essentially contribute to the evolution of social and cultural relations (Mircică, 2014, p. 592).

Gruber (2016) also provides a historical view on rhetoric and how it is often considered a "bad" word. He presents the defence of rhetoric from Rousseau to Lanham:

> Disputes about the value and role of rhetoric recur for millennia. Although it is not pertinent here to review the long debate, charges equating rhetorical forms to verbal manipulation advanced by philosophers "against rhetoric"—Jean-Jacques Rousseau among them—have waned, in humanistic circles at least, ever since Richard Lanham's (1993) "Strong Defense of Rhetoric" (p. 155). Lanham proclaims that all symbolic formations are rhetorical insofar as they include and exclude, illustrate and interpret, structure and situate. In light of the Strong Defense, the so-called "Weak Defense" championed by those like Rousseau—forwarding that rhetoric is value-neutral while specific deployments are "good" or "bad"—is disarmed because "goodness" and "badness" itself is "a matter of judgment" always already constructed through rhetoric (Lanham, 1993, p. 158). Put differently, concerns over ethically appropriate rhetorical formations are subsumed by the rhetorical nature of all discourse (p. 155–167) (Gruber, 2016, p. 36).

Persuasion, which is highlighted in this study, consists of rhetoric, where rhetoric is the art of persuasion—a concept that began with Aristotle. "Rhetoric was the ability to find available means of persuasion in any instance. The modes of persuasion, often referred to as ethical strategies or rhetorical appeals, are devices in rhetoric that classify the speaker's appeal to the audience. They are: ethos, pathos, and logos, and the less-used Kairos" (Diggs, 1964, p. 359).

Rhetoric is highlighted in this study through the case study analyses. Rhetoric is used to persuade and establish relationships that lead to actions and build trust—a desired path for collaboration. This study does not debate the ethics of persuasion; however, it highlights some concepts around the debate important for emphasizing ethical persuasion and related voluntary informed actions rather than the unethical use of persuasion.

> The unethical use of persuasion is one of man's most typical and most glaring faults. Misuse Of "the persuasive arts" has been so common and at times so notorious, that some have regarded persuasion as inherently evil, something which … "ought to be avoided," like a lie. Nevertheless, when it comes time to say in what the unethical use consists or what about persuasion is bad, there is confusion and disagreement … The confusion no doubt stems to … the lack, or ineffectiveness, or impermanence of some standards. However, it also stems from lack of clarity about the character and justification of the standards and ideals we have, not only of those which govern speech, but of those which govern our actions generally … Many philosophers … have claimed that terms like “right” and “wrong,” “good” and “evil” are themselves persuasive instruments, and to know this is to know what these terms mean (Diggs, 1964, p. 359).

Ethical persuasion and professional persuasion are important to this discussion where

> professional persuasion is a means to an immediate and instrumental end (such as increased sales or enhanced corporate image), ethical persuasion must rest on or serve a deeper, morally based final (or relative last) end. Among the moral final ends of journalism, for example, are truth and freedom (Baker and Martinson, 2001, p. 148).

Baker and Martinson (2001) propose guiding principles as a moral compass for professional persuasion, which are summarized in their TARES test: “Truthfulness (of the message), Authenticity (of the persuader), Respect (for the persuadee), Equity (of the persuasive appeal) and Social Responsibility (for the common good)” (p. 148). The authors support the concept that ethical persuasion is a communication activity that unites people while allowing maximum individual choice, focusing on creating voluntary change in attitudes and/or actions. They also highlight the importance of voluntary change in distinguishing persuasion from indoctrination and coercion, which don't allow significant choice. They support persuasion methods that respect individuals as capable of making rational choices and emphasized the importance of avoiding deceptive and manipulative tactics to maintain ethical persuasion.

Moving from rhetoric to trust requires intentional design of actions. Inkpen and Currall (2004) conceptualize trust as a person, group, or firm deciding to act, where actions can be measured. They also see trust evolving as partners learn about each other and their joint ventures; thus, trust is not

static, it requires familiarity and understanding, and it is dependant on time and context. “As the relationship ages, previous successes, failures, and partner interactions will influence the level of trust…Experience will lead to adjustment of the probability, which in turn may lead to a shift in the level of trust” (Inkpen & Currall, 2004, p. 588). They use reliance and risk as the two principles of trust in their study of joint ventures, for example,

> Reliance is action through which one party permits its fate to be determined by another. Risk is the potential that the trusting party will experience negative outcomes, i.e., "injury or loss" if the other party proves untrustworthy (March and Shapira 1987, Sitkin and Pablo 1992). Risk creates the opportunity for trust (Rousseau et al. 1998). Thus, trust is based on social judgments such as assessment of the other party's benevolence, competence (Currall 1992), together with assessment of the costs if the other party turns out to be untrustworthy. Under a condition of risk, a party's trust is signified by a decision to take action that puts its fate in the hand of the other party. Focusing on actions is consistent with the idea that partner firm actions shape and modify the interorganizational relationship (p. 588).

They argue, “in interorganizational relationships learning plays a critical role in establishing firm bargaining power, shaping partner interactions, and influencing decisions about control processes and risk taking” (Inkpen & Currall, 2004, p. 596).

We have also categorized textual codes based on the studied cases into Blomqvist's (2002) four components of trust, namely, capability, goodwill, behavior, and self-reference, which we posit as affordances leading to various forms of trust. We aimed to demonstrate how the various indicators of trust building were present in the context of the studied collaboration projects. Codes related to capability highlight the importance of demonstrating knowledge, expertise, and the ability to deliver on promises. Goodwill-related codes emphasize empathy, respect, and the intention to consider the interests of others. Behavior codes focus on active engagement, flexibility, and transparency in communication, all of which contribute to a sense of trust in these types of relationship. And finally, self-reference codes which are reflected in the internal evaluation of the relationship and scope, the internally acknowledged legacy of trust, as well as the internal commitment to the relationship by addressing internal confusion and doubts. This effort provided a comprehensive understanding of the multifaceted nature of trust affordances that contributed to building and maintaining trust in the context of the studied collaboration projects. Examples of

these textual codes of trust indicators, inspired from the analysis of the cases taken from Appendix D, based on Blomqvist trust model and its four components are presented in Table 5.4.

Table 5.4 Trust Components and Trust indicators

Component	Indicators (Themes)
Capability	Demonstrating knowledge
	Strengthening relationship through sharing of information
	New project resource establishing relationship with partners
	Project PM demonstrating leadership
	Internal project leader demonstrating business savvy and value for overall organization
	We are experts, trust our legacy
	Respect the track record of stakeholders
Goodwill	Building relationship
	Strengthening relationship through adjacent collaboration
	Elevating the relationship
	Building relationship through involvement in action
	Strengthening relationship through adjacent activities
	Partner accepting politely bad news and communicating will to continue relationship
	Building relationship with New POC
	Building relationship with partner outside of the current collaboration
	Investing in relationship with partner outside of current collaboration
	Empathy with partners and respect for their efforts
	Demonstrating goodwill
	Demonstrating empathy
	Demonstrating interest in considering others' interests
	Partner demonstrating re-engagement
	Demonstrating cooperative attitude

Table 5.4 Trust Components and Trust indicators (cont'd and end)

	Demonstrating understanding of others' actions
	Demonstrating understanding of others' self-interests
	Give and take relationship
Behavior	Informing, demonstrating engagement
	Demonstrating agreement
	Demonstrating flexibility for a win-win scope
	Demonstrating confidence
	Demonstrating progress
	Demonstrating Trust
	Passive demonstration of control through facts and questions
	Demonstrating engagement based on internal understanding of offer
	Demonstrating agreement with opinion
	Demonstrating intentions to advance the project
	Soliciting support of event given relationship on adjacent project
	Holistic project approach being promoted internally and value being demonstrated
	Respect
	Confirm-clarify doubts-uncertainty
	Highlighting Challenges; Doubting Current Idea Proposal
	Express doubts
	Non-standard artefact agreed upon based on expected mutual trust
Self-reference	Highlighting a commitment through a relationship of trust
	Internal confusion about collaboration project scope and relation to internal efforts
	Trust our legacy

In Summary, rhetoric, when used ethically, is a powerful tool for communication, persuasion, and building relationships of trust in collaborative environments. Trust is a critical component in collaborative relationships as we have seen form the studied cases, particularly in asymmetric technology partnerships where differences in resources, capabilities, power, and organizational culture are present. Blomqvist's (2002) trust model provided a framework to highlight trust indicators found in the cases as affordances contributing to enabling the components of trust which include capability, goodwill, behavior, and self-reference, and providing valuable insights into the multifaceted nature of trust affordances.

Effective communication, including the ethical use of rhetoric, is important to building trust by facilitating the exchange of critical information, values, and norms. As partners become more familiar with each other and their collaboration relationship, trust will evolve and strengthen, ultimately contributing to the success of the collaboration venture.

5.1.5 Emotional intelligence in collaboration

Another concept highlighted in the case analyses is emotional intelligence (EI), which according to Mayer (2004) involves four abilities:

- accurately perceive emotions in oneself and others
- use emotions to facilitate thinking
- understand emotional meanings, and
- manage emotions (p. 3)

and focuses on “the mental ability to reason about emotion and emotional meanings” (p. 10). Goleman takes a broader view on EI with, what Mayer (2004) calls, mixed models that go beyond the abilities and include personality traits such as optimism, sociability, warmth, service orientation, and initiative. Mayer et al. (2004) describe an emotionally intelligent person as one who

> can better perceive emotions, use them in thought, understand their meanings, and manage emotions, than others. Solving emotional problems likely requires less cognitive effort for this individual. The person also tends to be somewhat higher in verbal, social, and other intelligences, particularly if the individual scored higher in the understanding emotions portion of EI. The individual tends to be more open and agreeable than others. The high EI person is drawn to occupations involving social interactions such as teaching and

> counseling more so than to occupations involving clerical or administrative tasks. The high EI individual, relative to others, is less apt to engage in problem behaviors, and avoids self-destructive, negative behaviors such as smoking, excessive drinking, drug abuse, or violent episodes with others. The high EI person is more likely to have possessions of sentimental attachment around the home and to have more positive social interactions, particularly if the individual scored highly on emotional management. Such individuals may also be more adept at describing motivational goals, aims, and missions. Mayer, Salovey, & Caruso, 2004, p. 210) (p. 8).

According to Mayer, some examples of EI are:

- People with higher emotional intelligence are likely to have better social support, and fewer problematic interactions with others.
- People higher in emotional intelligence are more satisfied with their social networks and appear to receive more social support.
- People higher in emotional intelligence seemed to more successfully avoid interpersonal arguments and fights. (p. 13).

Goleman (2000) describes EI as "a powerful blend of self-management and relational skills" (p. 57)**,** where

> self management skills include self-awareness (knowledge of your weaknesses and willingness to discuss them), self-regulation (the ability to control your impulses and channel them for good), and motivation (a passion for achievement for its own sake). Relational skills include empathy (the capacity to take others' feelings into account while making decisions) and social skill (the ability to build rapport with others, win their cooperation, and move them in the direction you desire) (p. 57).

Cox (2014) highlights the importance of understanding the emotions of others in collaboration:

> Of primary importance to studying collaboration and the factors that impact collaboration is in understanding the emotions of others and allowing each member of a team or group to be heard—this is supported by a firm foundation of emotional competency based on empathy and taking an active interest in others for mutual understanding (Slater, 2005) (p. 55).

He considers the components of EI (self-awareness, self-management, awareness of others' emotions, and management of others' emotions) as predictors of collaboration (integrating, compromising, and communicating) among teams and concludes that improved EI improves collaboration. "EI was also found to impact (positively) the collaboration factors, integrating, compromising, and communication" (Cox, 2014, p. 171).

Self-management is a key factor of EI, is observed in this study, and according to Drucker, is a key competence of modern organizations: "competence is measured less in terms of subject matter and

more in terms of abilities—for example, empathy and stamina under pressure" (Harris, 1993, p. 29).

Change management is a major theme in the case studies, where change involves both logic and emotion, where we can appreciate in Table 5.5 the multitude of emotional themes and feelings present in these collaboration projects.

> Most people won't want to help if you appeal only to logic, with numbers and business cases. You must also appeal to how people feel. As have all the great leaders throughout history, you must speak to the genuine and fundamental human desire to contribute to some bigger cause, to take a community or an organization into a better future. If you can provide a vehicle that can give greater meaning and purpose to their efforts, amazing things are possible (Kotter, 2014, p. 36).

Cameron and Green (2009) propose that a model of leadership which reflects a balancing act of three key dimensions in their organizational context, namely, outcomes (Developing and delivering business outcomes), interests (Mobilizing influence, authority and power) and emotions (enabling people and culture to adapt), "Paul Evans (2000) says that 21st century leadership of change issues is not simple; he sees modern leadership as a balancing act… Paul Evans is emphasizing the need for leaders to pay attention to both management and leadership." (p. 3)

Leaders are at the centre of all three. They shape, direct and juggle them. One dimension may seem central at any time: for example, developing a strategy. However, leadership is about ensuring that the other dimensions are also kept in view. The three balls must always be juggled successfully. (Cameron & Green, 2009, p. 6)

Furthermore emotions shape sense-making and its importance in the process of change in organizations, where Steigenberger (2015) defines sense-making and sense giving respectively as the

> Process of attempting to influence the sensemaking and meaning construction of others toward a preferred redefinition of organization reality" is called sense giving (Gioia and Chittipeddi, 1991, p. 442). While sense-making is about structuring one's reality, sense giving is a process of executing power via negotiation and leadership. (p. 435)

Steigenberger (2015) discusses how emotions such as anger, fear, anxiety and hope influence the sense-making and sense giving processes. Where the propensity to engaging is sense giving is high where emotions such as anger or hope are present, whereas the openness to sense giving of others

is not open when anger is felt, and on the contrary it is open when hope is felt. The author also posits that the sensemaking processes have emotions as both inputs and outcomes.

Cameron and Green (2009) conclude that the discrete emotions described above have "predictable effects on the sensemaking process as well as the likelihood that an individual will engage in sensegiving activities and be inclined to accept interpersonal sensemaking accounts" (p. 445). They also suggest that "change management and strategy implementation might benefit from active emotion management, although this strategy has the potential to backfire, if not executed carefully. Emotions are important contingencies for implementing a change effort in an organization" (p. 445).

Cameron and Green (2009) suggest that people discuss their personality types to understand others including their responses to change:

> We have found in working with individuals and teams through change that it is useful to identify and openly discuss people's personality types. This information helps people to understand their responses to change. It also helps people to see why other people are different from them, and to be aware of how that may lead to either harmony or conflict (p. 50).

They identify five factors that influence a person's response to change: individual personality type, individual history, organization history, type of change, and consequence of change. They also highlight the anxiety related to change,

> Schein identified two competing anxieties in individual change: survival anxiety versus learning anxiety. Survival anxiety has to be greater than learning anxiety if a change is to happen. … the need for managers to reduce people's learning anxiety rather than increase their survival anxiety (p. 61).

Four schools of thought on individual change increase understanding of some of the approaches observed in organizations. These schools of thought are also guidelines for managers:

- The **behaviourist approach** is about changing the behaviours of others through reward and punishment. This leads to behavioural analysis and use of reward strategies.
- The **cognitive approach** is about achieving results through positive reframing. Associated techniques are goal setting and coaching to achieve results.
- The **psychodynamic approach** is about understanding and relating to the inner world of change. This is especially significant when people are going through highly affecting change.

- The **humanistic psychology approach** is about believing in development and growth and maximizing potential. The emphasis is on healthy development, healthy authentic relationships, and healthy organizations.

Each of the four approaches above leads to a set of guidelines for managers:

- **Behavioural**: get your reward strategies right.
- **Cognitive**: link goals to motivation.
- **Psychodynamic**: treat people as individuals and understand their emotional states as well as your own!
- **Humanistic**: be authentic and believe that people want to grow and develop. (Cameron & Green, 2009, p. 61).

Table 5.5 Emotions and Feelings Themes

Second-Level Theme: Emotions and Emotional Intelligence
Action Verbs from First-Level Themes: Express, Partner, Persevere, Feel, Accept, Reassure, Build, Confirm, Clarify, Apologize, Temper, Demonstrate, Elevate, Communicate, Greet, Overcome, Made, Happen
First-Level Themes:
Sense of accomplishment
Express frustration
Long term thinking
Partner still engaged even after bad news
Partner upset that they have been excluded from discussions
Express Surprise
Express humbleness
Perseverance in pursuing collaboration
Politeness with new resource
Polite request for action
Positivity
Gentleness
Feeling guilty
Feeling of being excluded
Humbly accepting being corrected
Express humbleness
Uncertainty
Express (best) wishes
Express hope
Express commitment

Table 5.5 Emotions and Feelings Themes (cont'd and end)

Express interest
Express desire to keep in touch - future exchanges
Reassuring
Building goodwill
Building relationship
Express disappointment-dissatisfaction
Confirm-clarify doubts-uncertainty
Express excuses
Apologize
Indirectly trying to temper moods and clarify negotiation stance
Feeling vindicated
Demonstrating goodwill
Demonstrating agreement
Apologizing for delay
Apologies for delays in communications
Express excitement
Politeness
Apologizing
Elevating the relationship
Express satisfaction
Honest communication
Expressing gratitude
Personal Greetings
Message to partners, it was difficult, run through overcome obstacles, we made it happen together

5.1.5.1 Empathy as a collaboration affordance

Empathy is a major theme in the case analyses where over 200 textual codes demonstrate the presence of empathy related themes as illustrated in Table 5.6. It is an essential component of emotional intelligence. Emotional intelligence as we have illustrated in the previous section is the ability to recognize, understand, and manage our own emotions and the emotions of others, where empathy is the capacity to understand and share the feelings of others, allowing us to connect with them on an emotional level. Empathy is a critical aspect of collaboration and an is essential theme in the cases analyses. In the following paragraphs we further explore the concept of empathy as defined by Decety and Jackson (2004) as the subjective experience of shared feelings between self and others, involving both an affective experience and recognition of another's emotional state. We further emphasize that empathy, with its cognitive and affective components, is an ability that develops through interactions with others. Also, as we have seen in previous chapters, empathy is an integral part of design thinking, a human-centered activity where designers must empathize with users to understand their problems and create effective solutions, including also the management of projects. We further explore with Klimecki (2019) that empathy can be practiced by stakeholders so that they become more empathetic and strengthen their prosocial behavior. Additionally, increasing communication with others is essential for effective empathy.

Decety and Jackson (2004) describe empathy as

> the naturally occurring subjective experience of similarity between the feelings expressed by self and others without losing sight of whose feelings belong to whom. Empathy involves not only the affective experience of the other person's actual or inferred emotional state but also some minimal recognition and understanding of another's emotional state (p. 71).

They describe empathy as the

> natural ability to understand the emotions and feelings of others, whether one actually witnessed his or her situation, perceived it from a photograph, read about it in fiction book, or merely imagined it, refers to the phenomenological experience of empathy. This "every-day mind reading," to borrow Ickes's (2003) metaphor, is not something one needs to learn. Rather, the basic building blocks are hardwired in the brain and await development through interaction with others (p. 71).

According to the authors, the primary components of empathy include:

> (a) an affective response to another person, which often, but not always, entails sharing that person's emotional state;
>
> (b) a cognitive capacity to take the perspective of the other person; and
>
> (c) some regulatory mechanisms that keep track of the origins of self and other-feelings.
>
> … Thus, empathy requires both the ability to share the emotional experience of the other person (affective component) and an understanding of the other person's experience (cognitive component) (p. 73).

Finally, the authors propose that the following components interact dynamically to produce empathy in humans:

- affective sharing between the self and the other, based on perception-action coupling that leads to shared representations;
- self-other awareness. Even when there is some temporary identification, there is no confusion between self and other;
- mental flexibility to adopt the subjective perspective of the other and also regulatory processes (Decety & Jackson, 2004, p. 75).

Klimecki (2019) provides an interesting overview of the definition and concepts related to empathy where she states that

> empathy and empathy-related processes, such as compassion and personal distress, are recognized to play a key role in social relations. …Despite the limitations of empathy, there is growing evidence that empathy and compassion are associated with more prosocial behavior in interpersonal relations (p. 310).

The author describe empathy on the affective and cognitive levels as

> sharing the emotions of others is often denoted as empathy (Titchener, 1909; see also De Vignemont & Singer, 2006), a translation of the German word "Einfühlung" (Lipps, 1903). Beyond the sharing of affective states, empathy has also been suggested to involve a minimal understanding of the other's emotional state (Decety & Jackson, 2004). One can thus also speak of affective empathy to denote the emotional sharing of other's feelings, and of cognitive empathy to denote the cognitive understanding of other's feelings (Shamay-Tsoory, Aharon-Peretz, & Perry, 2009) (p. 311).

The practice of empathy helps one become more empathetic and strengthens prosocial behaviour:

> Interestingly, the more that participants experienced empathy, the more they helped others in need (Batson et al., 1981; Klimecki, Mayer, et al., 2016) (p. 312)…In summary, there is encouraging evidence that empathy and compassion are associated with more helping behavior, less aggression, more favorable intergroup attitudes during conflicts, and more readiness for reconciliation after conflicts (p. 323).

Decety and Jackson (2004) go on to describe empathy as an intentional capacity triggered voluntarily and potentially in our context can be purposely designed. The authors state that empathy is a complex process involving both automatic and intentional initiation, relying heavily on mental simulation and conscious control in humans. They further posit that empathy is not a simple reflection of another's feelings, where it requires a clear understanding of the other's subjectivity, self-awareness, and emotion regulation. Empathy is a motivated and voluntary process that can be employed to gain understanding of another person. The authors contend that the capacity for empathy can be further developed or enhanced through training or interventions.

It is important to recognize the different concepts of empathy and their complementarity. When emotional empathy is not present or declines, one can resort to cognitive empathy. In relation to this in healthcare settings, Riess (2017) highlights that Empathy is vital for interpersonal and societal relationships by promoting pro-social behavior through emotional connections. This requires a complex interplay of neural networks that enables the perception, resonance, and distinction of emotions from others. However, studies show that empathy declines in medical training, leading to unsatisfactory patient care. Cognitive empathy becomes necessary when emotional empathy is lacking due to differences. Self- and other-empathy in important to maintain and develop human empathy. Thus, it is crucial to enhance our empathic capabilities to strengthen bonds on various levels for a more compassionate world.

Furthermore, the concept of empathy underpins design thinking because it is a human-centred activity, where one of the designers' challenges is to empathize with the user perspective and the problem they're trying to solve.

Kimbell (2011), in her review of design thinking, quotes Brown who

> suggests, they (Designers) more or less feel their way through to a new solution. According to Brown, a successful design outcome exists at the intersection of three concerns: what is desirable from the users' perspective, what is technically feasible, and what is commercially viable for the organization (Brown 2009) (Kimbell, 2011, p. 12).

Ben Mahmoud-Jouini et al. (2016) highlight the explorative potential of design thinking in project management through empathy: "the ability to imagine the world from multiple perspectives—those of colleagues, clients, end users, customers (both current and prospective), and all parties involved (p. 149). And, "Design thinking emphasizes the iterative identification of stakeholders and promotes frequent and rich interactions with them, involving several artifacts such as stimulators to develop empathy" (Ben Mahmoud-Jouini et al., 2016, p. 151).

Brown (2009) highlights key insights that empathy in design thinking provides when understanding how people use things, for example.

> This insight comes not from crunching numbers, but rather from observing what people actually do, noting what they don't do, and understanding what they don't or can't explain about what they do. Design thinking borrows ethnographic observational techniques from anthropology and reapplies them to generating practical solutions. This requires empathy, because feeling alongside others allows you to move past seeing them as subjects or consumers and really experience things as they do" (p. 3).

Although empathy is all the rage in academic and business circles, with companies using empathy from product design to leadership skills development, like Ford Motor Company's engineers wearing empathy bellies to simulate the experience of a pregnant woman behind the steering wheel, to age suits to simulate the physical constraints of elderly people,

> recent research … suggests that all this heat and light may be a bit too intense. Though empathy is essential to leading and managing others—without it, you'll make disastrous decisions and forfeit the benefits just described—failing to recognize its limits can impair individual and organizational performance (Waytz, 2016, p. 68).

Regardless, the author emphasizes the essential role of empathy at work and that managers should invest in it; however, empathy should include increased communication with the party being empathizing with: "When trying to empathize, it's generally better to talk with people about their experiences than to imagine how they might be feeling." (Waytz, 2016, p. 73).

Throughout the studied collaboration projects, stakeholders empathized with others or prompted action, directly and indirectly, to seek empathy from others. A common theme across these codes is the importance of empathy in enabling effective communication, understanding, and

collaboration between stakeholders. The codes emphasize various aspects of empathy, such as actively empathizing, seeking empathy from others, demonstrating empathy, and empathizing while adhering to organizational procedures. These codes highlight the critical role of empathy in collaborative settings. Empathy is key for building strong relationships, understanding different perspectives, and supporting interactions. What was unique from the codes, is that they did not only show themes of active empathy, where stakeholders empathize with each other, but also codes related to purposely seeking and demonstrate empathy within these collaborations. Additionally, the codes showed that empathy was maintained even while following internal procedures, ensuring a balance between adherence to processes and the human relationship. Table 5.6 presents the major themes illustrating the first-level textual codes related to empathy as found Appendix D.

Table 5.6 Empathy Themes

Active empathizing	Engaging in empathetic behavior to understand and relate to others' emotions and experiences.
Seeking empathy	Actively requesting or encouraging empathy from others.
Demonstrating empathy	Showing empathy through actions, words.
Balancing empathy and organizational procedures	Maintaining empathy while following internal processes, ensuring a human-centric approach even within organizational constraints.
Empathy in enabling effective communication	Utilizing empathy to enhance communication and understanding between stakeholders.
Empathy and respect	Acknowledging the efforts of partners and displaying empathy to show mutual respect and appreciation.

We propose these themes as affordances, as they collectively contribute to enhancing collaboration, communication, and interpersonal relationships in the context of collaboration. Active empathizing, seeking empathy, and demonstrating empathy serve to strengthen relationships, promote open communication, and foster effective problem-solving. Balancing empathy with organizational procedures ensures that achieving goals and relationships are both considered for the success of the collaboration. Empathizing in communication allows for the understanding of other perspectives, leading to designing more innovative solutions.

5.1.5.2 Kindness as a collaboration affordance

In the case study analyses, there are several instances of communication where acts of kindness are demonstrated by individuals, which led to the interest and further investigation of this theme. Kindness is a complex phenomenon that goes beyond simple altruism and compassion. It has behavioral and affective components, which play a role in how we interact with others. However, kindness may mean different things to different people where Rowland's (2018) critiques and disagrees with the view that "Kind acts are acts that benefit others, at some cost to yourself" (p. 33).

Rowland states that kindness has both behavioural and affective components and that it does not perfectly overlap with altruism and compassion. He highlights the lack of research on the psychological processes behind kindness and how kindness can be measured.

Canter et al. (2017)

> identified three components to kindness:
>
> 1. benign tolerance, a type of everyday courteousness, acceptance and love of one's fellows;
> 2. empathetic responsivity, a consideration of the feelings of other particular individuals; and
> 3. principled proaction, broadly altruistic behaviour that is proactive and about behaving honourably.
>
> They also identified an overarching aspect of kindness: core kindness, which relates to empathy but tends toward active gestures born of warm feelings for others (p. 17).

Core kindness, a basic human trait that energizes the various forms of kindness, relates to empathy; however, it is primarily manifested through actions:

> a tendency towards active gestures motivated by genuine warm feelings for others. There is no expectation of reward or social approbation because these behaviors are anonymous or beyond social proscriptions. These active gestures may operate in a cognitive … , behavioral … or affective … mode (p. 17).

This study has a potential impact on kindness, which Rowland (2018) highlights as an important characteristic of human behaviour that matters: "known instinctively since early in our evolutionary history: that kindness matters, and it makes a difference"(p. 35).

Kindness is contagious and promotes prosocial behaviours and emotions. This means that when people witness or experience acts of kindness, they are more likely to engage in kind behaviors themselves:

> James Fowler and Nicholas Christakis' seminal research has suggested that "once networks are established, altruistic acts—from random acts of kindness to a cascade of organ donation—can spread through them". Promisingly, the research shows that prosocial actions can mutate and cross behaviour types, and even jump from behaviour to affect (Nook et al., in press). Therefore, as kindness spreads it may transcend its origins and multiply to be more effective (Rowland, 2018, p. 34).

Kindness, and specifically unconditional kindness, is identified by Thielmann and Hilbig (2015) as one of the three mechanisms underlying trustworthiness in addition to positive and negative reciprocity, and is directly linked to trustworthiness regardless of prior trust. Nowak and Sigmund (1998) propose that "the emergence of indirect reciprocity was a decisive step for the evolution of human societies" (p. 573), where direct reciprocity is one of the tenants of cooperation and reciprocal altruism involves repeated encounters with the same person; however, indirect reciprocity does not require individuals to meet again. "Also, individual selection can nevertheless favour cooperative strategies directed towards recipients that have helped others in the past. Cooperation pays because it confers the image of a valuable community member to the cooperating individual" (p. 573). Related to this study's observations of kindness is the warm-glow economic theory, which posits that "people help others in order to feel good about themselves" or "their contributions" (Andreoni, 1990)" (Allison, McKenny, & Short, 2013, p. 690).

This study's interest in the warm-glow theory is in the context of collaboration, a relation which has not been studied, to consider kind acts in this context that are not purely altruistic or egoistic, but that make people feel good about themselves:

> The economics literature has traditionally explained contributions to charity as being driven by altruistic or egoistic motives (Simon, 1993). Altruistically-motivated giving is driven by the desire to help others without consideration of personal benefit, whereas egoistically-motivated giving is driven by the promise of external reward or the avoidance of external punishment. A third motive, warm glow, was introduced as a compromise between these two extremes to explain giving behavior not explained by pure altruism or egoism (Andreoni, 1990). Warm-glow-motivated giving is driven by the pursuit of the positive affective state one feels following actions taken to help those in need (Andreoni, 1990; Cialdini et al., 1973) (Allison et al., 2013, p. 693).

Furthermore, Canter et al. (2017) underline the relationship between kindness and empathy, which overlap, and prosocial behaviour. Kindness has been identified as an important affordance in the studied cases, in particular in relation various aspects of stakeholders' interactions, communication, decision-making, leadership, adaptation, and conflict resolution. It was inspired through textual codes and themes, in Appendix D and Appendix F., Table 5.7 presents some of the themes and textual codes which inspired kindness in collaboration:

Table 5.7 Kindness Themes

Kindness in Stakeholder Interactions	Open communication
	Active listening
	Empathy
	Appreciation
	Consideration of others' perspectives
	Supportive and empowering of stakeholders
Textual Code Themes	Finding mutually beneficial solutions
	Providing support and encouragement
	Providing guidance
	Celebrating achievements
	Empowering others to act
	Proactive communication
	Understanding stakeholders' needs and constraints
	Fair and considerate resource allocation
	Collaborating for creative solutions
	Conflict resolution
	Acknowledging mistakes
	Expressing gratitude
	Building relationships of trust (reliability, understanding)

As we have seen kindness can be manifested in kind acts which we proposed as affordances due to their impact and influence on many aspects of human interactions. As illustrated by Canter et al. (2017), kindness encompasses diverse components, such as benign tolerance, empathetic responsivity, and principled proaction, along with the concept of core kindness, which emphasizes empathy expressed through actions. The contagious nature of kindness promotes prosocial behaviors and emotions, further enabling relationships of trust and cooperation through acts of reciprocity. Finally, recognizing acts of kindness as affordances allows us to better understand its essential role in shaping collaborations, empowering stakeholders, enabling conflict resolution, adapting to challenges the challenges of the wicked collaboration problem.

We have also seen many interactions throughout the cases, where the concept of politeness has been demonstrated throughout the types of exchanges between the stakeholders. We in have considered that politeness acts are kindness act, as they also involve showing respect, consideration, and understanding towards others. These politeness acts in the studied cases included, communication that has different forms of addressing the stakeholders politely, accepting politely bad news, remaining polite and professional in difficult times, politely requesting actions to be taken although the other party may be in default, and politely delegating actions to subordinates and supervisors.

5.2 Design is a human problem-solving dynamic capability

Design thinking allows designers to solve problems, including the wicked problems of collaboration. Design thinking is not linear or analytical, which “are unlikely to resolve ‘wicked’ problems (Rittel, 1972) that lack both definitive formulations and solutions and are characterized by high uncertainty and ambiguity” (Ben Mahmoud-Jouini et al., 2016, p. 147). Problems with high uncertainty and ambiguity need

> an uncertainty reduction strategy that can be achieved through a learning focused, hypothesis-driven approach (Beckman & Barry, 2007; Owen, 2007; Schön, 1982); this learning associates abstract reasoning with action in order to launch a “reflective conversation with the situation” (Schön, 1982). According to Liedtka (2014), design thinking “is a hypothesis-driven process that is problem, as well as solution, focused. It relies on abduction and experimentation involving multiple alternative solutions that actively mediate a variety of tensions between possibilities and constraints and is best suited to decision contexts in which uncertainty and ambiguity are high. Iteration, based on

> learning through experimentation, is seen as a central task" (Ben Mahmoud-Jouini et al., 2016, p. 148).

The creative and abductive nature of design thinking promotes exploring and imagining many potential solutions with stakeholders. Potential solutions and how they may be implemented by users considers their contexts.

> According to Brown (2008), design thinking is a system of spaces rather than a predefined series of orderly steps**.** Design projects pass through three spaces: inspiration, ideation, and implementation. Projects will loop back through these spaces—particularly the first two—more than once as ideas are refined and new directions taken. (Ben Mahmoud-Jouini et al., 2016, p. 148).

According to Simon, designers are problem solvers: "[e]veryone designs who devises courses of action aimed at changing existing situations into preferred ones" (Huppatz, 2015, p. 29). Although Simon's rational problem-solving definition is dominant in the literature, other thought leaders provide an alternative view on design as a social and political problem-solving activity, where wicked problems can be addressed through a design approach. Schön's "reflection-in-practice" model also leverages human capabilities for problem solving; it allows for "both professional expertise and intuition in the design process" (Huppatz, 2015, p. 38). Nelson and Stolterman consider judgement as "a full and equal partner in any intellectual pursuit in design, on par with rational decision making" (Huppatz, 2015, p. 38). Since Simon's original work, Huppatz suggests that "the interest in the roles of intuition, experience, and judgment in design practice has increased rather than declined" (Huppatz, 2015, p. 38). Bousbaci suggests that the "whole human" is part of the design act and "what really bounds rationality in human action is nothing more than all the other parts which comprise [sic] the human existence as a whole: poetics, rhetoric, hermeneutics, and ethics; because, when humans act, they act as whole humans." (Huppatz, 2015, p. 40).

Design thinking as a human centered approach to solving problems is also a dynamic capability that enables stakeholders and organizations to adapt to rapidly changing environments. As it incorporates empathy, experimentation, and iteration into the process, it allows for the development of sensing, learning, integration, and coordination capabilities. These dynamic capabilities help organizations renew competencies, reconfigure resources, and transform existing knowledge into new operational capabilities. Design thinking fosters innovation and enables collaborative

advantages, allowing organizations to create value through enabling and fostering interorganizational collaboration projects.

Teece et al. (1997) refer to the achievement of new forms of competitive advantage as “dynamic capabilities”: “dynamic”, which “refers to the capacity to renew competences so as to achieve congruence with the changing business environment” and “capabilities”, which “emphasizes the key role of strategic management in appropriately adapting, integrating, and reconfiguring internal and external organizational skills, resources, and functional competences to match the requirements of a changing environment (p. 515). Thus, dynamic capabilities is defined as “the firm's ability to integrate, build, and reconfigure internal and external competences to address rapidly changing environments” (Teece et al., 1997, p. 516).

Pavlou and El Sawy (2011) trace the origins of dynamic capabilities to Schumpeter's (1934) concept of innovation-based competition, where competitive advantage arises from creatively destroying existing resources and recombining them into new operational capabilities. The authors credit Teece et al. (1997) for developing the concept further. The authors posit that dynamic capabilities extend the resource-based view (RBV) by focusing on resource renewal rather than resource picking, emphasizing the reconfiguration of resources into new combinations of operational capabilities.

Cousins (2018) proposes that design thinking is a dynamic capability that enhances absorptive capacity, while Zahra and George (2002) view it as “a set of organizational routines and processes by which firms acquire, assimilate, transform, and exploit knowledge to produce a dynamic organizational capability” (p. 186). Cousins (2018) extends the “dynamic capabilities theory by confirming design thinking as a means of integration, learning, and reconfiguring knowledge to build competitive advantage” (p. 103).

Cousins also notes that “design thinking can support an organization’s absorptive capacity and thus provides a dynamic capability and competitive advantage to acquire, assimilate, and apply external knowledge for value creation” (p. 103).

Zheng (2018) argues that design thinking is a dynamic capability due to its ability to balance analytical and intuitive thinking, enabling managers to address conflicting issues such as brand relevance and consistency. Additionally, design thinking is a thinking pattern that comprehensively

defines and solves problems. As wicked problems are prevalent in rapidly changing environments, design thinking could be a useful tool for addressing them. Therefore, design thinking could be considered a dynamic capability, as defined by (Teece et al., 1997), which is a firm's ability to adapt to dynamic environments (Zheng, 2018).

Dynamic capabilities can extend beyond strategic management into operational management, intra- and inter-organizational, where design thinking is valid for the management of everyday tasks: "Although both capabilities are collections of routines, dynamic capabilities describe the ability to reconfigure and change, whereas operational capabilities denote the ability to "make a daily living" (Winter, 2003, p. 991)" (Pavlou and El Sawy, 2011, p. 242).

Pavlou and El Sawy (2011) note "that dynamic capabilities govern the change of operational capabilities by reconfiguring them to keep them relevant to the changing environment." (p. 242)

Pavlou and El Sawy (2011) propose a dynamic capabilities model relevant for managing and reconfiguring operations, where

> The proposed dynamic capabilities that are proposed as tools for reconfiguring existing operational capabilities are: (i) sensing, (ii) learning, (iii) integration, and (iv) coordination capabilities. … The proposed dynamic capabilities are neither exhaustive, nor sufficient for reconfiguration to occur, but they are posited as important enablers of the ability to reconfigure operational capabilities (p. 243).

Although in general this process is in general presented sequentially, the authors posit that there are "reciprocal relationships among these capabilities" (p. 243).

Eisenhardt and Martin (2000) identify dynamic capabilities as "a set of specific and identifiable processes such as product development, strategic decision making, and alliancing" (p. 1105). And dynamic capabilities have "significant commonalities across firms (popularly termed 'best practice')" (p. 1105). However, they make a distinction between traditional moderately dynamic markets with routine processes and "high-velocity markets, they are simple, highly experiential and fragile processes with unpredictable outcomes" (p. 1105).

R&D collaborations in the advanced technologies aerospace sector resemble dynamics of high-velocity markets where

> uncertainty cannot be modeled as probabilities because it is not possible to specify a priori the possible future states. In these markets, dynamic capabilities necessarily rely much less

> on existing knowledge and much more on rapidly creating situation-specific new knowledge. Existing knowledge can even be a disadvantage if managers overgeneralize from past situations (Argote, 1999). Effective dynamic capabilities in high-velocity markets are simple, not complicated as they are in moderately dynamic markets. Simple routines keep managers focused on broadly important issues without locking them into specific behaviours or the use of past experience that may be inappropriate given the actions required in a particular situation. Often these routines consist of a few rules that specify boundary conditions on the actions of managers or indicate priorities, important in fast-moving markets where attention is in short supply (Eisenhardt & Martin, 2000, p. 1111).

This description is applicable to managers dealing with wicked R&D projects in fast-paced dynamic collaborations where design thinking is a "simple dynamic capability".

5.2.1 Cognitive and affective states enabling design thinking as a dynamic capability

Analysis of the cases in this study show that thoughts, feelings, and emotions are present in collaborators' day-to-day actions and are incorporated in design thinking as dynamic capabilities.

> Teece (2007: 1341) observes that "enterprises may be more like biological organisms than some economists, managers, and strategy scholars are willing to admit". Our analysis takes this biological metaphor to a new level by illuminating the ways the individuals and groups who manage these entities are governed by thoughts and feelings: always boundedly rational, but manifestly driven by emotion (Hodgkinson & Healey, 2011, p. 1512).

Following are some examples of action verbs from Appendix G which reflect cognitive and affective states. Cognitive states examples include: Provide, Request, Inform, Communicate, Acknowledge, Share, Suggest, Propose, Need, Set, Facilitate, Plan, Explain, Seek, Accept, Exchange, Build, Apologize, Agree, Influence, Accelerate, Confirm, Reassure, Make, Follow up, Highlight, Consult, Prompt, Create, Appreciate, Express, Involve, Ask, Approve, Act, Demonstrate, Empower, Understand, Respond, Summarize, Illustrate, Collaborate, Introduce, Consider, Clarify, Think.

Whereas affective states examples include: Surprise, Motivate, Congratulate, Empathy, Flatter, Empathize, Care, Recognize, Help you, Feel, Comfort, Blame, Criticize, Worry.

Additionally, we have included examples from Appendix H which also reflect cognitive and affective states from the list of general collaboration affordances. Cognitive states examples from

this list include: Understanding, Responsibility, Review, Expectations, Impasse, Specific Reason, Solution, Ability, Confusion, Decision making, Ownership, Confidence, Uncertainty, Misunderstanding.

The affective states examples include: Mutual pleasure, Afraid, Sensitive, Gentleness, Past bad experience, Friendly tone, Polite, Empathy, Trust, Honest, Emotion, Guilty, Eagerness, Disappointment, Frustration, Empathizing, Skeptical, Excitement, Appreciation, Calm and reassuring, Happiness, Fear.

Hodgkinson and Healey highlight the emotional and unconscious cognitive processes for strategic adaptation:

> Indeed, the dynamic capabilities project now occupies center stage in the field of strategic management. Yet the accounts developed thus far—like much of the field's theory and research more generally—are predicated upon a cold cognition logic that downplays the significance of emotional/affective and nonconscious cognitive processes for strategic adaptation (p. 1500).

They "demonstrate how the fundamental capabilities of sensing, seizing, and transforming each require firms to harness the cognitive and emotional capacities of individuals and groups to blend effortful forms of analysis with the skilled utilization of less deliberative, intuitive processes" (p. 1500).

They propose the positive impact of "hot cognition" (high affect) on sensing and that incorporating intuition, which they define based on "Dane and Pratt's (2007: 40) succinct definition, 'affectively-charged judgments that arise through rapid, nonconscious, and holistic associations', renders abundantly clear why intuition is apposite to the sensing process" (p. 1506) allows effective identification and response to opportunities. They propose that organizations are more likely to seize opportunities if they encourage emotional commitments when evaluating and selecting these opportunities. And finally, for reconfiguring assets, organizations must ensure they address and regulate identity-based affective responses to increase the chance of success of strategic transformations "As with sensing and seizing, one of the most significant practical requirements for supporting identity transition during strategic transformation is the creation of a psychologically secure emotional climate" (p. 1510).

Hodgkinson and Healey illustrate how current dynamic capabilities privilege "calculation and computation through cold, effortful processes as the primary route to organizational adaptation and performance" (p. 1510). They demonstrate how the

> development and maintenance of dynamic capabilities requires firms to harness managers' reflexive and reflective abilities, to utilize implicit and explicit cognitive and emotional processes in harmony, to facilitate sensing, seizing, and reconfiguration… The result of this endeavor is a behaviorally more plausible depiction of organizations: driven by thinking and feeling inhabitants who are fired by affect, and often as reliant on inspiration and the skilful management of emotion and intuition as on calculating cognition (p. 1510-1511).

Design thinking is a dynamic capability that enables the integration, learning, and reconfiguring of knowledge to address rapidly changing environments. By incorporating cognitive and affective states, such as emotions, intuition, and reflection, design thinking enables organizations to sense, seize, and transform opportunities, driven by thinking and feeling individuals who manage emotions and intuition alongside rational thinking.

5.3 Higher-order thinking and wicked collaboration problems

The case studies highlight actions of individuals constantly analyzing, evaluating, and synthesizing situations to create new artefacts and circumstances for the next iteration of discussions, negotiations, and agreements. These individuals' actions prompt exploration of higher cognitive thinking. This study seeks different viewpoints to understand the complexities of human collaboration. One of the first concepts explored was Bloom's, which provided a framework for skills relevant to collaboration and related thinking and learning processes. Bloom's taxonomy consists of six hierarchical levels in two categories. First is the lower-level thinking category that includes recalling information, comprehending, and applying. Second is the higher-level thinking category that includes analyzing, synthesizing (creating something new), and evaluating against standards (Murtonen et al., 2017).

Bloom's taxonomy was revised in the 1990s by one of his students, Anderson; however, the revision was limited to verbs instead of nouns to describe actions for the six hierarchical levels, and the two top levels were rearranged such that creation was interchanged with evaluation as the highest level (Churches, 2008; Krathwohl, 2002). Bloom's taxonomy reflects, through observable

indicators and actions, cognitive, affective, and psychomotor learning as they would be enacted in the world by knowledge, skills, behaviours, and attitudes. Roets and Maritz (2017) state that "The revision provided more valuable and inclusive additions of how the taxonomy intersected and acted upon different types and levels of knowledge namely factual, conceptual, procedural, and metacognitive" (p. 52). The researchers contend that HOT skills (HOTS) expand on and go beyond Bloom's taxonomy by encompassing critical thinking, creative thinking, problem-solving, decision-making, and metacognition. These are skills manifested by individuals in this study.

Developing higher-order skills is important for the design of affordances that facilitate collaboration. It is as applicable during collaboration as it is in academia. Marzano argues, in Dubas and Toledo (2016), that HOTS must be developed to achieve learning from the design of learning materials to assessment and feedback in academia:

> If we want students to be able to use the tools of economics as they interpret a novel situation through the lens of an appropriate economic model or predict the impact of a policy proposal, i.e., to think like an economist, we must intentionally facilitate the development of higher-order skills. In an increasingly complex, dynamic world, this skill will become even more important and more highly valued (Hart Research Associates, 2013)" (Dubas & Toledo, 2016, p. 12).

While Irvine (2017) acknowledges taxonomies like Bloom's original taxonomy, Bloom's revised taxonomy, and Marzano's taxonomy to delineate HOTS, he critiques the linear nature of these taxonomies and highlights that learning is not linear, which is important for the iterative design and learning approach of this study.

The skills at the higher end of Bloom's taxonomy promote creative thinking for problem-solving. As mentioned, collaboration problems are wicked problems that do not have a single solution. This study illustrates that creative and critical thinking, as well as analyzing and synthesizing advance collaboration projects, because there are no collaboration recipes for these unique, uncertain, and unstable situations. But individuals who use skills non-linearly acquire such skills through experience and not through traditional learning methods.

Alternatively, in the case studies, lower-order thinking is reflected in processes, where stakeholders master the processes that worked previously for the same type of project in product delivery organizations. However, the moment a project deviates from the well-oiled machine process, for example, into R&D collaboration projects, stakeholders struggle with navigating non-standard

processes through the linear remember-comprehend-apply paradigm. To solve complex problems, Siddique et al. (2013) found that higher-order cognition skills include analysis, evaluation, and creativity; are complex and open ended; and are more than memorizing and applying routines. There can be many correct solutions (as well as many incorrect ones). “Whether or not a solution is ‘right’ might depend on the specific context. … Higher order cognitive engagement and tasks are necessary to promote development of creativity and innovation” (Siddique et al., 2013, p. 1).

Collaboration problems are usually ill-defined, wicked problems that require creativity; a HOT skill observed in the case study analyses. Creativity is an important pillar of design and design thinking to find elegant solutions to complex problems: “creativity is held to lie in the generation of high-quality, original, and elegant solutions to complex, novel, ill-defined problems” (Mumford et al., 2012, p. 30). Mumford et al. propose a model that aligns with design thinking:

> creative problem-solving … must be based on knowledge and information … Second, it was held that one could not generate new ideas solely on the basis of extant knowledge. Rather, this knowledge must be recombined and reorganized to produce the new knowledge that allows for the generation of novel ideas … and finally, ideas must be evaluated and shaped into viable plans for directing work on a creative project (p. 31).

The model translates into eight processes: “(a) problem definition, (b) information gathering, (c) information organization, (d) conceptual combination, (e) idea generation, (f) idea evaluation, (g) implementation planning, and (h) solution monitoring” (p. 43).

The above process underlines the HOT creative design process used in design thinking.

Agarwal and Selen (2009) illustrate higher-order capabilities that enable better service offerings in services organizations. They demonstrate “that higher-order dynamic capabilities in services are generated as a result of collaboration between stakeholders” (p. 431).

They introduce “dynamic capabilities and how it results in the creation of higher-order skills that goes [sic] beyond the essentials of changing the operational routines to creating and delivering better service levels” (p. 434). They list the following higher-order capabilities: “entrepreneurial alertness, collaborative agility, customer engagement, collaborative innovative capacity, and collaborative organizational learning” (p. 435).

They demonstrate that higher-order capabilities influence collaboration outcomes and collaboration promotes dynamic capability building, which is relevant to this study. They highlight

that dynamic capabilities provide "a systematic and proactive way to explore new opportunities and at the same time help anticipate threats from competitive innovations" (Agarwal & Selen, 2009, p. 458).

The case studies in this research highlight the importance of higher-order thinking skills (HOTS) for effective collaboration, problem-solving, and creativity. These skills which include critical thinking, creative thinking, problem-solving, and decision-making have been prominent in the design of collaboration affordances in these projects. Creativity is also a crucial aspect of design thinking, which involves generating elegant solutions to complex problems based on knowledge and information, and evaluating and shaping ideas into useful affordances. This study underlines the importance of HOTS in enhancing collaboration outcomes and exploring new opportunities while anticipating and adapting to the context. Table 5.8 presents the higher-order thinking themes which were inspired from the analysis and first-level codes and second-level themes from the studied cases.

Table 5.8 Higher Order Thinking Skills and Themes from the Analysis

Higher Order Thinking Skills	Themes Examples	Key Themes from the Cases
Analysis	Sharing information	Breaking down complex information into its components and interpreting the relationships between them
	Involving relevant parties	
	Understanding and communicating constraints	
	Another iteration of the project set-up following review by specialized resource	
	Confirming accuracy of artefact with producer of artefact	
	Review of artefact	
Synthesis	Maintaining open communication channels	Combining information from various sources and reorganizing into new forms that can guide decision-making and action
	Taking the lead in negotiations	
	Providing guidance	

Table 5.8 Higher Order Thinking Skills and Themes from the Analysis (cont'd)

	Communicating a summary artefact to facilitate understanding	
	Project scope definition	
	Partner evaluating offer	
	Informed evaluation of efforts	
	Internal evaluation of partner's proposal	
Evaluation	Realizing potential benefits of different options	Assessing the value and relevance of information to make informed decisions and optimize resource usage
	Resource allocation	
	Expert Providing feedback on artefact	
	Highlight lack of key artefact	
	Systematic feedback on artefact	
	Adjusting to new information or circumstances	
Critical Thinking	Seeking clarification	Ability to analyze and evaluate information and arguments objectively and make well informed decisions
	Addressing disagreements	
	Discussing challenges	
	Suggesting adapting of artefacts	
	Finding common ground	
	Being creative with collaboration artefact	
Application	Exploring alternative solutions to overcome challenges	Using acquired knowledge and experiences for new situations and adapting them to meet the specific needs of the new context
	Reflecting on situations	
	Seeking opportunities for growth	
	Resolving conflicts	
	Adapting artefact to new project set-up	

Table 5.8 Higher Order Thinking Skills and Themes from the Analysis (cont'd and end)

Understanding	Acknowledging mistakes	Constructing meaning from information and experiences, as well as empathizing with others to build trust and strengthen relationships through acknowledging understanding and challenges
	Emphasize understanding	
	Expressing appreciation and empathy	
	Understanding the audience of the artefact	
	We now understand	
	Summarizing understanding of the situation	
	Explaining reason behind modifications to artefact	
	Communicating a summary artefact to facilitate understanding. Making sure of common understanding. Communicating understanding of discussions for confirmation.	

5.3.1 Experiential learning and higher-order thinking

Collaboration design requires higher order thinking, which can be learned through higher-level cognitive problem solving. Siddique et al. (2013) demonstrate how facilitating higher-order learning can positively impact higher cognition and positive attitudes in learning. Kolb's experiential learning model aligns with design thinking (reflective practitioner), and Kolb proposes that experiential learning through collaboration strengthen HOTS. Kolb's model is summarized as follows:

- **Concrete Experience**: the learner must be willing and be actively involved in the experience;
- **Reflective Observation**: the learner must be able to reflect on the experience;
- **Abstract Conceptualization**: the learner must possess and use analytical skills to conceptualize the experience; and
- **Active Experimentation**: the learner must possess decision making and problem-solving skills to use the new ideas gained from the experience (Siddique et al., 2013, p. 2).

The two complementary dimensions of this model, “grasping information and then transforming that information” (Siddique et al., 2013, p. 2) are clearly part of the major themes of the case studies. The learning experiences throughout the case studies demonstrate that, with every iteration of grasping and transforming information, the next phase of collaboration is facilitated by knowledge and experience acquired by individuals.

Holmqvist (2004) extends experiential learning to organizations, where experiential learning of exploitation and exploration within collaborating organizations generates interorganizational exploitation and exploration, which, in turn, generates intraorganizational exploitation and exploration. This is important for this study, where the organization can realize the benefits of experiential learning through collaboration.

This study notes that conversations are at the heart of interactions between collaborators. Baker et al. (2005) propose that “attending to this conversational space enables those in the conversation to remain engaged with each other so that differing perspectives can catalyze learning experientially and promote individual learning and organizational learning” p. 411).

They “propose conversational learning as an experiential process of learners constructing meaning from their collective experiences through conversation—that is, conversation as experiential learning” (p. 413). Conversation promotes experiential learning and enables parties to construct meaning through experiences, the foundation of which is “attending to how we talk to each other” (p. 426).

Tacit knowledge and intuitive action are also HOTS. Collaborators in the case studies have tacit knowledge of how to build and execute collaboration projects. Lejeune (2011) defines tacit knowledge as “all of the intricacy of the different experiences that people acquire over time, and which they utilize and bring to bear in carrying out tasks effectively, reacting to unforeseen circumstances, or innovating” (p. 91). He highlights the intuitive nature of tacit knowledge and that it is difficult to express in words. According to Lejeune (2011), tacit knowledge is difficult to formalize or explain rationally. It is transferred through methods like observation, imitation, socialization, metaphors, or training-related means and is closely linked to intuition and often forms the basis for decision-making in organizations. Experts develop a personal, intuitive vision that helps them solve problems without always being able to explain their process rationally.

> One can conclude from this that tacit knowledge is a special high-level awareness of “how to act” that people develop over time and that they employ to solve practical problems at work and elsewhere … Tacit knowledge cannot be taught. It is conveyed, in a normal environment, through observation, proximity, socialization, and “sharing of good practices” (p. 102).

Learning through hands-on experience of collaboration is an important element of experiential learning, which enables HOT processes and facilitates collaboration.

Williams (2002) presents the boundary spanner, which is interesting for building and facilitating collaboration. A boundary spanner is a stakeholder who has tacit knowledge, learns through experience, and thinks at a higher order to facilitate collaboration. Williams considers boundary spanning an art, and the competent boundary spanner an enabler of building sustainable relationships. Boundary spanners communicate well, are active listeners, understand context, empathize with others, and resolve conflicts when dealing with ill-defined problems, which are qualities observed in the case studies. Boundary spanners, according to Williams, manage through influencing and negotiation, manage complexity and interdependencies among organizations, and manage roles, accountabilities, and motivations for collaboration.

We further highlight the importance of developing higher-order thinking skills (HOTS) in collaboration projects context. The examples of HOTS provided earlier in the previous section, such as comparing and contrasting different ideas, interpreting data, and synthesizing information from multiple sources link to Kolb's experiential learning model involving reflective observation and abstract conceptualization, which require analytical skills like comparing, contrasting, and interpreting. Additionally, active experimentation calls for problem-solving and decision-making skills, which are important for evaluating and creating solutions in collaboration. Furthermore, conversational learning, boundary spanners, and the development of tacit knowledge all contribute to the stakeholders ability to synthesize information, think critically, and make informed decisions. Thus, the development of HOTS through experiential learning, conversational learning, and the acquisition of tacit knowledge in the context of collaboration design.

5.3.2 Individual and organizational Learning

Organizational and individual learning are present throughout the case study collaboration projects and have an important impact on the enactment of collaboration. Through social cognitive theory

and the expansion of existing models, we will explore in this section how researchers have emphasized the importance of conscious learning processes, such as conversation and social modeling. As well as how learning organizations foster creativity, innovation, and systemic thinking, ultimately leading to the experiential production and reproduction of organizational rules that guide behaviors and facilitate collaboration. The codes from this study allowed to observed themes related to individual learning, including, communication and collaboration, decision-making and problem-solving, adaptation and flexibility, and conflict resolution and negotiation. Additionally, these themes involve personal skills and abilities that individuals acquire and improve upon through observation, experiences, and interactions. Organizational learning has been observed in themes which include, project management and lessons learned, resource and constraints management in relation to challenges faced by the organization, and empowerment of employees to share knowledge. These themes involved the collective effort of individuals working together, sharing knowledge, and creating ideas with a common goal to improve the collaboration process and reach the desired outcomes of the collaboration project.

Castaneda and Ríos (2007) use social cognition and social interaction to study organizational learning, which they describe as a social process. According to Bandura's social cognitive theory, human function is explained by personal, environmental, and behavioural factors, which are determinants that influence each other, and when outside stimuli are weak, personal factors have the most influence. The theory posits that individuals are proactive and anticipative, not only reactive, and that human capabilities symbolize, learn through modeling, have forethought, self-regulate, and self-reflect. Bandura highlights that people's behaviours change organizations, and that organizational learning is a collaborative effort of sharing knowledge—a dynamic that creates ideas. Castaneda and Ríos (2007) highlight Bandura's concept of observational learning, where people learn by consciously observing others, which requires attention (exploration and perception), retention (rules and concepts), motor preproduction (turn into actions), and motivation.

Castaneda and Ríos (2007) add to Crossan et al.'s influential model of organizational learning, which includes intuiting, interpreting, integrating, and institutionalizing, by broadening individual learning to include conscious learning supported by attention, retention, production, and motivation. They add two conscious processes to group level learning (there are three levels of

learning: individual, group, and organization), which are conversation (a conscious process central to organizations) and social modeling (allows for higher levels of learning).

According to Orr (2004), the human future depends on learning people and organizations; he quotes Senge to praise learning organizations where:

> "people continually expand their capacity to create the results they truly desire, where new and expansive patterns or thinking are nurtured, where collective aspiration is set free, and where people are continually learning how to learn together" (1990, 3). Learning organizations, Senge writes, "develop people who learn to see as systems thinkers see, who develop their own personal mastery, and who learn how to surface and restructure mental models collaboratively" (ibid., 367). They foster people capable of seeing the organization and institution at a higher level of generality and thereby capable of challenging basic premises. In short, learning organizations encourage creativity, innovation, out-of-the-box thinking, and the heretics who speak to fundamentals. On such people and on such organizations the human future depends (pp. 77–78).

Holmqvist (2004) defines organizational learning as the process where experiences shape and reproduce organizational rules, leading to behavioral changes or stability, where an organization is a unique combination of behaviors resulting from the diverse and conflicting experiences of its members. Ongoing discussions, conversations, and interactions among potential and existing members produce organizational rules. The organizational learning is guided by past experiences and emerges from these discussions and interactions. Organizational rules connect individual behaviors, providing both constraints and resources for specific activities.

5.4 Entrepreneurship and alertness in interorganizational collaborations

The concept of Entrepreneurship and entrepreneurial alertness, in relation to the study findings, are important in building and sustaining collaboration as we will present in the following paragraphs.

Entrepreneurship continuous to be of topic of great interest, it is an "emerging economic environment created by the confluence of changes in the corporate world, new technology, and emerging world markets" (Fiet, 2000a, p. 102) (Harrison & Leitch, 2005, p. 353).

Stevenson (2000) introduces entrepreneurship as

> "the pursuit of opportunity beyond the resources you currently control" (Stevenson 1983, 1985, 1990). This definition takes into account both the individual and the society in which the individual is embedded. The individual identifies an opportunity to be pursued and then, as an entrepreneur, must seek the resources from the broader society. This approach follows on the work of early scholars such as Schumpeter (1934) who identified the interaction of the individual with the context in his early work (Stevenson, 2000, p. 3).

And, "Schumpeter (1934) … described entrepreneurs as individuals whose function was to carry out new combinations of means of production" (Carland et al., 2007, p. 73). Schumpeter also highlighted innovation and initiative as behaviours and attitudes manifested by entrepreneurs.

> Schumpeter (1934) suggested that five categories of behavior can be observed that are characteristic of an entrepreneurial venture. These categories, listed below, are supported by Vesper (1980) and can be used as the basis for classification criteria.
>
> 1. Introduction of new goods
> 2. Introduction of new methods of production
> 3. Opening of new markets
> 4. Opening of new sources of supply
> 5. Industrial reorganization (Carland et al., 2007, p. 78).

The definitions of entrepreneurial venture and entrepreneur align with interorganizational R&D collaboration projects and collaborators, respectively. Carland et al.'s definitions are in line with the Schumpeterian view on entrepreneurship:

- **Entrepreneurial venture**: An entrepreneurial venture is one that engages at least in one of Schumpeter's categories of behaviour: that is, the principal goals of an entrepreneurial venture are profitability and growth and the business is characterized by innovative strategic practices.
- **Entrepreneur**: An entrepreneur is an individual who establishes and manages a business for the principal purpose of profit and growth. The entrepreneur is characterized principally by innovative behaviour and will employ strategic management practices in the business (Carland et al., 2007, p. 79).

(Stevenson & Jarillo, 2007) propose that the main characteristics associated with entrepreneurship are **growth, innovation**, and **flexibility**. The authors consider Schumpeter's view that considers entrepreneurship as the main driver of the whole economy. "Its essence is 'innovation.' He writes that 'the carrying out of new combinations we call "enterprise"; the individuals whose function is to carry them out we call "entrepreneurs" (1934: 74)" (p. 157).

Of particular interest for organizational structures is the Schumpeterian view of entrepreneurs, which includes those who carry out new combinations of resources and innovate within businesses but are not necessarily owners.

> We call entrepreneurs not only those "independent" businessmen in an exchange economy who are usually so designated, but all who actually fulfil the function by which we define the concept, even if they are, as is becoming the rule, "dependent" employees of a company, like managers, members of boards of directors, and so forth, or even if their actual power to perform the entrepreneurial function has any other foundations, such as the control of a majority of shares. As it is the carrying out of new combinations that constitutes the entrepreneur, it is not necessary that he should be permanently connected with an individual firm (Stevenson et al., 2007, 157).

The authors underlines that entrepreneurs are not only businesspeople: "Most economists (and many non-economists as well) have accepted Schumpeter's identification of entrepreneurship with innovation. This represents a change from the previous tradition, where the term 'entrepreneur' meant basically 'businessman' (p. 158).

This definition of entrepreneurship applies to this study in terms of combining resources, including uncontrollable resources, for desirable outcomes:

> entrepreneurship is a process by which individuals—either on their own or inside organizations—pursue opportunities without regard to the resources they currently control" (Stevenson, Roberts, and Grousbeck, 1989). 'Opportunity' is defined here as a 'future situation which is deemed desirable and feasible' (Stevenson et al., 2007, 163).

And,

> Entrepreneurial behavior would be, following the economists' tradition started by Schumpeter, the quest for growth through innovation, be this technological or purely managerial. But pursuing opportunity, whether through specific company structures or not, constitutes the core of entrepreneurship, both individuals and corporate (Stevenson et al., 2007, 166).

The case studies include collaboration with academic institutions and Etzkowitz (2003) describes research groups and university researchers as entrepreneurial, a description that is important for understanding the context of the studied collaborations:

> The internal organization of the Research University consists of a series of research groups that have firm-like qualities, especially under conditions in which research funding is awarded on a competitive basis. Thus, the Research University shares homologous qualities with a start-up firm even before it directly engages in entrepreneurial activities (p. 109).

Where

> the traditional concept of entrepreneurship typically presumes that the entrepreneur is an individual person. The notion of the heroic individual entrepreneur can serve as an ideological myth that conceals the role of academic and government initiatives in firm-formation. Several persons may jointly undertake entrepreneurial roles in forming new firms and other organizations. Indeed, although some persons may not be willing or able to become entrepreneurs individually; they are able to do so collectively, … Individual entrepreneurs have their collective counterpart when groups and organizations take entrepreneurial initiatives. As Schumpeter pointed out, "… the entrepreneurial function need not be embodied in a physical person and in particular in a single physical person" (Schumpeter, 1949, p. 255) (Etzkowitz, 2003, p. 112).

Moroz et al. (2011) explore the typology of entrepreneurial universities and propose a taxonomy based on their performance where the concept of entrepreneurial universities refers to academic institutions that possess the ability to create patentable intellectual property that can be transformed into innovative products and services for the market.

Ardichvili et al. (2003) propose a theory of entrepreneurial opportunity identification and development or entrepreneurial alertness: **"**It identifies entrepreneur's personality traits, social networks, and prior knowledge as antecedents of entrepreneurial alertness to business opportunities. Entrepreneurial alertness … is a necessary condition for the success of the opportunity identification triad: recognition, development, and evaluation" (p. 105).

They highlight entrepreneurs to identify business opportunities to create and deliver value for stakeholders in prospective ventures. They state that opportunities can be "recognized", and emphasize that opportunities are "made, not found". They identify five factors that influence opportunity recognition and development leading to business formation, which are:

1. entrepreneurial alertness;
2. information asymmetry and prior knowledge;
3. social networks;
4. personality traits, including optimism and self-efficacy, and creativity; and
5. type of opportunity itself.

> The development process begins when entrepreneurial alertness exceeds a threshold level. Alertness is likely to be heightened when there is a coincidence of several factors: certain personality traits (creativity and optimism); relevant prior knowledge and experience; and social networks. The particular activities within the process are also affected by the degree of specificity of knowledge about market needs and resources (p. 106).

The interactions between these factors areas follows:

- There is interaction between social networks and alertness. As Hills et al. (1997) have demonstrated, the denser an entrepreneur's network (the more connected a person is), the higher is his/her alertness to potentially successful entrepreneurial opportunities.
- The stronger an entrepreneur's interest in Domain 1 (specific area of personal interest, hobby, etc.), the higher the alertness (Sigrist, 1999).
- When Domains 1 and 2 [industry knowledge] converge, it increases alertness (Sigrist, 1999).
- There is a continuous interaction between one's knowledge base, and the opportunity development process. This interaction results in an iterative learning process, described by Argyris and Schoen (1978) as double-loop learning, and in the development of a knowledge corridor, described by Ronstadt (1988), which leads to heightened alertness to new opportunities (p. 119).

Ardichvili et al. (2003) formulate eight propositions for the model of opportunity identification relevant for collaboration and observed at various levels in the case studies. These include the importance of entrepreneurial alertness, an extended social network, convergence of knowledge domains (special interest knowledge and industry knowledge), and prior knowledge of markets, customer problems, and ways to serve markets for successful opportunity recognition. Additionally, high levels of entrepreneurial alertness are linked to creativity and optimism, while successful opportunity identification experiences enhance an entrepreneur's knowledge base and alertness, increasing the likelihood of identifying future opportunities. Furthermore, Yu (2001) discusses Kirzner's view of entrepreneurial alertness:

> The entrepreneurial discovery process is associated with the actor's interpretation framework, or the stock of knowledge, which is derived from everyday life experiences. Discovery in this context means that the actor interprets incoming information in a way different from perceptions of the general public. Two kinds of entrepreneurial discovery, namely ordinary and extraordinary … In terms of mental constructs, ordinary discovery is a "backward" interpretation in a sense that the entrepreneur endeavours to exploit profit opportunities by doing some things better. This type of discovery largely promotes change within an existing situation. Extraordinary discovery is a "forward" interpretation that involves a new dimension of interpreting events. In this case, the entrepreneur explores profit opportunities by doing some things drastically different from the traditional. This type of discovery enhances revolutionary change to the economy (p. 47).

According to Yu, alertness is key in Kirzner's theory of entrepreneurship:

> Alertness leads individuals to make discoveries that are valuable in the satisfaction of human wants. The role of entrepreneurs lies in their alertness to hitherto unnoticed

> opportunities. Through their alertness, entrepreneurs can discover and exploit situations in which they are able to sell for high prices that which they can buy for low prices (p. 48).

Remaining alert to opportunities is an intentional purposeful act. According to Yu, opportunities exist only when perceived by entrepreneurs, who have an extraordinary sense of "smelling" opportunities. Entrepreneurial alertness is like an antenna that constantly scans the environment for unnoticed opportunities. Self-competition, the desire to test one's abilities and fulfill a vision, is crucial in enhancing entrepreneurial alertness. Although profit is important, entrepreneurs' passion often supersedes monetary goals. Due to their self-challenging nature, entrepreneurs can create uncertainty for themselves and the market, sometimes leading to disequilibrium.

> Self-competition seems to be the most important factor in enhancing entrepreneurial alertness. Self-competition is defined by Khalil (1997) as “inter-temporal competition between future and past selves stemming from the desire of the present self to test self-ability”. For entrepreneurs, businesses are their passions. They have a desire to fulfill a vision, to see things become true. This passion often supersedes the desire to make a profit, though money is important at the early stage of entrepreneurial career (Gilad et al. 1988:491–492). Owing to this self-challenging character, entrepreneurs often create uncertainty to themselves and to the market. If viewing from the equilibrium paradigm, entrepreneurial activities can be diseqillibrative too (p. 52).

Yu introduces “inertia”:

> the opposite of alertness, develops because individuals take experiences for granted and interpret incoming information routinely. In this regard, a failure of being alert to an opportunity cannot be considered as an “error”, as Kirzner (1979:120-136) argued. Instead, it often reflects the operation of an ideological filter (Weick 1995:113). Entrepreneurial discovery or creativity means that the actors do not take the knowledge for granted. Rather, they are able to escape from the present routine. The entrepreneur, in Choi’s (1997:36; 1999:20) words, is thus a deviant. With a different perspective, he or she “may see something of significance where conventionalists see none, or recognise the possibility of new combinations that the majority with their conventional blinders neglect”. Accordingly, to escape from inertia, actors need to consciously challenge their way of interpreting things. For this, they require entrepreneurial vision. This point reiterates the argument that self-competition is an important source of entrepreneurial alertness. The quality of alertness, essentially associated with actor’s interpretation framework, cannot be obtained from deliberate search but is “contaminated” from everyday-life activities, via socialization at school, family, workplace, and other social activities (p. 57).

Thus, through experiential learning and tacit knowledge, entrepreneurship is a learning experience where *(Minniti & Bygrave, 2001)* present the process of entrepreneurship as a learning experience where entrepreneurs update their subjective knowledge based on past experiences. The authors

propose an entrepreneurial learning model that involves iterated choice problems and a calibrated algorithm. The entrepreneurs make decisions based on which choices seem most promising, while discarding those that have resulted in failure. They process information, make mistakes, update their decision-making processes, and hopefully improve their performance through this continuous learning process.

Agarwal and Selen (2009) highlight the importance of alertness:

> According to Yu (2001), an opportunity exists only if it is perceived and will not be discovered if the alertness system is switched off … Sambamurthy et al. (2003) define EA as the "dynamic capability of an organization to explore its marketplace, and detect areas of current and future market place threats and opportunities" (p. 435).

Clifford (2019) conducted a study to investigate the cognitive process that underlies opportunity recognition, evaluation, and exploitation in entrepreneurs. The author found that entrepreneurs have stronger capacities for integrative thinking compared to managers. The study suggests that entrepreneurs have a greater ability to focus on practical achievements than non-entrepreneurial managers, indicating the highly developed ability of opportunity recognition, evaluation, and exploitation among entrepreneurs. The author argues that the measurable construct of Integration is a crucial indicator of entrepreneurial cognition.

In support of the concept of entrepreneurship within organizations, we suggest that entrepreneurial management shapes organizations. Regarding dynamic capabilities and enterprise performance, Teece (2007) notes that "enterprises with strong dynamic capabilities are intensely entrepreneurial. They not only adapt to business ecosystems, but also shape them through innovation and through collaboration with other enterprises, entities, and institutions" (p. 1319). Dynamic capabilities as we have seen in previous sections involve sensing and shaping opportunities, seizing opportunities, and maintaining competitiveness. Entrepreneurial management is not limited to start-ups and individual actors; it is a critical function for businesses of all sizes to achieve success. This involves recognizing trends, directing resources, and reshaping organizational structures to address technological opportunities while aligning with customer needs. Entrepreneurs do not only start businesses, they are also embedded in organizations and are key enablers of dynamic capabilities:

> We have come to associate the entrepreneur with the individual who starts a new business providing a new or improved product or service. Such action is clearly entrepreneurial, but the entrepreneurial management function embedded in dynamic capabilities is not confined to

> start-up activities and to individual actors. It is a new hybrid: entrepreneurial managerial capitalism. It involves recognizing problems and trends, directing (and redirecting) resources, and reshaping organizational structures and systems so that they create and address technological opportunities while staying in alignment with customer needs. The implicit thesis advanced here is that in both large and small enterprises entrepreneurial managerial capitalism must reign supreme for enterprises to sustain financial success. Nor is entrepreneurial management merely "intrapreneurship", as there is a large role for the entrepreneurial manager in external activities, including shaping the ecosystem (Teece, 2007, p. 1347).

The textual codes in Appendix D and Table 5.9, include codes and themes which reflect the entrepreneurship characteristics of, growth, innovation, and flexibility. Where codes related to planning, decision making, communication, leadership, collaboration, and progress reflect growth in the context of the studied projects. Innovation themes include codes associated with positive communication, proposing alternative solutions, change, creative thinking, and addressing conflicts. Whereas flexibility was inspired by codes linked to managing uncertainty, open communication, relationship building, confirming understanding, and demonstrating empathy and support. In summary, we posit that entrepreneurship, underpinned by the concept of entrepreneurial alertness, plays a significant role in shaping collaboration, particularly within interorganizational R&D projects. It promotes opportunity seeking beyond the controlled resources, fostering innovative practices and a growth mindset. Entrepreneurship extends beyond the traditional view of an entrepreneur as a businessman. It includes individuals within organizations who innovate and propose new combinations of resources, aligning with the objectives of collaborators across the boundary of organizations. The characteristics of entrepreneurship, which found in the analyses of the cases, extend to growth, innovation, and flexibility, all important attributes of entrepreneurial alertness. This alertness enables the detection of subtle signals in the environment and catalyzes the pursuit of opportunities regardless of the current available or controlled Resources. We propose collaborative alertness as an equivalent concept to entrepreneurial alertness, where interorganizational collaboration shares the qualities of entrepreneurship ventures as described above. We posit that the new concept which we coined as **Collaboration Alertness** shares similar principles as Entrepreneurial Alertness, with both concepts focusing on the ability to identify and seize opportunities, adapt to changes, and effectively manage resources and relationships. Collaboration Alertness, based on our study and the themes, specifically targets interorganizational

partnerships, emphasizing effective communication, teamwork, decision-making, leadership, project management, adaptability, resource and risk management, and trust-building. Collaboration Alertness is observed in collaboration venture by individual collaborators and their ability to recognize collaboration opportunities and capitalize on them through innovation solutions, risk-taking, and interorganizational teams networking. Both concepts highlight the importance of being proactive, adaptable, and resourceful to succeed in dynamic and complex environments.

Table 5.9 Second-Level Themes Inspiring Entrepreneurship and Collaboration Alertness

Second-Level Themes (Corresponding first-level themes are provided in Appendix F)	
Facilitating Progress and Moving Forward	Initiating Action, Commitments, Facilitating Action
Proposing, Planning, Negotiation, Influencing, Decision Making	Recognizing opportunity to augment the project with additional resources.
Creative Problem-Solving, Partner Engagement, Discovery and Iteration	Accountability, Creative Solutions, and Proposing Alternatives
Suggesting workaround, Proposal and Alternatives	Challenges, Problem Solving, Managing Relations and Change
Influencing and Negotiation	Proposal Development and Evaluation, Influencing
Participation and Seeking and Encouraging Involvement	Interpersonal Dynamics, Influencing, and Resource Management
Negotiations Dynamics and Strategy, Communication and Discussions	Setting and Clarifying Expectations, and Providing Guidance
Communicate, Inform, and Provide Updates	Negotiation and Strategy and Internal Dynamics
Feedback and Advice on Artefacts, Progress and Updates	Informing and Directing, Enable Action through Information and Artefacts
Artefacts, Information and Resource Sharing	Exploring Constraints, Seeking Clarification and Information
Expressing Intentions to Support, Promote Understanding	Requesting and Providing Information Clarifications and Advice
Emotions and Emotional Intelligence	Stakeholder Engagement, Building and Demonstrating Trust
Challenges and Concerns	Recognition and Respect
Partner and Stakeholder Engagement Dynamics	Challenges and Conflict Management

Table 5.9 Second-Level Themes Inspiring Entrepreneurship and Collaboration Alertness (cont'd and end)

Internal Negotiation Dynamics and Accountability	Partnership Dynamics, Design
Stakeholder Engagement, Mobilizing, Persistence	Feedback, Improving, Follow-Up, and Reminding
Structure, Manage, and Coordinate	Accountability, Conflict Management, Coordination, Strategy
Leading, Learning, and Reflecting	Facilitating, Logistics and Planning Dynamics
Strategy, Leadership, Partners Management, and Risk, Opportunity Recognition	Leadership and Partners Dynamics

5.5 The framework

Based on the analysis in the previous sections, we proposed a complementary comprehensive conceptual framework that reflects propositions from the abductive phase of the study illustrated in Figure 5.1. This framework emphasizes the importance for collaboration stakeholders to be aware and leverage both tangible and intangible affordances, which include resources, actions, capabilities, behaviours, communication, and trust enablers. By incorporating design thinking approaches, stakeholder and organizations can adopt a human centric problem-solving mindset, promoting creativity, innovation, and empathy. This framework also underscores the role of higher-order thinking skills, such as critical thinking, problem-solving, and decision-making, in analyzing and evaluating complex wicked problems faced in collaborative ventures.

Furthermore, fostering an entrepreneurial mindset within collaborations encourages innovation, risk-taking, and proactive behavior, enabling organizations to seize opportunities, experiment with new ideas, and adapt to changing collaboration conditions. We also introduce the concept of collaboration alertness which we believe is vital for interorganizational collaboration, as it entails maintaining vigilance and responsiveness to changes in collaboration environments. By integrating these elements into the proposed framework, we hope we can contribute to enhancing the ability of stakeholders to navigate dynamic collaboration environments, address complex their challenges, and achieve collective success. The proposed conceptual framework provides valuable insights and guidance for organizations seeking to maximize the potential of interorganizational collaboration

in today's complex environments. In summary, the qualitative textual codes from the study have inspired the connectedness of the concepts of design thinking, collaboration affordances, higher-order thinking, and entrepreneurship and alertness in various ways. These concepts are crucial for successful problem-solving, innovation, and value creation, both individually and within interorganizational collaboration relationships:

- Collaboration affordances both tangible and intangible: This framework dimension emerged through the analysis of codes which were related to relationship building, trust, transparency, sharing information, stakeholder engagement, and teamwork. These codes and themes inspired the expansion of the concept of intangible collaboration affordances, which refer to the various ways that individuals and organizations can work together effectively, including tangible resources (e.g., technology and tools) and intangible aspects (e.g., trust, shared understanding, and communication, empathy, and kindness acts).
- Design thinking as a human problem-solving dynamic capability: The codes related to adaptability, problem-solving, offering solutions, proposing alternatives, and managing challenges can be linked to the concept of design thinking. Design thinking is a human centric approach that focuses on understanding users' needs and generating creative solutions to problems. In this context, we proposed that design thinking is a dynamic capability that enables individuals and teams to address complex issues and create value through innovative solutions.
- Higher-order thinking and learning: Which include complex cognitive processes such as critical thinking, analysis, synthesis, and evaluation. Codes related to decision-making, conflict resolution, addressing disagreements, providing guidance and advice, and seeking approval were connected to this dimension of the framework. As seen from the analysis of the cases and through the resulting themes, these processes were reflected by individuals had a propensity to analyze and evaluate information, make reasoned judgments, and synthesize diverse perspectives to solving complex problems and creating innovative solutions.
- Entrepreneurship and Alertness: Entrepreneurship involves the recognition and identification of opportunities, creation of new ventures, and assumption of risks to achieve

success. Codes related to perseverance, persistence, preparedness for action, demonstrating control, managing risks, and exploring alternative options can be linked to entrepreneurship. Collaboration Alertness, also based on our study and the codes emphasizes effective communication, teamwork, decision-making, leadership, project management, adaptability, resource and risk management, and trust-building. Collaboration Alertness was observed in the collaboration ventures of the studies cases by individual collaborators and their ability to recognize collaboration opportunities and capitalize on them through innovation solutions, risk-taking, and interorganizational teams networking.

We hope that this framework and its dimensions inspires further research as it contributes to contextualizing the human-centric aspect of collaboration. It may also be adapted to organizational stakeholders to address their challenges of managing collaborative interorganizational research projects.

We further propose that this framework can be further explored in future research as a dynamic framework which illustrates the interdependencies and interactions between its different dimensions. This framework is envisioned as an iterative, non-linear model with a continuous interaction and feedback loops between its components.

At the heart of this framework are the collaboration affordances, including resources, trust, communication, and empathy, which are the foundation for effective collaboration. We also propose the key role of design thinking as a human-centric approach to problem solving and which influences and enables higher-order thinking skills like critical thinking and decision-making. Entrepreneurship within this model is proposed as a driver of innovation and for creating new resources and opportunities. Equally, Collaboration Alertness plays is a foundation dimension across all components and phases of the collaboration process which allows for responsiveness and adaptability to the constant change and the need to recognize opportunities within the complex dynamics of collaborative projects and beyond at the intersection of projects and the innovation ecosystem. The interactions between the dimensions of these combined frameworks are expected to be cyclical as illustrated in Figure 5.1 and represent the continuous and iterative nature of these interactions.

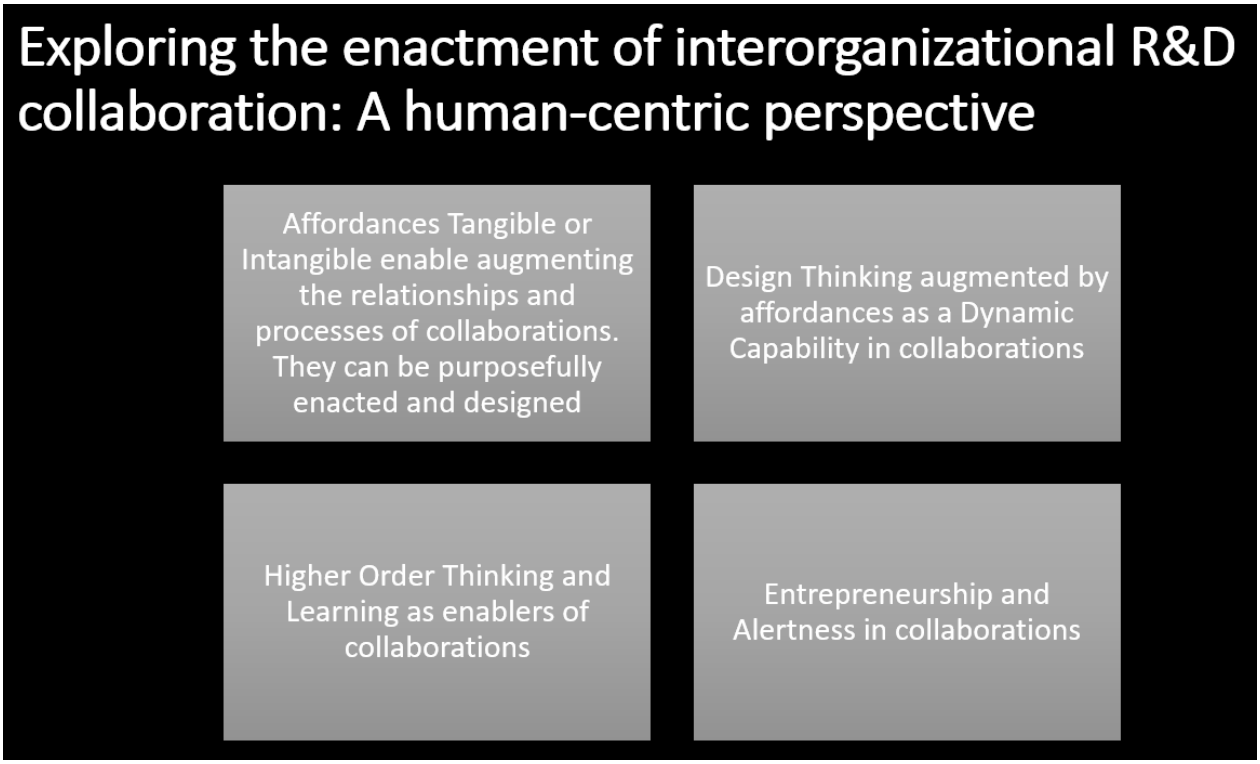


Figure 5.1 Conceptual Framework and Dimensions Based on the Abductive Analysis Phase

Further to this, we propose that the original conceptual framework components for interorganizational collaboration, as presented in Chapter 2, namely, Collaboration Processes, Design Thinking, Change Management, and Project Management, are vehicles processes through which in the inner elements of the new conceptual framework presented in Figure 5.2 are embodied and manifested in practice. A change in any of these elements of the framework is expected to impact all others in this interconnected encompassing framework. We would hope and expect that the proposed overall model will also be leverage as a baseline for a comprehensive and flexible approach to understanding and managing the complexities of interorganizational collaborations and offer individuals and organizations a deeper awareness and understanding of the collaborative process and enhancing their ability to navigate and succeed in these ventures.

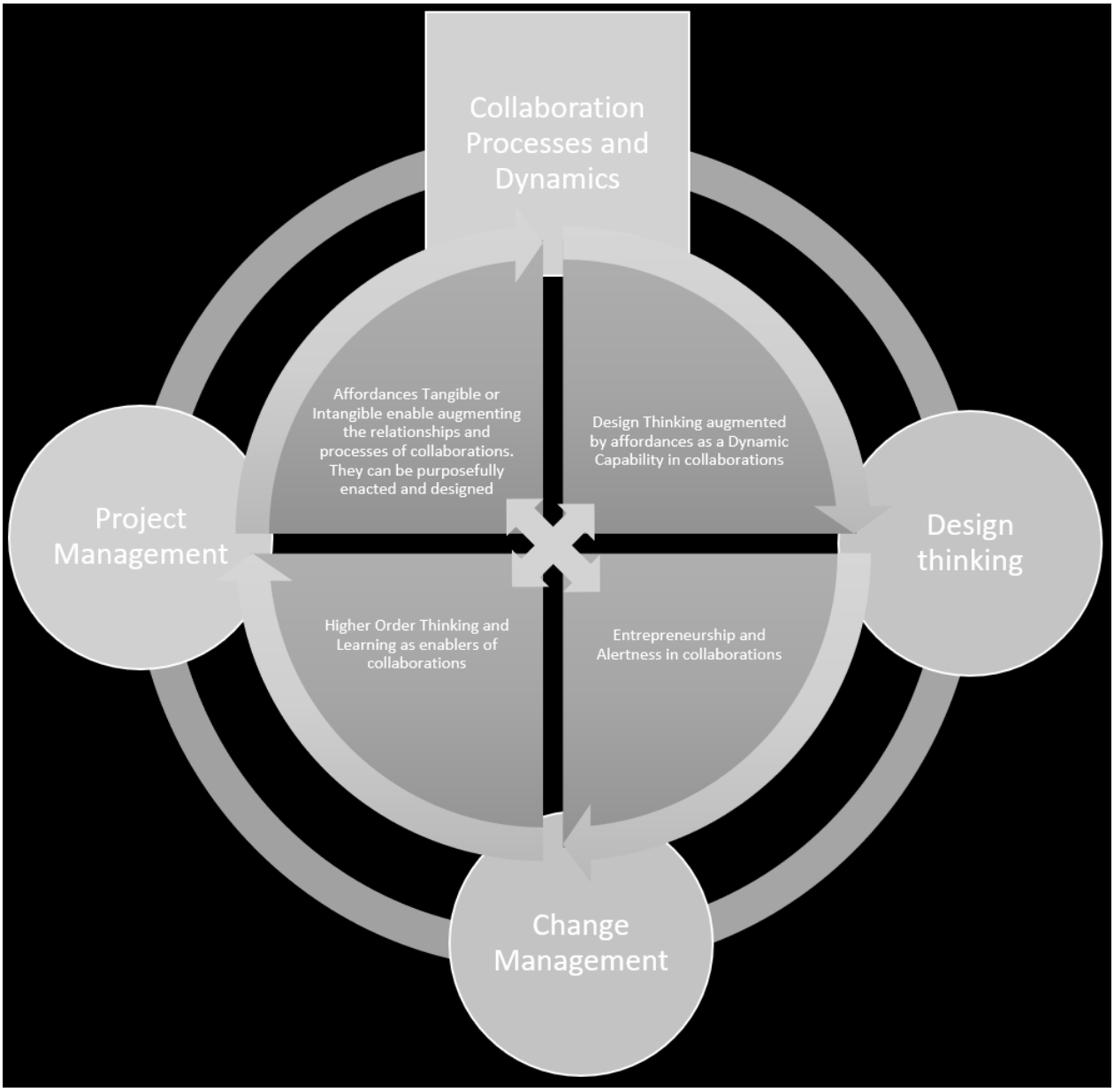


Figure 5.2 Proposed Encompassing Conceptual Framework

CHAPTER 6 CONCLUSION AND OUTLOOK ON FUTURE RESEARCH

This research project focused on interorganizational collaboration in the aerospace sector, aiming to study and shed some light on the human-centric aspects of collaboration and develop a framework in support of collaboration management. As collaborative relationships become increasingly important in addressing complex issues and fulfilling social responsibilities, understanding their intricacies is crucial in today's fast evolving world.

The human-centric approach of this study examines stakeholder interactions, behaviors, actions, and values within interorganizational collaboration projects. By analyzing case studies from the aerospace sector, this research seeks to also enhance the understanding of collaboration management and identify best practices for collaboration process improvements. We believe that the research findings contribute to a better understanding of collaboration processes in general, design thinking in collaboration, and underlying attributes and principles, while potentially serving as a foundation for developing comprehensive collaboration practices applicable across various industries and contexts.

We have presented an extensive critical literature analysis based on which we proposed a preliminary conceptual framework to guide first phases of the research analysis. The literature review highlighted the lack of understanding of day-to-day collaboration management and the challenges faced by stakeholders in inter-organizational relationships. Traditional managerial practices fall short in addressing these challenges, emphasizing the need for better understanding and models for collaboration projects. The preliminary conceptual framework integrates the collaboration process dimensions with a high-level project management process framework, and design thinking and change management concepts. The preliminary conceptual framework served as a themes-based framework for qualitative analysis, serving as a baseline tool for analyzing and exploring interorganizational R&D collaboration projects.

By employing a multidisciplinary approach and a preliminary conceptual framework, this study aimed to provide a comprehensive analysis of selected collaboration projects, delving into the day-to-day experiences within the "black box" of collaboration management at both micro and macro levels. This study, we believe, offers valuable insights into the factors and dimensions that impact

interorganizational collaboration projects. We have examined stakeholders' interactions, behaviors, relationships, and practices, shedding light on the human element of collaboration. Understanding these underlying motivations and actions is crucial for grasping the complexities of interorganizational collaboration.

We have chosen a relativist ontological stance and a constructionist epistemological perspective. Additionally, the pragmatist paradigm was adopted, which allowed for the use of diverse methods to better understand the subject and analyse the data through different perspectives. The study was also influenced by interpretivist and social constructivist perspectives, which focus on understanding the subjective reality of individuals and how they construct meaning in their world. Furthermore, deductive, inductive, and abductive approaches were employed to guide data collection, analysis, and interpretation in a multi-method analysis approach. The qualitative methodological approach was chosen to describe and interpret individuals' actions, views, and experiences, placing this study on the more descriptive, interpretive, and explanatory end of the qualitative research continuum.

We analysed the textual data codes from the selected cases studied, where key findings from the analysis revealed the presence of collaboration process dimensions throughout project phases and the iterative nature of change management, design thinking, and project management. The preliminary conceptual framework highlighted the importance of governance, administration, autonomy, mutuality, trust, and reciprocity in interorganizational collaboration. These components establish the foundation for effective collaboration, ensuring alignment on objectives and common understandings around processes and artefacts.

The analysis also revealed the significance of communication, planning and execution, acknowledgment and engagement, adaptability and flexibility, and relationship-building and teamwork in successful collaboration projects. Common themes between change management and design thinking included an iterative approach to problem-solving, emphasizing empathy, communication, and continuous improvement. The study's findings also suggested the importance of emotions, values, and attitudes such as empathy, politeness, hope, and apology.

The prominence of communication, stakeholder alignment, and iterative problem-solving in the codes confirmed the applicability of the preliminary conceptual framework for understanding

interorganizational collaboration projects. These insights, we hope, will contribute to the development of innovative solutions, effective change management, and project management frameworks within collaborative settings.

The deductive and inductive phase of the cases analysis was following by a second abductive phase which allowed us to propose a new conceptual framework for interorganizational collaboration, which also addresses gaps in the existing literature by incorporating key themes which were inspired from the analysis and which include the concept of intangible collaboration affordances, design thinking, higher-order thinking, entrepreneurship, and collaboration alertness, which is also another new term which we have coined. The objectives for this second phase of the analysis have also been met through the proposal of a comprehensive framework which integrate these concepts and provides valuable insights into the processes and practices of collaborative partnerships. Through this novel framework, we believe that we are responding to the challenges of interorganizational collaboration projects by proposing additional tools to stakeholders for understanding these collaborations. These tools, which may be potentially applicable in various contexts, include leveraging tangible and intangible affordances, adopting a human-centered problem-solving mindset, and fostering an entrepreneurial attitude within collaborative partnerships. We hope that the framework can help practitioners address the challenges of collaboration by providing guidance on key aspects presented in this study which can help address challenges related to collaborative relationships including communication, decision-making, and leadership. We also hope that it can serve as a tool for organizations to assess and improve their collaboration abilities, resources, and efforts.

Through the deductive/inductive phase of the study, the following are confirmed:

- The components of the collaboration process dimensions are present in the case studies through plans, actions, and behaviours manifested by participating stakeholders. The same also holds true for design thinking that is also present in the enactment of collaboration in the studied cases.
- The management framework is present and applicable for use in collaboration projects, although in an unstructured and iterative manner.

- Change management is clearly the backdrop of collaboration, it is present throughout the life cycle of the case studies and in immediate actions and tasks of participants.

The following are proposed from the abductive phase of this study:

- Design thinking is a collaboration dynamic capability present throughout the collaboration life cycle. It is a sensemaking capability intuitively present in collaboration and can be leveraged to manage and create opportunities within the project for individuals and across collaborating organizations.
- Tangible or intangible affordances augment the relationships and processes of collaboration and can be purposefully enacted and designed.
- Higher order thinking and learning are key capabilities necessary for collaboration and enable design thinking and affordances design.
- Alertness in collaborations is similar to alertness in entrepreneurship, where innovation and R&D collaboration is enabled by entrepreneurial mindsets and organizations. Learning is key to entrepreneurship, and alertness is influenced by the experiential learning of collaborations.
- Managing change is key throughout collaboration, where humans are at the centre of process and change dynamics.

The main theoretical contributions of this thesis include the integration of multiple themes and concepts within a unified framework for interorganizational collaboration based on detailed an extensive qualitative analysis of relevant cases. The novel framework provides a more holistic understanding of collaboration compared to the preliminary model based on existing models by addressing various dimensions that influence collaborative relationships.

Additionally, further elaborating the concept of "Intangible Collaboration Affordances" and the introduction of the term "Collaboration Alertness" represent a significant theoretical contribution to the literature on interorganizational collaboration. As proposed, collaboration affordances include both tangible and intangible element such as resources, trust, communication, empathy, and shared understanding which facilitate collaborative efforts among stakeholders. This concept extends traditional affordance literature into the intangibles of collaborative environments.

Collaboration alertness, on the other hand, encapsulates the entrepreneurial quality of being alert and responsive to changes within collaborative settings. This concept underlines the importance of adaptability, foresight, and proactive engagement in recognizing emerging opportunities within all the phases of the collaboration, and opportunities outside the traditional boundaries of a collaboration project. These concepts enrich the existing literature by offering new perspectives into the enactment of collaborations and highlighting how both the tangible and the intangibles of the collaboration environment play and important role in impacting these ventures. These new terms have been proposed as part of the conceptual framework to augment the understanding of collaborative projects and inspire the design of solutions to their wicked problems.

The limitations of the research include the potential for biases in the data collection and analysis process, as well as the possibility that the proposed framework may not be applicable across different collaborative contexts. Whereas the methodological limitations may also be related to the reliance on a data source from the same organization. Advise to future researchers in this area would be to consider incorporating additional data sources from various organizations, as well as to incorporate interviews in relation to the case studied to provide a more robust understanding of the latent content of artefacts.

A new researcher building on this work could explore the applicability of the proposed framework in different industries or organizational contexts, investigating the impact of cultural, social, legal, regulatory, or economic factors on interorganizational collaboration, or more specifically examining the role of technology in facilitating collaboration leveraging the proposed novel framework. This study has also inspired a proposal to future researchers to explore the proposed novel framework from this study in relation to the concept of adhocracy, which was popularized by Toffler (1970) as “an organization that is being shaped on the fly according to needs/purposes as they occur” (Travica, 1999, p. 311) and further advanced by Mintzberg as “possess[ing] to the highest degree the capability of problem-solving and creating innovations”. Today’s innovative approaches to management in organizations focused on creativity and talented employees is resonated by Mintzberg (1993) on adhocracy where it is described as the future of structure of organization, whereas bureaucracy and divisionalized forms are those of the past. Furthermore, we also propose the study of power dynamics in collaboration and how they affect relationships and outcomes. Cropper et al. (2011) argue for a perspective on power that recognizes divergent

interests, asymmetrical power relations, and the presence of marginalized groups in IOR. Of specific interest would be studying the ways power influences collaboration, including the role of discourse in creating a collaboration collective identity, and generating emotions that motivate participation in collaborations which are always in "the act of becoming (Tsoukas and Chia 2002) rather than as a discrete entity" (p. 380).

As "interorganizational relationships are difficult to manage" (Barringer et al., 2000, 368), and as observed in this study, collaboration management is a craft that requires reflection on the context, the project, the resources, and expected outcomes by reflective practitioners, who are the day-to-day designers, creators, and managers. We have seen from the cases that practitioners try to find optimal outcomes for wicked collaboration problems, they are the intrapreneurs in these projects, they intuitively create collaboration affordances, and they learn, think, and act beyond prescribed processes. Practitioners bring their challenges into a higher-order space while being alert to opportunities, creative, and aiming for desired outcomes. Human-centred collaboration management is enabled by these practitioners through affordances enacted and exhibited through trust, empathy, rhetoric, emotion, kindness, and change management. This enabled human-centric view has implications beyond this study in the aerospace sector, where several research themes found in this study can be further explored to intentionally and purposely integrated into best practices while reflecting in the action of collaboration. Reflecting in practice is an art as described by Schön (1983): "It is this entire process of reflection-in-action which is central to the 'art' by which practitioners sometimes deal well with situations of uncertainty, instability, uniqueness, and value conflict" (p. 50).

This study further emphasizes the usefulness of insights in practice; recommends users to reflect on their context and devise the optimal approach to collaborative relationship management.

> Research thrust should be a focus on development of the use of these insights in a "handles for reflective practice" mode (Huxham and Beech 2003)…The expectation would be that users would then invoke their own expertise and judgement to craft a course of action (Bardach 1998). (Cropper et al., 2011, p. 409)

We hope that stakeholders of collaborative relationship managers become more of crafters and less as technicians, where collaboration is an art that is not only about rules and theories (Schön, 1983).

We also hope that this study contributes to the creation of Cropper et al.'s (2011) IOR Italian garden that benefits from communities of researchers and practitioners from different disciplines to grow the field, where "a field of IOR would be rather more like an Italian garden, elegantly designed with its variety strictly regulated, than a jungle" (p. 733).

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APPENDIX A –GLOBAL CLASSIFICATION AND CONTEXTUALIZING OF COLLABORATIONS

Table A.1 Global classification and contextualizing of collaborations (in green scopes the selected area for this study)

	(Al-Laham et al., 2010) , (Huang & Yu, 2011)						
Portfolio Type (knowledge, Technology)	Explorative (R&D)	Exploitation (commercialization), R&D and Non-R&D					
	(Perkmann & Walsh, 2009)						
Technology Maturity Typology	Basic Research	Applied Research					
	(Fitjar & Rodríguez-Pose, 2013)						
Technology/Field	Science, Technology and Innovation (STI)	Doing, Using and Interacting (DUI)					
	(Perkmann & Walsh, 2009)						
Technology/Field	Sciences of the artificial	Other disciplines concerned with non-technological objects of analysis					
Collaboration Type	(Hagedoorn, Link, & Vonortas, 2000), (Howells, Ramlogan, & Cheng, 2012), (Howells, Ramlogan, & Cheng, 2012), (Hagedoorn, 2002)						
	Formal	Informal Interaction					
	(Anderson, 1995)						
Collaboration mode	Quasi-vertical	Quasi-Horizontal					
	(Suh & Kim, 2012)						
Collaborative Relationship Type	customer-provider	strategic alliance	inter-firm alliance				
	(Huang & Yu, 2011)						
Collaborative Relationship Type	Competitive	Non-Competitive					
Interorganizational Relation	Technology acquisition or licensing as customer-provider	R&D Collaboration as strategic alliance	Networking as inter-firm alliance	R&D partnerships	equity joint ventures	collaborative manufacturing	
Interorganizational Relation	complex co-marketing arrangements	Co-authorship of Scientific publications	international collaborative ventures	global strategic partnerships	competitive alliances	Consortia	
Organizations (Combinations of any for collaboration)	University	Firms	Strategic Industry Initiatives	Non-Profit (Mission and Cash brokers)	NGOs	Government Programs and Policies	
Organizations (Combinations of any for	Consortiums	Research Platforms	Sectoral Groups, Associations	Research Lab	Poles/Centers of excellence	Institutes	
			Environment and Ecosystem				
Presence of clusters	Yes	Agglomeration	Clustering				
Sector	Aerospace	Automotive					
Sectoral Market	High Competition	Low Competition	Market Uncertainty				
	(Bodas Freitas, Marques, & Silva, 2013)						
Sectoral Technology	Emergent	Mature	High Intensity	Low Intensity			
Sector Patent Propensity	High	Low					
	(Fitjar & Rodríguez-Pose, 2013), (Owen-Smith & Powell, 2004), (Bodas Freitas, Marques, & Silva, 2013), (Anderson, 1995)						
Geographic Proximity	Non-regional	Regional	Foreign	multinational	Local	National	International
			Motives				
Purpose of the Collaboration	Joint research alliances	Licensing agreements	Sharing Knowledge and reinforcing absorption	Develop New Products	New Processes	New Services	
Purpose of the Collaboration	Strategic Purposes	Social Purposes	R&D partnerships	Licensing Deals	Commercialization and marketing arrangements	Investment ties	
Purpose of the Collaboration	"insider presence"	Creating new Intellectual Capital	Regional Benefits Programs	Design by supplier	"it was the thing to do."	know how trading	
Purpose of the Collaboration	Risk sharing	access to new markets	access to new technology and Knowledge, and assets	speeding NPD to market	Pooling complementary skills	Abundance of external ideas	
			Characteristics of Collaborating Entities				
Age of the entity (Level of Collaboration	Learning	Experienced	Culture of Collaboration				
Risk Management Culture (Risk Aversion)	High	Medium	Low				
Intreaction Modes	Scienct, Technology and Innovation	Doing, Using, Interaction (DUI)					
Forms of interaction	Consulting	Materials	Knowledge Providers				
	(Al-Laham, Amburgey, & Baden-Fuller, 2010), (Hagedoorn, Link, & Vonortas, 2000)						
Type of Entity	Public	Private	Non-profit				
Field of Activities	Manufacturing	Services	High Tech				
Size of Entity	Small	Medium	Large				
Competitive Advantage	HR	Technology	Know how (Tacit, codified)				
Relationships	Arm's length	Non Arm's Length	Extramural, Interfirm	Intramural, intrafirm			

APPENDIX B – CASE 1 - CODER 1 ORIGINAL CODES

Table B.1 Case 1 - Coder 1 original codes

CODE THEME	NUMBER OF CODING REFERENCES	CODE THEME	NUMBER OF CODING REFERENCES	CODE THEME	NUMBER OF CODING REFERENCES	CODE THEME	NUMBER OF CODING REFERENCES	CODE THEME	NUMBER OF CODING REFERENCES
Create sense of urgency	51	Approval of proposed idea	4	Internal evaluation of convenience partner proposal	2	Dropping one of the collaborators, the convenience partner	1	Perception that partners made changes to artefact without informing us	1
acknowledging receipt of information and confirming action to be taken	49	Communicate operating constraints	4	Internal facilitator communicating internally the level of effort required to manage his portfolio	2	empower others to act on the vision and plan	1	Project hierarchy leader not available, can you reschedule	1
Personal Greetings	45	Considering new collaboration set-up	4	Internal facilitator coordinating, facilitating stakeholders meeting, call, logistics	2	Execution	1	Project leader coordinating parallel efforts	1
EMPATHIZE	37	Defining Project Scope Given fluid partnerships discussions	4	Internal project leader demonstrating business savvy and value for overall organization	2	External facilitator escalating indirectly	1	Project Plan using an artefact, referred to as Design the project plan	1
Affirmative tone for a forward-looking plan	34	Delegating meeting, call	4	Internally clarifying proposal scope	2	External project leader communicating bad news on behalf all of the partners	1	Projecting and planning outcome if successful	1
Invitation to meet, call and discuss project plan	30	Demonstrating interest in considering others interests	4	Invitation to professional event, sign of goodwill	2	External project leader communicating his position to lead industrial partner; He, she support our position vs. other partner	1	Promoting internal stakeholders to take action and not wait	1
IDEATE	27	Empowering and providing guidance, giving clear directions	4	I've supported you; it is your turn now to support me, this is internal	2	External project leader communicating his position to lead industrial partner; He will leave the negotiations to the specialized resources, they know their position	1	Propose an alternative solution to standard process for short term wins	1

Table B.1 Case 1 - Coder 1 original codes (cont'd)

Planning	26	Ensuring coordination of efforts of partner organization	4	Keep us, me informed	2	Facilitating organization contacting the project hierarchy team	1	Proposing a communication language and idea which does not offend the partner	1
communicating appreciating	26	Exchanging information on project initiation logistics	4	Lack of greetings under pressure of time	2	facilitating organization requesting call to discuss project	1	Proposing a project plan after many iterations	1
Initiation and Planning	26	Highlighting the need to consult partner, need information from partner	4	Lack of internal coordination, communication at one of the partners	2	Facilitating organization seeking funding. Budget information clarification	1	Proposing alternative contact point to move project forward	1
PROTOTYPE	23	holistic approach being further developed by partner	4	Lead industrial partner communicate their commitment to continue supporting already engaged resources on the project	2	facilitator organization making sure that all parties are informed, copied on project status	1	Proposing different options to come up with an agreement on IP	1
acknowledging receipt of information	23	Internal discussions on our position on IP, communicating through an artefact, e-mail and documents	4	Let's not wait for anyone, I want to know now so that we can take actions	2	Facilitator organization providing new useful information	1	Providing artefact to partner organization, showing them that conditions which you don't accept now, were accepted before by your organization	1
Informing, demonstrating engagement	22	Internal project leader working out project logistics to ensure closure on new proposal	4	Negotiated non-standard practice proposed to facilitate moving the collaboration project forward	2	facilitator organization providing standard artefact; project decision	1	Providing artefact to use for guidance	1
Seeking Empath from other partner	22	Inviting others to join in on the project plan and create allies	4	New proposal for a short-term win	2	Feeling vindicated	1	Providing direction without answering a clarification question	1
Promoting exchange of a standard artefact	21	Making the partners feel that the proposal is in their best interest	4	One of the partners showing leadership and providing guidance requested by another partner from facilitating organization	2	Following up on a new collaboration. starting from the same e-mail thread as current collaboration discussions	1	Providing precision on project plan timeframe to project team	1

Table B.1 Case 1 - Coder 1 original codes (cont'd)

Keeping key stakeholders informed of important information	19	Offering support and at the same time cautioning to operate within constraints	4	Our own interpretation of the offer, but's let's call to confirm, however, do you agree in principle	2	follow-up by partner with keen interest in closing a sale, deal part of the collaboration	1	questioning indirectly the value of the convenience partner	1
Communicate hope of overcoming obstacles in timeframe	16	Offering support during tough situations	4	Partner 1 discussing with Partner 2 that partner 3 wants to collaborate for other reasons than the project itself, which seems to be ok for partners	2	Grabbing attention and highlighting urgency	1	Questioning the strategy related to funding, authorize spend based on available budget or authorize budget based on received scope estimates	1
Seeking approval of proposed ideas	15	Propose an alternative solution	4	Partner accepting politely bad news and communicating will to continue relationship	2	Highlighting a challenging task	1	Recognizing the partner's interest in the collaboration	1
Communicating the will to meet, provide specific timeframe	14	Proposing face to face meeting	4	Partner communicating an official artefact to highlight their offer	2	Highlighting and communicating common internal agreement	1	Referencing teleconference, where partners had different understanding of agreements, given that they were not referencing the same baseline for the discussions	1
Providing an artefact to use to exchange project plans	14	Proposing scope which includes a holistic approach to the collaboration with partner on several projects	4	Partner communicating interest to collaborate	2	Highlighting importance of a marquee collaborator	1	Request that boss efforts coordinate with team	1
Providing guidance and suggesting direction	14	Providing information to specialized resources	4	Partner evaluating offer	2	Highlighting the need to inform other negotiating parties with our clear position on what we cannot accept	1	Requesting an understanding of what is in it for the third partner, their motivation	1
Tempting the collaborator with potential rewards	14	Providing new useful information to facilitate and show interest	4	Partner organization want to negotiate with right specialized expertise in other organizations	2	I made the network aware of the situation	1	requesting artefact from specialized resourced	1

Table B.1 Case 1 - Coder 1 original codes (cont'd)

Communicating bad, disengaging news	13	Re-Engaging with partner	4	Partner requesting guidance from facilitator organization	2	I'll keep you informed and run the recommendations by you once I have more info	1	requesting artefact to help in decision making and way forward	1
Partner communicating appreciating	13	Request Project Funding. Budget Artefact	4	Partner using official form to emphasize the proposal, this is a sales proposal part of collaboration project holistic approach	2	Indirect apology for the delay	1	requesting clarification on obligations from PM	1
Proposing alternative ideas based on new information	13	Requesting artefact to use for guidance	4	Plan the creation of an alliance	2	Indirectly communicating frustration with facilitating organization process	1	Requesting clarifications on partners position during negotiations	1
Initiation	12	Requesting artefacts from partner to exchange project plans	4	Portfolio Planning	2	Indirectly communicating frustration with process	1	Requesting confirmation if the proposed approach is understood by the receiving party	1
TEST	12	Requesting clarification on procedure and process	4	Potential partner seeking internal approval	2	Indirectly communicating that decisions are not solely in the interlocuter's hands	1	Requesting confirmation of partner engagement per written plan	1
Empathy with partners and respect for their efforts	12	Seeking to build value, justify, having a convenience partner onboard	4	Project key stakeholder Reasserting leadership role	2	Indirectly trying to temper moods and clarify negotiation stance, we want to work with you again	1	Requesting information to move with project funds.	1
acknowledging good news, showing engagement	11	Trying to understand our negotiating position internally	4	Propose an alternative solution to standard process	2	Industrial partner with, this is our final offer type , but let's put that our to our partners in nicer words	1	Requesting precision on plan timeframe	1
Clarifying proposal scope	11	What is in this new proposal for us	4	Provide Project Funding artefact	2	Informing external facilitator on other partners interests to collaborate	1	Seeking approval of final artefact from a specialized resource at industrial partner	1

Table B.1 Case 1 - Coder 1 original codes (cont'd)

Communicate Limits and Constraints	11	acknowledging receipt of information and providing guidance through clarifications request	3	Providing guidance on meeting logistics	2	informing external facilitator that we have selected a new organization and new project set-up	1	Seeking understanding of the partners proposal	1
Communicate the vision	11	acknowledging value of the internal win-win proposal	3	Providing precision on project plan timeframe	2	Institutionalize new approaches and evangelize on how new behaviours lead to corporate success	1	Set and communicate project objectives	1
Establish a sense of urgency	11	Communicating artefact with comments on new project set-up	3	Questioning the urgency and value of the short term win	2	Internal ally providing advice based on history and experience	1	Setting facilitator partner expectations and providing options	1
highlighting an achievement	11	Communicating frustration with process	3	Recognition of efforts and expertise	2	Internal ally providing advice on value of internal proposal part of the holistic approach	1	Setting partners expectations and providing options	1
Ideate with constraints in mind	11	Communicating new coordination information	3	Recognition of the partner's expertise	2	Internal clarification lacking complete information required for decision making	1	Sharing internally a non-standard practice recommended by facilitating partner	1
Internal negotiations in support of funding a key component of the collaboration, not officially part of the collaboration set-up, holistic approach	11	Considering an alternative project set-up to move forward	3	Relegating decision making to experts in field	2	internal deliberation on the value of continuing the collaboration in its current form	1	SME taking leadership role, specific interest in making holistic approach work	1
Demonstrating flexibility for a win-wing scope	10	Create a vision	3	Requesting action to be taken by specialized resource in other partners organization	2	Internal discord on commitment to partner A or partner B	1	SME wants to understand their role	1
Invitation to Brainstorm solutions	10	facilitator organization providing standard guidelines	3	Requesting guidance on meeting logistics	2	Internal discussions on the value of the contribution to the collaboration project.	1	Solicit support	1
Invitation to workout project artefacts and logistics	10	Facilitator organization setting expectations	3	Requesting specific information on expected deliverables	2	Internal facilitator setting expectations with partners	1	Soliciting a new partner in the background	1
Offering a useful artefact, info, to help with this and future projects	10	Facilitator providing many options to set-up timely discussions	3	Requesting that partners seek internal approvals on new proposal	2	Internal facilitator seeking information on internal practices and procedures	1	Specialized resource delegating negotiations to boss during vacation	1

Table B.1 Case 1 - Coder 1 original codes (cont'd)

Celebrating good news	9	Following up but really saying that we need to close	3	Seeking clarification on new proposal, given the different internal interpretation of the offer.	2	Internal Not my action, it is your action	1	specialized resource providing information on negotiation process	1
Requesting action to be taken by specialized resource	9	Highlighting differences and suggesting that perhaps there is a common ground	3	Seeking internal support	2	Internal project leader communicating their frustration with the process	1	Suggesting influencing partner to join in for maximizing project outcome	1
Seeking empathy	9	ideate	3	Seeking written approval from the boss	2	Internal project leader intercepting invitation to discuss project with facilitating organization; Talk to me not the hierarchy of the project	1	Suggesting making partnership decisions under time pressure	1
Seeking internal approval	9	Identifying problems and seeking advise	3	Setting internal negotiation expectations;	2	Internal project leader working out project logistics to ensure closure on deal with original convenience partner	1	Suggesting modifications to standard artefacts	1
Brain storming solution with boss before proposing	8	Internal communicating disagreement with artefact proposed by partners	3	Setting meeting expectations	2	Internal SMEs suggesting to soften our position on IP and providing suggestions	1	Suggesting new consortium set-up for the rejected project	1
Communicating artefacts to facilitate exchange of information	8	internal discussions on the received artefact	3	specialized resource communicating agreement with idea	2	Internally expressing frustration with partners proposal	1	Tasks	1
Communicating that the efforts are not significant to tempt adoption of proposal	8	Invitation to meet, call and discuss project plan, artefact, agreement	3	Stakeholder confirming agreement with proposal	2	Introducing a new internal facilitator	1	The boss reasserting their authority	1
Highlighting Challenges; Doubting Current Idea Proposal	8	invitation to other parties to give feedback on message	3	Suggesting diverging collaboration interests co-habitate within the same project	2	Invitation to workout internal project artefacts and logistics	1	the core project is rejected, do we continue with the side project part of the holistic approach	1
Mobilisation	8	Lack of greetings during the last miles	3	Tempting internal collaborator with potential rewards	2	IP position influenced internally by internal SMEs suggestions to soften position	1	Time is of the essence, no response is limiting our options	1
Plan for and create short-term wins	8	Let's keep focus on our objectives	3	What is in this new proposal for them	2	It is in the hand of the specialized resource	1	Tone is, we're done, let's move on	1
acknowledging receipt of artefact and informing of process	7	Mobilising and creating wins and synergies with the organization	3	4-Process-TimeLine	1	I've already confirmed, but here again for everyone to know	1	Using artefact as a tool to underline urgency of timeframe	1

Table B.1 Case 1 - Coder 1 original codes (cont'd)

Apologies for delays in communications	7	Not aware of standard artefacts	3	6-Lessons Learned	1	Keeping the same project set-up	1	Using artefact completion as a tool to underline urgency of timeframe	1
Communicating new information to solicit attention and action	7	offering support	3	A meeting is not required, talk to each other directly if needed	1	Knowledge	1	We now understand	1
Direction	7	Partner demonstrating re-engagement	3	Acknowledging error in leaving out the partner and communicating misleading information	1	Lack of greetings after communicating bad news	1	We will do our part, indirectly that others should do too	1
Expressing engagement and willing to collaborate	7	Partner offer perceived negatively by the other partner, receiving partner disengaged given offer	3	acknowledging receipt of artefact	1	Lack of greetings after requesting clarification	1	We would like to know if have the same understanding	1
Facilitating organization providing guidance and engaging partners	7	Partner providing many options to set-up timely discussions	3	Acknowledging receiving guidance and direction from facilitating organization	1	Less formal response at this stage and under pressure	1	We're done on our side what about you	1
Highlighting the need for internal approval, not only my decision	7	Partner seeking funding. Budget information clarification	3	Acknowledging that partners are not familiar with consortium set-up logistics, and not offering to explain	1	Let's discuss internally before we talk to the partners and prioritize our short term win	1	Yet another iteration of the project set-up following review by specialized resource	1
Internal facilitator seeking information and coordinating stakeholders	7	Partner still engaged even after bad news	3	Adding to internal proposal of project plan and confirming agreement with overall plan	1	Let's not celebrate yet	1	Design Thinking Frame	0
Offering support and extending invitation to contact stakeholder	7	Proposing an alternative lower cost idea for the perceived high cost idea	3	Another partner wants in on collaboration project, official proposal submitted, brain storming non-standard practice to have them join the project	1	Let's prioritize, what we must deliver now, and what we can deliver later	1	Change Management	0
Requesting affirmation of engagement	7	Putting the person with limits on the spot to have them commit to an agreed timeframe	3	Another partner wants in on collaboration project, official proposal submitted, they have unique and interesting expertise	1	Major partner make final choice on consortium funding mechanism	1	Execution	0
Requesting information and affirming engagement	7	Reminder for actions to be taken by internal facilitator	3	Another partner sharing true reason why a third partner is suggesting a new idea proposal	1	Message to partners, it was difficult, run through overcome obstacles, we made it happen together.	1	Observable Processes	0
acknowledging bad news, showing the engagement and the will to support	6	Requesting artefact from partner even after bad and disengaging news	3	Another partner wants in, however not willing to commit the resources	1	Negotiating outside of standard practices internally to find a solution to adopt a holistic approach collaboration	1	Monitor.Control	0

Table B.1 Case 1 - Coder 1 original codes (cont'd)

acknowledging receipt of information and providing guidance	6	Requesting guidance on artefact from specialized stakeholders in their organization	3	Another partner wants in, wants to combine two projects into one	1	New holistic proposal meeting partner expectation provided through an official artefact	1	Closure	0
Clarifying and communicating practice	6	Requesting understand and flexibility for a win-wing scope	3	apologies for error	1	New Partner creating a sense of urgency	1	Organizational	0
Communicating artefact with parties inputs and comments	6	Seeking advice on proposed solution and challenge, in particular IP	3	apologies for misunderstanding message	1	New Partner suggesting new consortium set-up	1	Actors	0
Empower others to act on the vision, change unhelpful structures and experiment	6	Specialized resource communicating disagreement with proposal	3	Are you seeking an approval or not	1	New Partner suggesting one to one discussions with other partners and excluding others	1	Create project structure	0
Expressing gratitude	6	Taking concrete actions	3	Asking partner to call, facilitating by making contact information readily available	1	New Partner suggesting that they are ready, and that others are not	1	Experimentation	0
Form a powerful guiding coalition, assembling people who can work well together	6	Trying to understand internally the partner offer without the partner's implication	3	attempting to understand the collaboration motives of the partner	1	No conflict of interest assurance message	1	Goals	0
It is a person communicating	6	Using formal greetings after tough negotiations	3	Being internally aware of the value of what we bring to the table during negotiations	1	Non-standard artefact agreed upon based on expected mutual trust	1	Institutional acknowledgment	0
partner following up on artefact status	6	Acknowledging delegation duty	2	Boss acknowledging the efforts should be coordinates.	1	Not celebrating after good engaging news	1	Organizations	0
Promoting exchange of an already proven artefact to facilitate negotiations	6	acknowledging receipt of information, and indirect agreement on way forward	2	Boss providing the written artefact required for internal approval and back-up of employee decision	1	Not ready to commit yet	1		
Requesting clarification on procedure and scope	6	Adapting artefact to new project set-up	2	Bringing background discussions with new partner to the foreground	1	officially communicating verbal decision through documenting an internal conversation	1		
Requesting clarifications on idea in the proposal	6	Answering request for scope clarification	2	Bringing everyone onto the same page	1	One of the partners aware of back-up plan if negotiations fail	1		
requesting guidance on process and practice from internal organization	6	apologies for making decision without partners buy-in	2	Call him to better understand the offer in the e-mail, I don't have the same understanding	1	Others have agreed, what about you	1		

Table B.1 Case 1 - Coder 1 original codes (cont'd)

sending an ping reminder	6	apologies for outcome	2	Challenging the motivation of the convenience partner	1	Partner communicating the interest of another partner to collaborate	1		
Working outside standard practices to promote a win-win internal and to partner organization of the holistic collaboration solution	6	Communicating a summary artefact to facilitate understanding of IP set-up	2	Clarifying acceptable enabling collaboration conditions of partner	1	Partner designing the collaboration to meet consortium requirements without consulting with other partners	1		
acknowledging receipt of information and requesting clarifications	5	Communicating Final project plan and proposal through an official artefact	2	Clarifying the intention of the message in the e-mail	1	Partner discussing internally benefits of potential new collaborator	1		
Communicating artefact which reflects last discussions on IP negotiations	5	communicating other business in project collaboration set-up email	2	Commanding language for way forward	1	Partner discussing internally other collaboration options and not sharing with rest	1		
Communicating artefact with new project set-up	5	Communicating the will to discuss and requesting timeframe suggestions	2	Commanding language for way forward under pressure	1	Partner discussing internally that they are not fully committed to collaborating with one of the other partners	1		
Communicating Funding. Budget Information on Project	5	Communicating understanding of discussions for confirmation	2	Communicate that cannot support, and not offering alternatives	1	partner following up on artefact status which is important for requesting partner but not for them	1		
Communicating good, engaging news	5	Consolidate improvements and produce still more change. Promote and reward people. Energize the process of change	2	Communicating artefact summarizing our understanding of verbal discussions	1	Partner providing guidance	1		
Communicating project plan and proposal through an official artefact	5	coordinating internal logistics to ensure holistic plan is executed in parallel to collaboration project planning	2	Communicating hope of coming to an agreement, no immediate timeframe	1	Partner recognizing relevance of artefact through the information it contained	1		
Exploring different options to come up with an agreement on IP	5	Delegating to the specialized resources during tough negotiations	2	Communicating internally the it is taking long for the partners to get back to us after tough round of negotiations	1	Partner reiterating his confidence in his resources after verbal discussion with partners got emotional between the parties	1		

Table B.1 Case 1 - Coder 1 original codes (cont'd)

My part, your part	5	Demonstrating understanding of others actions	2	Communicating new information; Now you know, so take action if you have to; not my problem	1	Partner requesting guidance	1		
Proactive follow-up on project	5	Demonstrating understanding of others self interests	2	Communicating new proposal to a different consortium	1	Partner requesting guidance on artefact from specialized stakeholders in their organization	1		
Proactive follow-up on project of interest by technical lead	5	External facilitator seeking information on partner engagement	2	Communicating non-standard artefact for signature	1	Partner specialized resource boss communicating agreement with final version of agreement to all partners	1		
providing an artefact to specialized resource	5	External project Leader summarizing several long artefacts into a single succinct artefact to facilitate decision making	2	Communicating partner position using language which was meant for internal discussion only	1	Partner specialized resource communicating bad news, blaming industrial partner, not informing industrial partner	1		
Questioning the value of the collaboration ROI	5	Facilitating organization providing guidance and tools outside of standard practice to facilitate collaboration set-up	2	Communicating preference in support of same strategy discussed with partners for months	1	Partner still engaged even after bad news	1		
Referencing previous efforts	5	facilitator organization requesting additional information	2	Communicating project scope to hierarchy	1	'Partner still engaged even after bad news	1		
Requesting clarification on the value, cost of the proposal	5	Highlighting a challenging task for the partners	2	Communicating standard practices and standard conditions	1	Partner suggesting solution without other partner given disengaging offer, lack of commitment.	1		
Requesting specialized support within organization	5	Highlighting a commitment through a relationship of trust	2	Confusion too many options, suggestions by stakeholders	1	Partner trying to influence the project to given them an advantage	1		
Seeking information on true value of a proposed Deal. Highlighting added value.	5	Highlighting diverging partners interests	2	Considering an alternative project set-up to keep the convenience partner for future project needs	1	Partner upset that they have been excluded from discussions	1		
Seeking internal approval of artefact to be communicated to partners	5	Highlighting key issues to discuss to come to an agreement, including IP	2	Convenience partner has limits and constraints may not be able to meet standard conditions	1	Partner who is not happy, is not communicating directly with industrial partner	1		

Table B.1 Case 1 - Coder 1 original codes (cont'd and end)

specialized resource providing information on procedures	5	Highlighting partners' duties and responsibilities	2	Convenience partnership	1	Partners not full aware of collaboration set-up logistics and benefits to the different partners	1		
Structuring	5	Highlighting value of holistic projects collaboration approach for internal support building	2	Creating a non-standard artefact to get the project going, get engagement	1	Partners specialized resource boss taking lead to move negotiations forward and communicating directly with boss on industry side	1		
Summarizing several long artefacts into a single succinct artefact to facilitate decision making	5	Highly emotional best wishes	2	Decision not to take risks based on doubt that an agreement can be reached timely	1	Person facilitating giving the recommended answer to be returned officially back to him for official records	1		
DEFINE	4	holistic project approach being promoted internally and value being demonstrated	2	define	1	Playing down the differences in scope between partners to positively impact the collaboration structure	1		
Acknowledging bad news, showing disengagement	4	Indirectly reaffirming that all projects are coordinated through a central entity	2	Demonstrating engagement based on internal understanding of offer	1	PM indirectly seeking approval to proceed from SME facilitator	1		
Appropriation	4	informing new internal facilitator	2	Discouraging alternative, current solution	1	PM Not fully informed on procedures and regulations related to the collaboration set-up	1		

APPENDIX C – CASE 1 - CODER 2 ORIGINAL CODES

Table C.1 Case 1 - Coder 2 original codes

ORIGINAL CODES	NUMBER OF CODING REFERENCES	ORIGINAL CODES	NUMBER OF CODING REFERENCES	ORIGINAL CODES	NUMBER OF CODING REFERENCES
Communicate-Inform	308	Monitoring-Controlling	25	Set conditions	5
Executing	285	Emphasize importance	24	Express doubts	5
Planning	247	Make assumptions	23	Suggest potential actions	4
Express appreciation	234	Express desire to keep in touch - future exchanges	23	Answer and remind-request action to be taken	4
Request feedback-answer	179	Discover	23	Propose support in exchange of collaboration	3
Define-communicate next actions	136	Propose meeting timeframe	22	Create project structure	3
Observe	132	Express disappointment-dissatisfaction	22	Try to convince potential partners to collaborate	3
Initiate-accept communication-discussions	105	Iterate	21	Confirm background action taken	3
Ideate	103	Give answer and request feedback to brainstorm and create teamwork to act on the vision	21	Leverage stories to discover insights	3
Emphasize timeline	101	Agree with proposed actions-ideas-suggestions	20	Express humbleness	3
Confirm-acknowledge information received	93	Confirm-clarify doubts-uncertainty	20	Express surprise	3
Prototype	91	Apologize	19	Consolidate answers and communicate them to the stakeholders	2
Communicate the vision	91	Express excuses	19	Send reminder and request action to be taken	2
Enable other people to action	89	Confirm and commit to follow-up	17	Retract and let-suggest other people continue the work	2
Communicate-request actions to be taken	85	Congratulate for the work done	17	Commit to verify availability for meeting	2
Set expectations	80	Do follow-up	17	Propose additional meeting	2
Express (best) wishes	79	Give credit for the work done	16	Do not accept meeting, but propose new timeframe	2
Give answer-information to enable other people to act on the vision	75	Emphasize understanding	16	Emphasize risk	2
Emphasize expectations	69	Request information to be able to act-plan (better)	16	Acknowledge and agree with information received	2
Express hope	63	Make constructive suggestions	16	Confirm background action taken in the past which brought (will bring) to a result	2
Express commitment	62	Giving polite indication for action to be taken (hierarchical request)	15	Emphasize confidentiality	2
Empathize	55	Request-emphasize importance of getting an answer	14	Try to negotiate, meet in the middle	2
Initiatiating Discussions	54	Set time constraints	14	Express flexibility in timeframe for meeting	2
Commit to take action	51	Request confirmation	14	Emphasize importance of the actions taken	2
Mobilising and creating wins and synergies with the organization	51	Request confirmation to be able to act further on the vision	14	Seeking external support	2
Suggest	50	Ask for actions to be taken	13	Offer partial support, negotiate participation-support	1
Express satisfaction	50	Frame and reframe	13	Propose training timeframe	1

Table C.1 Case 1 - Coder 2 original codes (cont'd and end)

Seeking internal support	49	Communicate-confirm decision taken	12	Confirm someone else's decision-action-suggestion	1
Send clarifications	49	Emphasize necessity of getting an answer	12	Accept meeting and ask to be called	1
Propose additional support	48	Express uncertainty	11	Disagree with proposed actions-ideas-suggestions	1
Giving heads-up	47	Give information and request opinions	11	Acknowledge but disagree with information received	1
Communicate information to enable other people to act	46	Initiate brainstorming	11	Plan for sarcastic revenge	1
Decide	45	Give positive feedback	10	Give information and request financial support	1
Request clarifications	42	Express satisfaction and congratulate for team and project success	10	Infirm participation but suggest other participants	1
Create working framework	33	Communicate conclusions of discussions	9	Propose help but ask for support in return (help me to help you)	1
Negotiation strategy	33	Answer on behalf of someone else, to advance the vision	9	Confirm partial availability (not available all the duration)	1
Communicate availability	32	Closing	9	Commit to consult other people before answering	1
Give information and plan for further communication	31	Give information and formally request decision-answer	9	Disagree with proposed actions-suggestions and counter propose	1
Request information to be able to act further on the vision	31	Justify request of information	8	Send document (prototype) for signature	1
Request (additional) information	30	Assume responsibility	8	Suggest lessons learned	1
Confirm taking action as required	29	Express excitement	7	Communicating meeting results	1
Acknowledge efforts done	28	Send document (prototype) to enable others to act on the vision	6	Suggest-express need of being less enthusiastic for the moment	1
Delegate	27	Rephrase to clarify understanding	6	Send final document for review	1
Send reminder	26	Send information requested	6	Request additional information for internal purposes (backup)	1
Validate your idea	26	Initiate other people's involvement	6	Acknowledge learning new things	1
Confirm meeting participation	26	Give heads-up and commit to follow-up	6	Request someone to act on one's behalf	1
Communicate information as a reminder and enabler for taking action	26	Use other event (excuse) to send reminder	6	Give bad news, apologize and explain	1
Express interest	26	Justify answer given, to emphasize credibility	5	Accept proposal, but request changes	1

APPENDIX D – ALL CASES –ORIGINAL CODES (EXCERPTS ONLY)

Table D.1 All cases –original codes; excerpts only

Qualitative textual codes:	**Qualitative textual codes:**	**Qualitative textual codes:**	**Qualitative textual codes:**	**Qualitative textual codes:**	**Qualitative textual codes:**
Requesting support and advice from partner on the next steps	Communicate-Inform	Confirming understanding	Planning project resources	Setting up internal project logistics to facilitate access to resources	New resource communicating plan forward
Realizing	Executing	Acknowledging receipt of information	Requesting support and advice from expert	specialized resource providing information on negotiation process	Informal sharing of progress on negotiations
Partners specialized resource boss taking lead to move negotiations forward and communicating directly with boss on industry side	Planning	acknowledging receipt of information and providing guidance	Potential partner seeking internal approval	Setting up meeting expectations	New successor
Realizing potential benefit of involving a third partner	Express appreciation	Communicating artefact with parties inputs and comments	Partner communicating an official artefact to highlight their offer	The more parties the more agendas that we have to accommodate	Informally exchanging information to create good will
Respect the track record of stakeholders	Request feedback-answer	Clarifying and communicating practice	Providing precision on project plan timeframe to	This is what we can do	No excuse, here is the lacking artefact
Partner trying to influence the project to given them an advantage	Define-communicate next actions	acknowledging bad news, showing the engagement and the will to support	Not suggesting alternatives to impress	Specifying clarification request by example	Information which may be helpful for our collaboration
Responding to request	Observe	Set conditions	One of the partners showing leadership and providing guidance requested by another partner from facilitating organization	Sharing good news	Exchanging artefact to facilitate understanding of scope
Reassuring internal stakeholders	Set expectations	Strengthening relationship through adjacent collaboration	Seeking approval of artefact	Propose help but ask for support in return (help me to help you)	Informed evaluation of efforts

Table D.1 All cases –original codes; excerpts only (cont'd)

Propose an alternative solution to standard process for short term wins	ideate	Justify answer given, to emphasize credibility	Providing status	Time is of the essence; no response is limiting our options	Demonstrating agreement with opinion
Reassuring of artefact compliance with agreements to accelerate progress	Initiate-accept communication-discussions	We will act now	Partner requesting guidance from facilitator organization	Tasks	Can not advance without your support
Seeking approval of plan by partner	Communicate the vision	Structuring	Providing template	Tone is, we're done, let's move on	Approval logistics
Reassuring through sharing of information on progress	Emphasize timeline	Express doubts	Partner communicating interest to collaborate	Disagree with proposed actions-suggestions and counter propose	Comforting
Seeking clarification on constraints	Confirm-acknowledge information received	Suggesting alternatives	Sense of accomplishment	Too formal	damage control
Positivity	Prototype	Signature logistics	Requesting guidance on meeting logistics	Start with a short-term interim collaboration	Commanding language for way forward
Seeking em	Enable other people to action	specialized resource providing information on procedures	Questioning the urgency and value of the short-term win	Translating verbal commitments in writing	Directing the project scope
Partner upset that they have been excluded from discussions	Communicate-request actions to be taken	Summarizing several long artefacts into a single succinct artefact to facilitate decision making	Requesting plan	Starting point discussions	Commanding language for way forward under pressure
proposing a contact point	Express (best) wishes	Requesting clarification on the value, cost of the proposal	Open to alternatives	Sharing information on project set-up at the partners organization	Articulating the challenge
Not communicating reason behind constraint	Give answer-information to enable other people to act on the vision	Providing guidance	Providing Evidence	Setting partners expectations and providing options	Being specific with the questions on progress

Table D.1 All cases –original codes; excerpts only (cont'd)

Seeking evaluation of level of efforts from non-expert but through gut feeling for validation	Emphasize expectations	Requesting specialized support within organization	Open to different options	The ball is in your court	Aware of the other partners constraints
Recognizing opportunity to augment the project with additional resources	Express hope	Open to integrate	Seeking Empath	Starting to work with no guarantee that the efforts will be compensated	Acknowledging receiving guidance and direction from facilitating organization
Seeking information	Express commitment	Seeking internal approval of artefact to be communicated to partners	Recognition of efforts and expertise	Sharing information reflecting conversation	apologies for misunderstanding message
Recognizing the opportunity	Empathize	Proactive follow-up on project	Seeking Review of artefact	Stop interacting	Acknowledging that partners are not familiar with consortium set-up logistics, and not offering to explain
proposing a face to face	Initiating Discussions	Seeking support	Recognition of the partner's expertise	Sharing information to facilitate support request	Acknowledging error in leaving out the partner and communicating misleading information
Recognizing the partner's interest in the collaboration	Mobilising and creating wins and synergies with the organization	Proactive follow-up on project of interest by technical lead	Providing information to help make a decision	Warm exchanges of wishes	Acknowledging the explanation on situation
Partner providing guidance	Informing	Referencing previous efforts	Partner using official form to emphasize the proposal, this is a sales proposal part of collaboration project holistic approach	The best we can do	Clarifying the intention of the message in the e-mail
Perception that partners made changes to artefact without informing us	Exchanging artefact	Seeking information on true value of a proposed Deal. Highlighting added value.	Plan the creation of an alliance	Strengthening relationship through sharing of information	Acknowledging the new understanding of the situation

Table D.1 All cases –original codes; excerpts only (cont'd)

Seeking permission	Commit to take action	Questioning the value of the collaboration ROI	Phone conversation to better understand each other	Transparency why we're late	Being internally aware of the value of what we bring to the table during negotiations
Prefer one on one collaborations	Seeking internal support	providing an artefact to specialized resource	Propose an alternative solution to standard process	Sympathizing	Communicate that cannot support, and not offering alternatives
Seeking stability of the collaboration	Create sense of urgency	Guide	Reiterating new POC	Sharing information with internal stakeholders to gage interest in collaborating	Convenience for the team
Not explaining the consequences of not respecting project constraints	Suggest	Face to face helpful	Providing complementary information	Suggesting a solution to progress faster	Acknowledging the quality of the artefact
Seeking support and understanding	Express satisfaction	Explaining reason behind actions and decisions	Relegating decision making to experts in field	The boss reasserting their authority	Another partner wants in, however not willing to commit the resources
Referencing teleconference, where partners had different understanding of agreements, given that they were not referencing the same baseline for the discussions	Send clarifications	Exploring different options to come up with an agreement on IP	Requesting Information	Systematic feedback on artefact	Communicating
Partner recognizing relevance of artefact through the information it contained	acknowledging receipt of information and confirming action to be taken	My part, your part	Professional communication	the core project is rejected, do we continue with the side project part of the holistic approach	Caring about the others preferences
Reflecting on situation	Propose additional support	I can help you but I need your inputs	Requesting inputs	Taking ownership of issue	Attention to form of information and details

Table D.1 All cases –original codes; excerpts only (cont'd)

Partner reiterating his confidence in his resources after verbal discussion with partners got emotional between the parties	Giving heads-up	Need guidance from expert	Reminding team of responsibilities	Uncertainty	define
Reiterating in writing the will to collaborate	Seeking empathy	acknowledging receipt of information and requesting clarifications	Requesting specific information on expected deliverables	Setting expectations for what i want to work on with you	Accommodating lack of official artefact
Proposing already agreed artefact to facilitate future collaborations	Providing information	Communicating artefact which reflects last discussions on IP negotiations	Project key stakeholder Reasserting leadership role	Sharing internally a non-standard practice recommended by facilitating partner	Change of key project resource
Preference	Communicate information to enable other people to act	Demonstrating Trust	Requesting that partners seek internal approvals on new proposal	We are experts, trust our legacy	Boss acknowledging the efforts should be coordinates.
Sending a reminder to sent artefact	Encouraging	Asking questions and suggesting actions at the same time	Requesting action to be taken by specialized resource in other partners organization	Sharing plan and next steps with all stakeholders	Demonstrating engagement based on internal understanding of offer
Rejection but honest on why	Decide	Being specific about flattering the partners	Planning next steps	We are serious	Boss providing the written artefact required for internal approval and back-up of employee decision
Proposing alternative contact point to move project forward	Personal Greetings	Communicating Funding. Budget Information on Project	Our own interpretation of the offer, but's let's call to confirm, however, do you agree in principal	Understanding the audience of the artefact	Being creative with collaboration artefact
Partner specialized resource boss communicating agreement with final version of agreement to all partners	Communicate constraints	Escalating	Seeking clarification on new proposal, given the different internal interpretation of the offer.	we cannot collaborate we don't not have a budget	Accepting apology

Table D.1 All cases –original codes; excerpts only (cont'd)

Preparing for the meeting	Suggesting action	Communicating good, engaging news	Proposing way forward to new team	Sharing potential for growth and doing more	Disagreements
Preparing team to support efforts	Urgency	Disappointment	Partner evaluating offer	We confirm our interest if collaborating with you in the future	Communicating approval of collaboration project
Knowledge	Request clarifications	Communicating information for validation of common understanding	Provide	Sharing the plan	Drawing attention to potential issue
New holistic proposal meeting partner expectation provided through an official artefact	Proposing a way forward	Communicating project plan and proposal through an official artefact	Partner organization want to negotiate with right specialized expertise in other organization	Confirm partial availability (not available all the duration)	Communicating artefact summarizing our understanding of verbal discussions
Making directive statement about project scope	1EMPATHIZE	Communicating artefact with new project set-up	Plan	Update	Approving plan
Expressing preferences	suggesting next steps	Suggest potential actions	Providing guidance on meeting logistics (Nodes)	Suggesting documenting scope ahead of meeting	Action completed
It is in the hand of the specialized resource	Influencing	Trying to understand our negotiating position internally	Provide Project Funding artefact	Updating internal stakeholders on progress	Empowering partner
Illustrating vision	requesting information	Answer and remind-request action to be taken	Seeking written approval from the boss	Accept meeting and ask to be called	Action is on our side and we key stakeholders do not know
I can help you but I need you to take action	Prompting action	Think of possible action outcomes	Partner 1 discussing with Partner 2 that partner 3 wants to collaborate for other reasons than the project itself, which seems to be ok for partners	Give information and request financial support	Ensuring specialized experts are part of the discussion

Table D.1 All cases –original codes; excerpts only (cont'd)

I'm already committed why change on me	Affirmative tone for a forward looking plan	What is in this new proposal for us	Portfolio Planning	Suggesting influencing partner to join in for maximizing project outcome	Actioning with no please hi or bye
I will reassure our partners	Negotiation strategy	Requesting artefacts from partner to exchange project plans	Partner accepting politely bad news and communicating will to continue relationship	Request someone to act on one's behalf	Convenience partnership
I'm at an impasse	Create working framework	Providing new useful information to facilitate and show interest	Providing information on the artefact	Suggesting making partnership decisions under time pressure	Activity based indirect team building around an interesting theme
Exposing benefits of project	Communicate availability	Offering support during tough situations	Facilitating organization providing guidance and tools outside of standard practice to facilitate collaboration set-up	Sharing understanding with all stakeholders	Correcting colleagues information discretely
Expressing will to move forward	acknowledging receipt of information	Pressuring	Highlighting diverging partners interests	Suggesting modifications to standard artefacts	Briefing internal expert on project while requesting support
Keep the team informed of progress	Request information to be able to act further on the vision	Request Project Funding. Budget Artefact	Explaining situation	Sharing with partners the major consequences of not completing action on time	Creating a non-standard artefact to get the project going, get engagement
I'm willing to change my mind to make this happen	Setting timeline expectations	Propose an alternative solution	facilitator organization requesting additional information	We hope you understand	Communicating commitment to the project
How can you help	Give information and plan for further communication	Seeking to build value, justify, having a convenience partner onboard	Negotiated non-standard practice proposed to facilitate moving the collaboration project forward	Updating the team on the status	Creating the collaboration artefact
Important challenge to the collaboration	Appreciation	Proposing face to face meeting	informing, tone is disengaged	Confirm someone else's decision-action-suggestion	Communicating common understanding of scope

Table D.1 All cases –original codes; excerpts only (cont'd)

I fully understand	Request (additional) information	Providing information to specialized resources	Lack of internal coordination, communication at one of the partners	Showing progress	Cynical; Collaboration aka make work projects
Uncertainty	Invitation to meet, call and discuss project plan	Proposing modification	External project Leader summarizing several long artefacts into a single succinct artefact to facilitate decision making (Nodes)	Acknowledge but disagree with information received	Briefing new internal stakeholder ahead of meeting with outside parties
Message to partners, it was difficult, run through overcome obstacles, we made it happen together.	Sense of urgency	Re-Engaging with partner	Following up on artefact	urge	Accepting responsibility for the blame
Including the key stakeholder that you had left out	Confirm taking action as required	Proposing scope which includes a holistic approach to the collaboration with partner on several projects	Inquiring	Send final document for review	Adding to internal proposal of project plan and confirming agreement with overall plan
Need more information to reassure stakeholders of complementarity of projects	Delegate	Requesting artefact to use for guidance	Highlighting partners' duties and responsibilities	Skeptical	Celebrating success
Indirect apology for the delay	Acknowledge efforts done	proposing way forward	Highlighting value of holistic projects collaboration approach for internal support building	Suggesting new consortium set-up for the rejected project	Communicating emotions
New project POC following up on progress	Informing of progress	Requesting clarification on procedure and process	Justifying delay	SME taking leadership role, specific interest in making holistic approach work	Chance to change and refocus the scope following transition

Table D.1 All cases –original codes; excerpts only (cont'd)

Indirectly communicating frustration with facilitating organization process (Nodes)	IDEATE	Provide constraints	Highly emotional best wishes	Suggest lessons learned	Bringing background discussions with new partner to the foreground
Involving the other party	Express interest	Sending completed and signed artefact	Influencing internal stakeholders	SME wants to understand their role	Backdoor request for update on progress
Indirectly communicating frustration with process (Nodes)	Send reminder	Offering support and at the same time cautioning to operate within constraints	Exploring alternative solutions	Setting facilitator partner expectations and providing options	Bringing everyone onto the same page
Highlighting the need to inform other negotiating parties with our clear position on what we cannot accept	Validate your idea	Making the partners feel that the proposal is in their best interest	Leading approval of artefact	Solicit support	Accepting the directive proposal of the collaboration key stakeholder
Indirectly communicating that decisions are not solely in the interlocuter's hands	Communicate information as a reminder and enabler for taking action	Exchanging information on project initiation logistics	Internal evaluation of convenience partner proposal	Suggesting success	Additional artefacts will be required during collaboration
Feeling guilty	Confirm meeting participation	Highlighting the need to consult partner, need information from partner	Highlighting changes	Soliciting a new partner in the background	Accommodating
Indirectly highlighting constraints	Initiation and Planning	Inviting others to join in on the project plan and create allies	Internal facilitator communicating internally the level of effort required to manage his portfolio	We need to follow internal procedures in Empathy context	Addressing challenge directly with stakeholder
Feeling of being excluded	communicating appreciating	Looking forward to working with you	Making decisions	Soliciting additional SMEs for support	Clarifying logistics

Table D.1 All cases –original codes; excerpts only (cont'd)

Indirectly influencing internal stakeholders by holding them accountable to external partners	Planning	Internal discussions on our position on IP, communicating through an artefact, e-mail and documents	Internal facilitator coordinating, facilitating stakeholders meeting, call, logistics	We need to rally internal support	Process-TimeLine
Learning about the collaborator	Monitoring-Controlling	Internal project leader working out project logistics to ensure closure on new proposal	Highlighting key issues to discuss to come to an agreement, including IP	Request additional information for internal purposes (backup)	Difficult times but remaining professional and polite
Indirectly informing of leadership role on adjacent project	Seeking understanding	Exchanging artefact to freely share information	holistic project approach being promoted internally and value being demonstrated	Suggesting that there is a solution	Acknowledging the suggested choice
Let's prioritize, what we must deliver now, and what we can deliver later	Emphasize importance	Exchanging artefacts on adjacent project	Informing of plan	Soliciting another collaborator	Directive communication on preferred project plan
Indirectly prompting action	Express desire to keep in touch - future exchanges	Guiding by illustrating and providing samples	Hoping this is convenient	We need your support	Communicating hope of coming to an agreement, no immediate timeframe
Major change for handover to new SME	Discover	Learning from experience	Informing while requesting information	Soliciting support of event given relationship on adjacent project	Discouraging alternative, current solution
Following up internally on artefact	Make assumptions	I will need help to complete the action you expect from me	Internal project leader demonstrating business savvy and value for overall organization	Setting a detailed discussion topic agenda for a phone call	Affirming commitment to the project
I need your support	Proposing an alternative	holistic approach being further developed by partner	Keep us, me informed	Summarizing roles and responsibilities of key project stakeholders	Documenting commitments
Indirectly trying to temper moods and clarify negotiation stance, we want to work with you again	PROTOTYPE	Communicating good news	Expert discussing artefact with stakeholder to aid decision making	Sharing information	Authorize

Table D.1 All cases –original codes; excerpts only (cont'd)

More to come	Demonstrating goodwill	Demonstrating interest in considering others interests	Keeping partners happy by timely responses	Sharing information on progress with all internal stakeholders	Eager to advance the project
Industrial partner with, this is our final offer type , but let's put that our to our partners in nicer words	Propose meeting timeframe	Considering new collaboration set-up	Internally clarifying proposal scope	Sharing accomplishment with internal stakeholders	Communicating internal project decisions to partner to move forward
Need facts to evaluate the collaboration	Express disappointment-dissatisfaction	Being flexible with logistics	Lack of greetings under pressure of time	We multiparty collaborations we will need to have separate work packages	Acknowledging Information
Following up on a new collaboration. starting from the same e-mail thread as current collaboration discussions	Seeking Empath from other partner	Acknowledging own action items	I need your help but not my fault	Send document (prototype) for signature	Communicating internally the it is taking long for the partners to get back to us after tough round of negotiations
Need your expertise	Politeness	Acknowledging bad news, showing disengagement	Lead industrial partner communicate their commitment to continue supporting already engaged resources on the project	We nee to get going and build a first bridge	empower others to act on the vision and plan
External facilitator escalating indirectly	Informing, demonstrating engagement	Congratulating on good news	Introducing oneself and role	We need support for the first phase of the project, the rest of the plan will be determined later	Communicating Need for an additional artefact
New Partner suggesting that they are ready, and that others are not	Give answer and request feedback to brainstorm and create teamwork to act on the vision	Ensuring coordination of efforts of partner organization	Highlighting challenges	Project hierarchy leader not available, can you reschedule	Empowering new resource with introduction to partner
Influencing internal stakeholders by holding them accountable	Iterate	Acknowledging receipt of information	I was not wrong after all	Not ready to commit yet	Afraid of the complexity of multiparty collaborations

Table D.1 All cases –original codes; excerpts only (cont'd and end)

New project resource, cause of delay	Requesting support	Availability to support	Let's not wait for anyone, I want to know now so that we can take actions	Requesting suggestions	encourage
Influencing internal stakeholders by holding them accountable to external partners	Promoting exchange of a standard artefact	DEFINE	Express frustration	Persistence in finding common time to bring the team together	Agree on project plan first, then technical aspects
Inviting participation	Requesting feedback	Delegating meeting, call	Long term thinking	Request that boss efforts coordinate with team	Collaboration PM Taking Responsibility after contract signature
Influencing the direction of the meeting with artefact	Volunteering information	Accepting Invitation	Explaining progress	Proposing an agile project management to progress rapidly	Communicating new information; Now you know, so take action if you have to; not my problem

APPENDIX E – PRELIMINARY CONCEPTUAL FRAMEWORK CODES

Table E.1 Preliminary conceptual framework codes

INSIDE THE COLLABORATION PROCESS COMPONENT: GOVERNANCE, ADMINISTRATION, AUTONOMY, MUTUALITY, TRUST AND RECIPROCITY	**CHANGE MANAGEMENT:** URGENCY, MOBILISATION, VISION, COMMUNICATE VISION, EMPOWER, PLAN, WINS, SUCCESS, NEW BEHAVIOURS	**DESIGN THINKING:** EMPATHIZE, IDEATE, DEFINE, PROTOTYPE, TEST	**PROJECT MANAGEMENT:** MOBILIZE, DIRECT, STRUCTURE, IMPLEMENT/EXECUTE, APPROPRIATE
1. Governance:	**1. Urgency, mobilize:**	**1. Empathize:**	**1. Mobilize:**
Seeking internal approval of artefact to be communicated to partners	Create sense of urgency	Seeking empathy	Create sense of urgency
Need decision makers around the table	Urgency	Empathy with partners and respect for their efforts	Mobilising and creating wins and synergies with the organization
Institutionalize new approaches and evangelize on how new behaviours lead to corporate success	Sense of urgency	Empathy	Affirmative tone for a forward looking plan
Change management	Establish a sense of urgency	Empathizing	Invitation to meet, call, and discuss project plan
Consulting key project leaders before making a decision on collaborations	Questioning the urgency and value of the short term win	Another partner sharing true reason why a third partner is suggesting a new idea proposal	Give answer and request feedback to brainstorm and create teamwork to act on the vision
Partners accepting project lead as main POC beyond the collaboration continuity manager	New Partner creating a sense of urgency	Informally exchanging information to create goodwill	Communicating the will to meet, provide specific timeframe
Major partner make final choice on consortium funding mechanism	Using artefact as a tool to underline urgency of timeframe	Demonstrating empathy	Plan for and create short-term wins
Relegating decision making to experts in the field	Using artefact completion as a tool to underline urgency of timeframe	We need to follow internal procedures in Empathy context	Inviting others to join in on the project plan and create allies

Table E.1 Preliminary conceptual framework codes (cont'd)

Acknowledging the suggested choice	Grasping attention and highlighting urgency	Seeking Empathy from other partner	Invitation to meet, call, and discuss project plan, artefact, agreement
Seeking approval of final artefact from a specialized resource at industrial partner	Emphasize necessity of getting an answer	Creating allies to strengthen the collaboration culture	Create a vision
Communicating internal project decisions to partner to move forward	Request-emphasize importance of getting an answer	Request feedback-answer	Let's not wait for anyone, I want to know now so that we can take actions
Approval logistics	Communicate hope of overcoming obstacles in timeframe	Express interest	Plan the creation of an alliance
Communicate-request actions to be taken	New Partner creating a sense of urgency	Seeking understanding	Empower others to act on the vision and plan
Set expectations	Plan the creation of an alliance	Congratulate for the work done	We would like to know if have the same understanding
Emphasize expectations	**2. Vision:**	Requesting support	We're partners on adjacent project and we should create a new collaboration
Communicate constraints	Communicate the vision	Appreciation	Calm and reassuring message on plan to move forward despite challenges
Setting expectations	Create a vision	Personal Greetings	Initiation
Proposing an agile project management to progress rapidly	Illustrating vision	Politeness	Initiate brainstorming
2. Administration:	Reminding the team of the project vision	Express excuses	Initiate
Seeking approval of proposed ideas	Communicate availability	Apologizing	Communicate information as a reminder and enabler for taking action

Table E.1 Preliminary conceptual framework codes (cont'd)

Requesting approval	Encouraging	Reassuring	Confirm meeting participation
Partner communicating appreciating	Influencing	Encouraging	Delegate
Appreciation of efforts	Proposing a solution	Proposing a communication language and idea which does not offend the partner	Express commitment
Seeking internal approval	**3. Communicate Vision, Empower:**	Informing, demonstrating engagement	Promoting exchange of a standard artefact
Providing approval	Give answer-information to enable other people to act on the vision	Express uncertainty	Informing resource managers of project plan
Providing information to facilitate decision making	Request information to be able to act further on the vision	**2. Ideate:**	Informing additional stakeholders
Explaining reason behind actions and decisions	Give answer and request feedback to brainstorm and create teamwork to act on the vision	Ideate	Volunteering information to facilitate project plan
Give information and formally request decision-answer	Request confirmation to be able to act further on the vision	Create a vision	Demonstrating knowledge
Highlighting the need for internal approval, not only my decision	Answer on behalf of someone else, to advance the vision	Give answer and request feedback to brainstorm and create teamwork to act on the vision	**2. Direct:**
Internal facilitator communicating internally the level of effort required to manage his portfolio	Send document (prototype) to enable others to act on the vision	Proposing alternative ideas based on new information	Setting the stage for the project plan
Expert discussing artefact with stakeholder to aid decision making	Communicate information to enable other people to act	Ideate with constraints in mind	Give information and plan for further communication

Table E.1 Preliminary conceptual framework codes (cont'd)

Requesting guidance from the collaboration continuity manager	Set time constraints	Inviting others to join in on the project plan and create allies	Exchanging information on project initiation logistics
Seeking approval of artefact	Setting timeline expectations	We're partners on adjacent project and we should create a new collaboration	Acknowledge efforts done
Seeking written approval from the boss	Empowering others to act	Highlighting Challenges; Doubting Current Idea Proposal	Acknowledging good news, showing engagement
Communicating approval of artefact to partner	Give positive feedback	Proposing an alternative lower-cost idea for the perceived high-cost idea	Recognizing actions and self initiating work
External project Leader summarizing several long artefacts into a single succinct artefact to facilitate decision making	Highlighting an achievement	Agree with proposed actions-ideas-suggestions	Acknowledging bad news, showing the engagement and the will to support
My choice of partner is better than your choice	Empower others to act on the vision, change unhelpful structures, and experiment	Seeking approval of proposed ideas	Acknowledging value of the internal win-win proposal
Appreciation and prompting further action	Empower others to act on the vision and plan	Being creative with collaboration artefact	Acknowledge and agree with information received
Approving artefact	Communicate-confirm decision taken	Specialized resource communicating agreement with idea	Acknowledgment of efforts
We will do multiparty collaborations if we have no choice	Creating a non-standard artefact to get the project going, get engagement	Suggesting next steps	I've already confirmed, but here again for everyone to know
Internal clarification lacking complete information required for decision making	**4. Plan, Wins, and Success:**	Disagree with proposed actions-ideas-suggestions	Boss acknowledging the efforts should be coordinated
Appreciation of efforts to help scope project	Projecting and planning outcome if successful	Invitation to Brainstorm solutions	Informing boss of plan for common understanding

Table E.1 Preliminary conceptual framework codes (cont'd)

Providing information	Demonstrating flexibility for a win-win scope	Proposing a way forward	Acknowledging the explanation on situation
Informing	Acknowledging value of the internal win-win proposal	Offering a useful artefact, info, to help with this and future projects	Acknowledging receiving guidance and direction from facilitating organization
Providing directions	Requesting understand and flexibility for a win-win scope	Observe	Directive communication on preferred project plan
Partner using official form to emphasize the proposal, this is a sales proposal part of the collaboration project holistic approach	Must be win-win	**3. Define:**	Institutional acknowledgment
Informing of progress	Win-win proposal	Mobilising and creating wins and synergies with the organization	Internal project leader working out project logistics to ensure closure on new proposal
Communicating bad, disengaging news	Discover insights	Define-communicate next actions	Internal project leader working out project logistics to ensure closure on deal with original convenience partner
3. Autonomy:	Working outside standard practices to promote a win-win internal and to partner organization of the holistic collaboration solution	Create working framework	Request clarifications
Communicate-confirm decision taken	Express satisfaction and congratulate for team and project success	Summarizing several long artefacts into a single succinct artefact to facilitate decision making	Request (additional) information
Internal negotiations in support of funding a key component of the collaboration, not officially part of the collaboration set-up, holistic approach	Suggesting success	Project Plan using an artefact, referred to as Design the project plan	Setting support expectations

Table E.1 Preliminary conceptual framework codes (cont'd)

Holistic approach being further developed by partner	Wishes of success	Framing understanding as a question for validation	Requesting information
Appropriation	Express appreciation	Create project structure	Informing of plan
Proposing scope which includes a holistic approach to the collaboration with partner on several projects	Appreciation of efforts	Creating the collaboration artefact	Justifying
Approval of proposed idea	Giving heads-up	Communicate-Inform	Offering support
Consulting internal experts before making a decision on collaboration	Confirm taking action as required	Seeking internal support	Demonstrating agreement
Suggesting alternatives to accelerate approval process	Decide	**4. Prototype:**	Negotiation strategy
Sharing information which may be relevant to decision making	Confirm and commit to follow-up	Creating specialized artefacts	Communicating new information; Now you know, so take action if you have to; not my problem
Collaboration project manager bridging information to new team	Do follow-up	Frame and reframe	We're close to agreeing with minor changes!
Holistic project approach being promoted internally and value being demonstrated	Approval of proposed idea	Prototype	**3. Structure:**
Suggest	Seeking internal approval	Send document (prototype) to enable others to act on the vision	Initiate-accept communication-discussions
Propose meeting timeframe	Approving plan	Creating artefact	Create working framework
	Seeking validation of proposal	Creating a non-standard artefact to get the project going, get engagement	Strategize plan

Table E.1 Preliminary conceptual framework codes (cont'd)

Make assumptions	Seeking approval of proposed ideas	Send document (prototype) for signature	Create project structure
Proposing an alternative	Requesting approval of new project plan	Summarizing several long artefacts into a single succinct artefact to facilitate decision making	Affirmative tone for a forward looking plan
Suggesting action	**5. New behaviors:**	Proposing scope which includes a holistic approach to the collaboration with partner on several projects	Planning project resources
Requesting approval of new project plan	Institutionalize new approaches and evangelize on how new behaviours lead to corporate success	Suggesting alternatives to accelerate approval process	Portfolio Planning
4. Mutuality:	Consolidate improvements and produce still more change. Promote and reward people. Energize the process of change	Providing information to help make a decision	Clarifying scope and plan
Requesting that partners seek internal approvals on new proposal	Suggest lessons learned	Suggesting have the right people on the call to accelerate decision making	Plan resources for the phase we know, when we understand the second phase then we'll plan accordingly
Potential partner seeking internal approval	Appropriation	Partner using official form to emphasize the proposal, this is a sales proposal part of collaboration project holistic approach	Adding to internal proposal of project plan and confirming agreement with overall plan
Highlighting value of holistic projects collaboration approach for internal support building	Lessons Learned	Illustrating artefact exchange, review and approval procedures	Plan to replace key project resource
Providing information to help make a decision	Consolidate improvements and produce still more change. Promote and reward people. Energize the process of change	Proposing an alternative lower cost idea for the perceived high cost idea	Planning ahead

Table E.1 Preliminary conceptual framework codes (cont'd)

Suggesting have the right people on the call to accelerate decision making		Proposing a project plan after many iterations	coordinating internal logistics to ensure holistic plan is executed in parallel to collaboration project planning
Transparency on reason behind decision		Project Plan using an artefact, referred to as Design the project plan	Planning follow-up timeline
Leading approval of artefact		Propose additional support	Planning meeting
Making decisions		Proposing a solution	Planning project
Illustrating artefact exchange, review and approval procedures		Suggesting adapting of artefacts	Agree on project plan first, then technical aspects
Need more information before being able to make an informed decision		Clarifying proposal scope	Project Plan using an artefact, referred to as Design the project plan
The decision we made is good, but you can modify within the following constraints		Following up on progress	Proposing a project plan after many iterations
Need to make informed decision		**5. Test:**	Projecting and planning outcome if successful
Confirm someone else's decision-action-suggestion		Seeking validation	Emphasize timeline
Negotiating outside of standard practices internally to find a solution to adopt a holistic approach collaboration		Requesting clarifications on idea in the proposal	Enable other people to action
Building relationship		Communicating information for validation of common understanding	Commit to take action
Express commitment		Approval of proposed idea	Prompting action

Table E.1 Preliminary conceptual framework codes (cont'd)

Demonstrating goodwill		Seeking validation of proposal	Requesting approval of new project plan
Building goodwill		Seeking evaluation of level of efforts from non-expert but through gut feeling for validation	Send reminder
Express desire to keep in touch - future exchanges		Requesting internal approval to proceed with creating an artefact	Open to discuss
Deflecting decision making to stakeholder		Validate your idea	**4. Implement/Execute:**
Apologies for making decision without partners buy-in		Plan for and create short-term wins	Executing
Acknowledging error in leaving out the partner and communicating misleading information		Send clarifications	Planning
5. Trust and Reciprocity:		Confirm-clarify doubts-uncertainty	Confirm-acknowledge information received
Non-standard artefact agreed upon based on expected mutual trust		Express disappointment-dissatisfaction	Initiating Discussions
Informing collaboration candidate that we need to wait before making a decision on collaborating		Tempting the collaborator with potential rewards	acknowledging receipt of information and confirming action to be taken
Not my decision		Exchanging artefact	Initiation and Planning
External project leader communicating his position to lead industrial partner; He will leave the negotiations to the specialized resources, they know their position		Specialized expert providing approval of artefact	Monitoring-Controlling
Not my decision, need to consult stakeholder			Request information to be able to act-plan (better)

Table E.1 Preliminary conceptual framework codes (cont'd)

Agreed to disagree, then converge on best approach			Providing an artefact to use to exchange project plans
Officially communicating verbal decision through documenting an internal conversation			Closing
We need to approve artefact before diffusion			acknowledging receipt of artefact and informing of process
Decision not to take risks based on doubt that an agreement can be reached timely			Acknowledging receipt of action item
Requesting internal approval to proceed with creating an artefact			Provide constraints
PM indirectly seeking approval to proceed from SME facilitator			Following up but really saying that we need to close
Seeking approval of plan by partner			acknowledging receipt of information and providing guidance through clarifications request
Approving plan			Requesting plan
Indirectly communicating that decisions are not solely in the interlocutor's hands			Acknowledging action item
Informing resource managers of project plan			Taking initiative
Approving suggested project cost			Provide Project Funding artefact
SME taking leadership role, specific interest in making holistic approach work			acknowledging feedback on artefact

Table E.1 Preliminary conceptual framework codes (cont'd)

Are you seeking an approval or not			Providing precision on project plan timeframe to stakeholder
Internal ally providing advice on value of internal proposal part of the holistic approach			New plan given the project status
Boss providing the written artefact required for internal approval and back-up of employee decision			Communicating Final project plan and proposal through an official artefact
Suggesting making partnership decisions under time pressure			Requesting specific information on expected deliverables
Facilitator organization providing standard artefact; project decision			Planning next steps
The core project is rejected, do we continue with the side project part of the holistic approach			Sharing the plan
Giving choices and freedom to decide on level of implication of SME			Communicating project plan and proposal through an official artefact
Communicating approval of collaboration project			Approving plan
Collaboration continuity manager as POC			We need support for the first phase of the project, the rest of the plan will be determined later
We need to replan based on new multiplayer approach			Confirming accuracy of artefact with producer of artefact
Justifying decision for support			New holistic proposal meeting partner expectation provided through an official artefact

Table E.1 Preliminary conceptual framework codes (cont'd)

Requesting artefact to help in decision making and way forward			New resource communicating plan forward
Requesting confirmation if the proposed approach is understood by the receiving party			One of the partners aware of back-up plan if negotiations fail
Appreciation of patience			Seeking approval of plan by partner
Communicating appreciation			Sharing plan and next steps with all stakeholders
Express appreciation			Producing
Communicating appreciating			Execution
Mutual pleasure			Authorizing project cost plan
Express (best) wishes			Requesting confirmation of partner engagement per written plan
Express hope			Follow-up by partner with keen interest in closing a sale, deal part of the collaboration
Express satisfaction			Let's prioritize, what we must deliver now, and what we can deliver later
Apologize			Make constructive suggestions
Give credit for the work done			**5. Appropriate:**
We want to know you more			Appropriation
We know you more now			Lessons Learned

Table E.1 Preliminary conceptual framework codes (cont'd)

			Suggest lessons learned
			Consolidate improvements and produce still more change. Promote and reward people. Energize the process of change
			Acknowledge learning new things
			Acknowledging receipt of information and providing guidance
			Acknowledging receipt of information and requesting clarifications
			Acknowledging receipt of information, and indirect agreement on way forward
			Acknowledging positive message
			Acknowledging the quality of the artefact
			Acknowledge but disagree with information received
			Acknowledging the new understanding of the situation
			Informing and suggesting plan forward
			Requesting artefacts from partner to exchange project plans
			New plan given the challenges

Table E.1 Preliminary conceptual framework codes (cont'd and end)

			Requesting precision on plan timeframe
			Providing precision on project plan timeframe to project team
			Exploring optimal plan forward
			We need to replan based on new multiplayer approach

APPENDIX F –SECOND-LEVEL THEMES, FIRST-LEVEL THEMES, ACTION VERBS

Table F.1 Second-level themes, First-level themes, Action verbs

Second-Level Themes	First-Level Themes	Action Verbs
Initiating Action, Commitments, Facilitating Action	**Initiating Action, Commitments, Facilitating Action**	**Request, Enable, Communicate, Suggest, Clarify, Prompt, Inform, Emphasize, Ask, Take, Respond, Limit, Rally, Get, Build, Excuse, Commit, Propose, Assume**
Initiating Action, Commitments, Facilitating Action	Request feedback-answer	
Initiating Action, Commitments, Facilitating Action	Enable other people to action	
Initiating Action, Commitments, Facilitating Action	Communicate-request actions to be taken	
Initiating Action, Commitments, Facilitating Action	Suggesting action	
Initiating Action, Commitments, Facilitating Action	Request clarifications	
Initiating Action, Commitments, Facilitating Action	Prompting action	
Initiating Action, Commitments, Facilitating Action	Requesting information	
Initiating Action, Commitments, Facilitating Action	Request (additional) information	
Initiating Action, Commitments, Facilitating Action	Request-emphasize importance of getting an answer	
Initiating Action, Commitments, Facilitating Action	Ask for actions to be taken	
Initiating Action, Commitments, Facilitating Action	Emphasize necessity of getting an answer	
Initiating Action, Commitments, Facilitating Action	Informing and prompting action	
Initiating Action, Commitments, Facilitating Action	Taking concrete actions	

Table F.1 Second-level themes, First-level themes, Action verbs (cont’d)

Initiating Action, Commitments, Facilitating Action	We're done on our side what about you	
Initiating Action, Commitments, Facilitating Action	Time is of the essence, no response is limiting our options	
Initiating Action, Commitments, Facilitating Action	The ball is in your court	
Initiating Action, Commitments, Facilitating Action	We need to rally internal support	
Initiating Action, Commitments, Facilitating Action	We need to get going and build a first bridge	
Initiating Action, Commitments, Facilitating Action	No excuse, here is the lacking artefact	
Initiating Action, Commitments, Facilitating Action	Commit to take action	
Initiating Action, Commitments, Facilitating Action	Propose additional support	
Initiating Action, Commitments, Facilitating Action	Assume responsibility	
Facilitating Progress and Moving Forward	**Facilitating Progress and Moving Forward**	**Promote, Take, Wait, Move, Realize, Involve, Propose, Ask, Work, Do, Get, Keep, Help, Need, Try, Influence, Give**
Facilitating Progress and Moving Forward	Promoting internal stakeholders to take action and not wait	
Facilitating Progress and Moving Forward	Is the team still happy with the collaboration partners	
Facilitating Progress and Moving Forward	Ready to move forward	
Facilitating Progress and Moving Forward	Realizing potential benefit of involving a third partner	
Facilitating Progress and Moving Forward	Propose help but ask for support in return (help me to help you)	
Facilitating Progress and Moving Forward	We want to work with you	

Table F.1 Second-level themes, First-level themes, Action verbs (cont'd)

Facilitating Progress and Moving Forward	We will do our part, indirectly that others should do too	
Facilitating Progress and Moving Forward	We will get back to you promptly	
Facilitating Progress and Moving Forward	We will keep you informed	
Facilitating Progress and Moving Forward	We will help	
Facilitating Progress and Moving Forward	We need your support	
Accountability, Creative Solutions, and Proposing Alternatives	**Accountability, Creative Solutions, and Proposing Alternatives**	**Take, Provide, Put, Propose, Express, Build, Remind, Explore, Offer, Not Provide, Challenge, Need, Suggest, Try, Understand, Negotiate, Answer, Request, Think, Stall, Scope, Act, Instruct, Complete, Accept, Agree, Communicate, Deflect, Exchange, Inform**
Accountability, Creative Solutions, and Proposing Alternatives	Taking back ownership	
Accountability, Creative Solutions, and Proposing Alternatives	Providing alternatives	
Accountability, Creative Solutions, and Proposing Alternatives	Put on hold collaboration with partner two	
Accountability, Creative Solutions, and Proposing Alternatives	Propose an alternative solution to standard process for short term wins	
Accountability, Creative Solutions, and Proposing Alternatives	Expressing interest in building alternative collaborations	
Accountability, Creative Solutions, and Proposing Alternatives	Providing an ultimatum if no response	
Accountability, Creative Solutions, and Proposing Alternatives	Reminding the partner of their action items	
Accountability, Creative Solutions, and Proposing Alternatives	Providing alternatives	
Accountability, Creative Solutions, and Proposing Alternatives	Exploring alternative solutions	

Table F.1 Second-level themes, First-level themes, Action verbs (cont'd)

Accountability, Creative Solutions, and Proposing Alternatives	Providing many options for meetings	
Accountability, Creative Solutions, and Proposing Alternatives	Not providing full context	
Accountability, Creative Solutions, and Proposing Alternatives	Internal logistics challenges Financial	
Accountability, Creative Solutions, and Proposing Alternatives	Need guidance from expert	
Accountability, Creative Solutions, and Proposing Alternatives	Suggest potential actions	
Accountability, Creative Solutions, and Proposing Alternatives	Trying to understand our negotiating position internally	
Accountability, Creative Solutions, and Proposing Alternatives	Answer and remind-request action to be taken	
Accountability, Creative Solutions, and Proposing Alternatives	Think of possible action outcomes	
Accountability, Creative Solutions, and Proposing Alternatives	What is in this new proposal for us	
Accountability, Creative Solutions, and Proposing Alternatives	Project is stalled	
Accountability, Creative Solutions, and Proposing Alternatives	Project scope	
Accountability, Creative Solutions, and Proposing Alternatives	Proactive	
Accountability, Creative Solutions, and Proposing Alternatives	Providing instructions	
Accountability, Creative Solutions, and Proposing Alternatives	Requesting artefact from specialized resource	
Accountability, Creative Solutions, and Proposing Alternatives	Completing artefact	
Accountability, Creative Solutions, and Proposing Alternatives	Accepting proposal	
Accountability, Creative Solutions, and Proposing Alternatives	Agreeing	

Table F.1 Second-level themes, First-level themes, Action verbs (cont'd)

Accountability, Creative Solutions, and Proposing Alternatives	Communicating new coordination information	
Accountability, Creative Solutions, and Proposing Alternatives	Deflecting the action to the expert	
Accountability, Creative Solutions, and Proposing Alternatives	Communicating artefact with comments on new project set-up	
Accountability, Creative Solutions, and Proposing Alternatives	Exchange of artefacts	
Accountability, Creative Solutions, and Proposing Alternatives	Completing action item and informing stakeholder	
Creative Problem-Solving, Partner Engagement, Discovery and Iteration	**Creative Problem-Solving, Partner Engagement, Discovery and Iteration**	**Offer, Caution, Operate, Highlight, Consult, Need, Leverage, Discover, Provide, Argue, Set, Use, Limit, Observe, Iterate, Volunteer, Give, Request, Offering, Interpret, Open, Justify, Frame, Reframe, Explain**
Creative Problem-Solving, Partner Engagement, Discovery and Iteration	Offering support and at the same time cautioning to operate within constraints	
Creative Problem-Solving, Partner Engagement, Discovery and Iteration	Highlighting the need to consult partner, need information from partner	
Creative Problem-Solving, Partner Engagement, Discovery and Iteration	Leverage stories to discover insights	
Creative Problem-Solving, Partner Engagement, Discovery and Iteration	Providing arguments in support of strong opinion	
Creative Problem-Solving, Partner Engagement, Discovery and Iteration	Facilitator organization setting expectations	
Creative Problem-Solving, Partner Engagement, Discovery and Iteration	Facilitator providing many options to set-up timely discussions	
Creative Problem-Solving, Partner Engagement, Discovery and Iteration	Using artefact	
Creative Problem-Solving, Partner Engagement, Discovery and Iteration	Limitations	
Creative Problem-Solving, Partner Engagement, Discovery and Iteration	Observe	

Table F.1 Second-level themes, First-level themes, Action verbs (cont'd)

Creative Problem-Solving, Partner Engagement, Discovery and Iteration	Iterate	
Creative Problem-Solving, Partner Engagement, Discovery and Iteration	Volunteering information	
Creative Problem-Solving, Partner Engagement, Discovery and Iteration	Give information and request opinions	
Creative Problem-Solving, Partner Engagement, Discovery and Iteration	Offering interpretations	
Creative Problem-Solving, Partner Engagement, Discovery and Iteration	Open to iterate	
Creative Problem-Solving, Partner Engagement, Discovery and Iteration	Justifying	
Creative Problem-Solving, Partner Engagement, Discovery and Iteration	Frame and reframe	
Creative Problem-Solving, Partner Engagement, Discovery and Iteration	Explaining	
Challenges, Problem Solving, Managing Relations and Change	**Challenges, Problem Solving, Managing Relations and Change**	**Give, Take, Lack, Need, Help, Highlight, Provide, Grow, Keep, Inform, Fail, Influence, Make, Have, Assist, Insist, Complete, Prefer, Learn, Change, Hand Over, Come, Celebrate, Maintain, Recommend, Illustrate, Explain, Request, Clarify, Apologize, Use**
Challenges, Problem Solving, Managing Relations and Change	Give and take relationship	
Challenges, Problem Solving, Managing Relations and Change	Lack of greetings under pressure of time	
Challenges, Problem Solving, Managing Relations and Change	I need your help but not my fault	
Challenges, Problem Solving, Managing Relations and Change	Highlighting challenges	
Challenges, Problem Solving, Managing Relations and Change	I was not wrong after all	
Challenges, Problem Solving, Managing Relations and Change	Facilitator organization providing new useful information	

Table F.1 Second-level themes, First-level themes, Action verbs (cont'd)

Challenges, Problem Solving, Managing Relations and Change	Growing current collaboration to surmount challenges	
Challenges, Problem Solving, Managing Relations and Change	Keep us informed	
Challenges, Problem Solving, Managing Relations and Change	Failed past collaborations influencing dynamics of setting up new collaborations	
Challenges, Problem Solving, Managing Relations and Change	Making assumptions	
Challenges, Problem Solving, Managing Relations and Change	May not have immediate return but still valuable	
Challenges, Problem Solving, Managing Relations and Change	I will help you	
Challenges, Problem Solving, Managing Relations and Change	Insisting on completing action politely	
Challenges, Problem Solving, Managing Relations and Change	Prefere one on one collaborations	
Challenges, Problem Solving, Managing Relations and Change	Friendly tone	
Challenges, Problem Solving, Managing Relations and Change	Good deal	
Challenges, Problem Solving, Managing Relations and Change	Learning about the collaborator	
Challenges, Problem Solving, Managing Relations and Change	Major change for handover to new SME	
Challenges, Problem Solving, Managing Relations and Change	More to come	
Challenges, Problem Solving, Managing Relations and Change	No new PCO	
Challenges, Problem Solving, Managing Relations and Change	Less formal response at this stage and under pressure	
Challenges, Problem Solving, Managing Relations and Change	Let's not celebrate yet	

Table F.1 Second-level themes, First-level themes, Action verbs (cont'd)

Challenges, Problem Solving, Managing Relations and Change	Maintaining all partners informed	
Challenges, Problem Solving, Managing Relations and Change	Making recommendations	
Challenges, Problem Solving, Managing Relations and Change	Illustrating consequences	
Challenges, Problem Solving, Managing Relations and Change	Explaining rationale behind strong opinion	
Challenges, Problem Solving, Managing Relations and Change	Lack of greetings after requesting clarification	
Challenges, Problem Solving, Managing Relations and Change	Late but not apologizing	
Challenges, Problem Solving, Managing Relations and Change	Using formal greetings after tough negotiations	
Suggesting workaround, Proposal and Alternatives	**Suggesting workaround, Proposal and Alternatives**	**Suggest, Modify, Propose, Offer, Negotiate, Communicate, Overcome, Suggest, Adapt, Invite, Brainstorm**
Suggesting workaround, Proposal and Alternatives	Suggesting modification to artefact	
Suggesting workaround, Proposal and Alternatives	Proposing modification	
Suggesting workaround, Proposal and Alternatives	Proposing alternatives	
Suggesting workaround, Proposal and Alternatives	Suggesting diverging collaboration interests co-habitate within the same project	
Suggesting workaround, Proposal and Alternatives	Offer partial support, negotiate participation-support	
Suggesting workaround, Proposal and Alternatives	Proposing an alternative	
Suggesting workaround, Proposal and Alternatives	Proposing a solution	
Suggesting workaround, Proposal and Alternatives	Communicate hope of overcoming obstacles in timeframe	

Table F.1 Second-level themes, First-level themes, Action verbs (cont'd)

Suggesting workaround, Proposal and Alternatives	Suggesting a way forward	
Suggesting workaround, Proposal and Alternatives	Suggesting adapting of artefacts	
Suggesting workaround, Proposal and Alternatives	Invitation to Brainstorm solutions	
Proposal Development and Evaluation, Influencing	**Proposal Development and Evaluation, Influencing**	**Communicate, Tempt, Adopt, Evaluate, Question, Request, Clarify, Seek, Highlight, Fund**
Proposal Development and Evaluation, Influencing	Communicating that the efforts are not significant to tempt adoption of proposal	
Proposal Development and Evaluation, Influencing	Partner evaluating offer	
Proposal Development and Evaluation, Influencing	Questioning the value of the collaboration ROI	
Proposal Development and Evaluation, Influencing	Requesting clarification on the value, cost of the proposal	
Proposal Development and Evaluation, Influencing	Seeking information on the true value of a proposed deal Highlighting added value	
Proposal Development and Evaluation, Influencing	What is in this new proposal for us	
Proposal Development and Evaluation, Influencing	Request Project Funding/Budget Artefact	
Influencing and Negotiation	**Influencing and Negotiation**	**Justify, Emphasize, Make, Feel, Communicate, Rally, Offer, Interpret, Provide, Direct, Answer, Clarify, Suggest, Lack, Commit, Request, Understand, Explain, Value, Make Explicit, Lead, Demonstrate, Seek, Build, Have, Work, Influence, Entice, Tempt, Deflect, Soften Suggest, Try, Temper, Clarify, Communicate, Adopt**
Influencing and Negotiation	Justify answer given, to emphasize credibility	

Table F.1 Second-level themes, First-level themes, Action verbs (cont'd)

Influencing and Negotiation	Making the partners feel that the proposal is in their best interest	
Influencing and Negotiation	Communicate to rally internal support	
Influencing and Negotiation	Offering interpretations	
Influencing and Negotiation	Providing direction without answering a clarification question	
Influencing and Negotiation	Partner suggesting solution without other partner given disengaging offer, lack of commitment	
Influencing and Negotiation	Requesting an understanding of what is in it for the third partner, their motivation	
Influencing and Negotiation	Explaining why an option has more value than another	
Influencing and Negotiation	Making explicit the implicit reason behind strong opinion	
Influencing and Negotiation	Leading the person of interest by hand to the water	
Influencing and Negotiation	New Partner suggesting one to one discussions with other partners and excluding others	
Influencing and Negotiation	Demonstrating progress	
Influencing and Negotiation	Seeking to build value, justify, having a convenience partner onboard	
Influencing and Negotiation	Please work with me, I'm leading	
Influencing and Negotiation	Influencing	
Influencing and Negotiation	Enticing	

Table F.1 Second-level themes, First-level themes, Action verbs (cont'd)

Influencing and Negotiation	Tempting the collaborator with potential rewards	
Influencing and Negotiation	Deflecting issue to experts	
Influencing and Negotiation	Polite suggestion of alternative	
Influencing and Negotiation	Indirectly trying to temper moods and clarify negotiation stance	
Influencing and Negotiation	Partner trying to influence the project to give them an advantage	
Influencing and Negotiation	IP position influenced internally by internal SMEs suggestions to soften position	
Influencing and Negotiation	Communicating that the efforts are not significant to tempt adoption of proposal	
Interpersonal Dynamics, Influencing, and Resource Management	**Interpersonal Dynamics, Influencing, and Resource Management**	**Request, Help, Demonstrate, Take, Put, Commit, Inform, Keep, Focus, Make, Summarize, Try, Convince, Express, Want, Understand, Need, Share, Introduce, Criticize, Communicate, Build, Involve, Use, Greet, Re-engage, Flexible**
Interpersonal Dynamics, Influencing, and Resource Management	Requesting guidance from experts	
Interpersonal Dynamics, Influencing, and Resource Management	I can help you but I need your inputs	
Interpersonal Dynamics, Influencing, and Resource Management	I will need help to complete the action you expect from me	
Interpersonal Dynamics, Influencing, and Resource Management	Demonstrating interest in considering others' interests	
Interpersonal Dynamics, Influencing, and Resource Management	Taking ownership of the process	

Table F.1 Second-level themes, First-level themes, Action verbs (cont’d)

Interpersonal Dynamics, Influencing, and Resource Management	Putting the person with limits on the spot to have them commit to an agreed timeframe	
Interpersonal Dynamics, Influencing, and Resource Management	Inform	
Interpersonal Dynamics, Influencing, and Resource Management	Let's keep focus on our objectives	
Interpersonal Dynamics, Influencing, and Resource Management	Making sure of common understanding	
Interpersonal Dynamics, Influencing, and Resource Management	Summarizing discussions	
Interpersonal Dynamics, Influencing, and Resource Management	Try to convince potential partners to collaborate	
Interpersonal Dynamics, Influencing, and Resource Management	Express surprise	
Interpersonal Dynamics, Influencing, and Resource Management	Want to understand, need information	
Interpersonal Dynamics, Influencing, and Resource Management	Taking back ownership	
Interpersonal Dynamics, Influencing, and Resource Management	Sharing information on the next steps	
Interpersonal Dynamics, Influencing, and Resource Management	Introducing formally new project resource to main stakeholders	
Interpersonal Dynamics, Influencing, and Resource Management	Requesting feedback on the artefact	
Interpersonal Dynamics, Influencing, and Resource Management	Criticizing	
Interpersonal Dynamics, Influencing, and Resource Management	Indirectly communicating frustration with facilitating organization process	
Interpersonal Dynamics, Influencing, and Resource Management	Building relationship with new Point of Contact (POC)	
Interpersonal Dynamics, Influencing, and Resource Management	Building relationship with partner outside of the current collaboration	

Table F.1 Second-level themes, First-level themes, Action verbs (cont'd)

Interpersonal Dynamics, Influencing, and Resource Management	Building relationship through involvement in action	
Interpersonal Dynamics, Influencing, and Resource Management	Ensuring coordination of efforts of partner organization	
Interpersonal Dynamics, Influencing, and Resource Management	Using formal greetings after tough negotiations	
Interpersonal Dynamics, Influencing, and Resource Management	Partner demonstrating re-engagement	
Interpersonal Dynamics, Influencing, and Resource Management	Being flexible with logistics	
Participation and Seeking and Encouraging Involvement	**Participation and Seeking and Encouraging Involvement**	**Suggest, Give, Please, Support, Invite, Involve, Solicit, Propose, Request, Offer, Communicate**
Participation and Seeking and Encouraging Involvement	Suggesting advancements	
Participation and Seeking and Encouraging Involvement	Give positive feedback	
Participation and Seeking and Encouraging Involvement	Pleased to support	
Participation and Seeking and Encouraging Involvement	Inviting participation	
Participation and Seeking and Encouraging Involvement	Involving new stakeholder who may have interest in the project	
Participation and Seeking and Encouraging Involvement	Soliciting support of event given relationship on adjacent project	
Participation and Seeking and Encouraging Involvement	Soliciting additional SMEs for support	
Participation and Seeking and Encouraging Involvement	Soliciting a new partner in the background	
Participation and Seeking and Encouraging Involvement	Proposing help	
Participation and Seeking and Encouraging Involvement	Requesting help to move the project forward	

Table F.1 Second-level themes, First-level themes, Action verbs (cont’d)

Participation and Seeking and Encouraging Involvement	Requesting for support with convincing argument	
Participation and Seeking and Encouraging Involvement	Offering support	
Participation and Seeking and Encouraging Involvement	Not my fault this is not complete	
Participation and Seeking and Encouraging Involvement	Opinion communicated bluntly	
Setting and Clarifying Expectations, and Providing Guidance	**Setting and Clarifying Expectations, and Providing Guidance**	**Emphasize, Set, Brainstorm, Propose, Provide, Explain**
Setting and Clarifying Expectations, and Providing Guidance	Emphasize expectations	
Setting and Clarifying Expectations, and Providing Guidance	Setting support expectations	
Setting and Clarifying Expectations, and Providing Guidance	Setting expectations	
Setting and Clarifying Expectations, and Providing Guidance	Setting expectations on review process	
Setting and Clarifying Expectations, and Providing Guidance	Setting partners' expectations and providing options	
Setting and Clarifying Expectations, and Providing Guidance	Brainstorming solution with boss before proposing	
Setting and Clarifying Expectations, and Providing Guidance	Partner providing guidance	
Setting and Clarifying Expectations, and Providing Guidance	Explaining how a new stakeholder adds value to the project	
Setting and Clarifying Expectations, and Providing Guidance	Explaining benefits of supporting the arguer's opinion	

Table F.1 Second-level themes, First-level themes, Action verbs (cont'd)

Negotiations Dynamics and Strategy, Communication and Discussions	**Negotiations Dynamics and Strategy, Communication and Discussions**	**Communicate, Exchange, Share, Disagree, Concern, Request, Clarify, Provide, Direct, Guide, Question, Inform, Run, Highlight, Need, Reassure, Negotiate, Propose, Give, Follow Up, Start, Review, Consider, Commit, Suggest, Promote, Exchange, Facilitate, Think, Express, Retract, Let, Continue, Request, Advise, Get, Respond, Send, Invite**
Negotiations Dynamics and Strategy, Communication and Discussions	Communicating artefact which reflects last discussions on IP negotiations	
Negotiations Dynamics and Strategy, Communication and Discussions	Exchanging artefact to freely share information	
Negotiations Dynamics and Strategy, Communication and Discussions	Communicating operating constraints	
Negotiations Dynamics and Strategy, Communication and Discussions	Communicating disagreement with artefact proposed by partners	
Negotiations Dynamics and Strategy, Communication and Discussions	Communicating concern with future challenges if no change to the artefact	
Negotiations Dynamics and Strategy, Communication and Discussions	Requesting clarifications on partners' position during negotiations	
Negotiations Dynamics and Strategy, Communication and Discussions	Providing technical directions for project scope	
Negotiations Dynamics and Strategy, Communication and Discussions	Requesting guidance from partner	
Negotiations Dynamics and Strategy, Communication and Discussions	Question with action intent	
Negotiations Dynamics and Strategy, Communication and Discussions	Requesting information to move with project funds funding entity	
Negotiations Dynamics and Strategy, Communication and Discussions	Highlighting the need to inform other negotiating parties with our clear position on what we cannot accept	
Negotiations Dynamics and Strategy, Communication and Discussions	Indirectly highlighting constraints	

Table F.1 Second-level themes, First-level themes, Action verbs (cont'd)

Negotiations Dynamics and Strategy, Communication and Discussions	Need more information to reassure stakeholders of complementarity of projects	
Negotiations Dynamics and Strategy, Communication and Discussions	Announcing change to partners	
Negotiations Dynamics and Strategy, Communication and Discussions	Negotiation strategy	
Negotiations Dynamics and Strategy, Communication and Discussions	Propose meeting timeframe	
Negotiations Dynamics and Strategy, Communication and Discussions	Giving heads-up	
Negotiations Dynamics and Strategy, Communication and Discussions	Do follow-up	
Negotiations Dynamics and Strategy, Communication and Discussions	Start with a short term interim collaboration with one partner only	
Negotiations Dynamics and Strategy, Communication and Discussions	We'll give your proposal a chance, we will review and consider it	
Negotiations Dynamics and Strategy, Communication and Discussions	Not ready to commit yet	
Negotiations Dynamics and Strategy, Communication and Discussions	Suggesting an alternative	
Negotiations Dynamics and Strategy, Communication and Discussions	Give heads-up and commit to follow-up	
Negotiations Dynamics and Strategy, Communication and Discussions	Promoting exchange of an already proven artefact to facilitate negotiations	
Negotiations Dynamics and Strategy, Communication and Discussions	Thinking of alternative solutions	
Negotiations Dynamics and Strategy, Communication and Discussions	Express flexibility in timeframe for meeting	
Negotiations Dynamics and Strategy, Communication and Discussions	Retract and let-suggest other people continue the work	
Negotiations Dynamics and Strategy, Communication and Discussions	Propose additional meeting	

Table F.1 Second-level themes, First-level themes, Action verbs (cont'd)

Negotiations Dynamics and Strategy, Communication and Discussions	Suggesting moving forward with actions based on understanding	
Negotiations Dynamics and Strategy, Communication and Discussions	Requesting support and advice from expert	
Negotiations Dynamics and Strategy, Communication and Discussions	Not providing specific timeframe to get back to the negotiating party	
Negotiations Dynamics and Strategy, Communication and Discussions	Not providing timely information	
Negotiations Dynamics and Strategy, Communication and Discussions	Responding to request	
Negotiations Dynamics and Strategy, Communication and Discussions	Sending a reminder to sent artefact	
Negotiations Dynamics and Strategy, Communication and Discussions	Sharing information on the next steps	
Negotiations Dynamics and Strategy, Communication and Discussions	Requesting feedback on the artefact	
Negotiations Dynamics and Strategy, Communication and Discussions	Informing all project stakeholders	
Negotiations Dynamics and Strategy, Communication and Discussions	Requesting feedback on directive proposal	
Negotiations Dynamics and Strategy, Communication and Discussions	Invitation to other parties to give feedback on message	
Negotiation and Strategy and Internal Dynamics	**Negotiation and Strategy and Internal Dynamics**	**Face, Explain, Delegate, Question, Authorize, Spend, Take, Move, Communicate, Influence, Hold, Accountable, Forecast, Try, Understand, Negotiate, Meet, Propose, Facilitate**
Negotiation and Strategy and Internal Dynamics	Face to face helpful	
Negotiation and Strategy and Internal Dynamics	Explaining reason behind modifications to artefact	
Negotiation and Strategy and Internal Dynamics	Delegating to specialized resources during tough negotiations	

Table F.1 Second-level themes, First-level themes, Action verbs (cont'd)

Negotiation and Strategy and Internal Dynamics	Questioning the strategy related to funding, authorize spend based on available budget or authorize budget based on received scope estimates	
Negotiation and Strategy and Internal Dynamics	Partners specialized resource boss taking lead to move negotiations forward and communicating directly with boss on industry side	
Negotiation and Strategy and Internal Dynamics	Influencing internal stakeholders by holding them accountable	
Negotiation and Strategy and Internal Dynamics	Forecast	
Negotiation and Strategy and Internal Dynamics	Trying to understand internally the partner offer without the partner's implication	
Negotiation and Strategy and Internal Dynamics	Trying to negotiate, meet in the middle	
Communicate, Inform, and Provide Updates	**Communicate, Inform, and Provide Updates**	**Communicate, Summarize, Share, Provide, Update, Set, Cause, Delay, Prioritize, Constrain, Suggest, Inform, Take, Update, Announce, Follow, Confirm, Commit, Send, Request, Show, Look forward, Invite, Highlight, Play, Reaffirm, Reassure, Propose, Discuss**
Communicate, Inform, and Provide Updates	Communicating Funding/Budget Information on Project	
Communicate, Inform, and Provide Updates	Communicating artefact with new project set-up	
Communicate, Inform, and Provide Updates	Communicating success	
Communicate, Inform, and Provide Updates	Summarizing progress to stakeholders	
Communicate, Inform, and Provide Updates	Communicating a summary artefact to facilitate understanding of IP set-up	
Communicate, Inform, and Provide Updates	Sharing information on project set-up at the partners organization	

Table F.1 Second-level themes, First-level themes, Action verbs (cont’d)

Communicate, Inform, and Provide Updates	Sharing information reflecting conversation	
Communicate, Inform, and Provide Updates	Sharing information to facilitate support request	
Communicate, Inform, and Provide Updates	Providing status	
Communicate, Inform, and Provide Updates	Providing information on the artefact	
Communicate, Inform, and Provide Updates	Providing updated artefact and setting expectations	
Communicate, Inform, and Provide Updates	New project resource, cause of delay	
Communicate, Inform, and Provide Updates	New project team priorities constraints	
Communicate, Inform, and Provide Updates	New resource communicating progress	
Communicate, Inform, and Provide Updates	New resource communicating next steps	
Communicate, Inform, and Provide Updates	New Partner suggesting new consortium set-up	
Communicate, Inform, and Provide Updates	Informing stakeholders of action to be taken	
Communicate, Inform, and Provide Updates	Informing new resource on progress of negotiations	
Communicate, Inform, and Provide Updates	Informing new resource of project history and context	
Communicate, Inform, and Provide Updates	Communicating availability	
Communicate, Inform, and Provide Updates	Communicating constraints	
Communicate, Inform, and Provide Updates	Updating internal stakeholders on progress	
Communicate, Inform, and Provide Updates	Announcing change to partners	

Table F.1 Second-level themes, First-level themes, Action verbs (cont’d)

Communicate, Inform, and Provide Updates	Partner following up on artefact status	
Communicate, Inform, and Provide Updates	Confirm taking action as required	
Communicate, Inform, and Provide Updates	Confirm and commit to follow-up	
Communicate, Inform, and Provide Updates	Send reminder	
Communicate, Inform, and Provide Updates	Request confirmation	
Communicate, Inform, and Provide Updates	Justify request of information	
Communicate, Inform, and Provide Updates	Send clarifications	
Communicate, Inform, and Provide Updates	Send information requested	
Communicate, Inform, and Provide Updates	Showing progress	
Communicate, Inform, and Provide Updates	Send final document for review	
Communicate, Inform, and Provide Updates	Looking forward to working with you	
Communicate, Inform, and Provide Updates	Invitation to workout project artefacts and logistics	
Communicate, Inform, and Provide Updates	Highlighting potential issue	
Communicate, Inform, and Provide Updates	Playing down the differences in scope between partners to positively impact the collaboration structure	
Communicate, Inform, and Provide Updates	Open to discuss	
Communicate, Inform, and Provide Updates	Professional communication	

Table F.1 Second-level themes, First-level themes, Action verbs (cont'd)

Communicate, Inform, and Provide Updates	Indirectly reaffirming	
Communicate, Inform, and Provide Updates	Reassuring through sharing of information on progress	
Communicate, Inform, and Provide Updates	Proposing a contact point	
Communicate, Inform, and Provide Updates	Informal discussions	
Communicate, Inform, and Provide Updates	Informing stakeholder second-hand	
Informing and Directing, Enable Action through Information and Artefacts	**Informing and Directing, Enable Action through Information and Artefacts**	**Communicate, Inform, Exchange, Provide, Enable, Act, Demonstrate, Engage, Direct, Keep, Share, Offer, Help, Request, Clarify, Give, Facilitate, Solicit, Rephrase, Confirm, Acknowledge, Receipt**
Informing and Directing, Enable Action through Information and Artefacts	Communicate-Inform	
Informing and Directing, Enable Action through Information and Artefacts	Informing	
Informing and Directing, Enable Action through Information and Artefacts	Exchanging artefact	
Informing and Directing, Enable Action through Information and Artefacts	Providing information	
Informing and Directing, Enable Action through Information and Artefacts	Communicate information to enable other people to act	
Informing and Directing, Enable Action through Information and Artefacts	Informing of progress	
Informing and Directing, Enable Action through Information and Artefacts	Communicate information as a reminder and enabler for taking action	
Informing and Directing, Enable Action through Information and Artefacts	Informing, demonstrating engagement	
Informing and Directing, Enable Action through Information and Artefacts	Providing directions	
Informing and Directing, Enable Action through Information and Artefacts	Keeping key stakeholders informed of important information	

Table F.1 Second-level themes, First-level themes, Action verbs (cont’d)

Informing and Directing, Enable Action through Information and Artefacts	Sharing information	
Informing and Directing, Enable Action through Information and Artefacts	Informing additional stakeholders	
Informing and Directing, Enable Action through Information and Artefacts	Offering a useful artefact, info, to help with this and future projects	
Informing and Directing, Enable Action through Information and Artefacts	Communicate conclusions of discussions	
Informing and Directing, Enable Action through Information and Artefacts	Request clarification	
Informing and Directing, Enable Action through Information and Artefacts	Providing feedback	
Informing and Directing, Enable Action through Information and Artefacts	Communicating artefacts to facilitate exchange of information	
Informing and Directing, Enable Action through Information and Artefacts	Communicating new information to solicit attention and action	
Informing and Directing, Enable Action through Information and Artefacts	Communicating an artefact	
Informing and Directing, Enable Action through Information and Artefacts	Rephrase to clarify understanding	
Informing and Directing, Enable Action through Information and Artefacts	Confirming understanding	
Informing and Directing, Enable Action through Information and Artefacts	Acknowledging receipt of information	
Informing and Directing, Enable Action through Information and Artefacts	Communicating artefact with with parties inputs and comments	
Feedback and Advice on Artefacts, Progress and Updates	**Feedback and Advice on Artefacts, Progress and Updates**	**Provide, Request, Need, Share, Make, Keep, Inform, Run, Recommend, Ensure, Copy, Meet, Look Forward, Talk, Follow Up**
Feedback and Advice on Artefacts, Progress and Updates	Providing feedback on the artefact	
Feedback and Advice on Artefacts, Progress and Updates	Providing feedback on the progress summary	

Table F.1 Second-level themes, First-level themes, Action verbs (cont’d)

Feedback and Advice on Artefacts, Progress and Updates	Providing feedback with caveats	
Feedback and Advice on Artefacts, Progress and Updates	Requesting feedback on impact of new information	
Feedback and Advice on Artefacts, Progress and Updates	Need your expertise	
Feedback and Advice on Artefacts, Progress and Updates	Informal sharing of progress on negotiations	
Feedback and Advice on Artefacts, Progress and Updates	I made the network aware of the situation	
Feedback and Advice on Artefacts, Progress and Updates	I'll keep you informed and run the recommendations by you once I have more info	
Feedback and Advice on Artefacts, Progress and Updates	Facilitator organization making sure that all parties are informed, copied on project status	
Feedback and Advice on Artefacts, Progress and Updates	Informal meetings	
Feedback and Advice on Artefacts, Progress and Updates	Meet	
Feedback and Advice on Artefacts, Progress and Updates	Looking forward to talking	
Feedback and Advice on Artefacts, Progress and Updates	Follow up on discussion in writing	
Exploring Constraints, Seeking Clarification and Information	**Exploring Constraints, Seeking Clarification and Information**	**Can, Do, Request, Seek, Understand**
Exploring Constraints, Seeking Clarification and Information	What can you do considering your limitations	
Exploring Constraints, Seeking Clarification and Information	Request additional information for internal purposes	
Exploring Constraints, Seeking Clarification and Information	Requesting clarification on obligations from PM	
Exploring Constraints, Seeking Clarification and Information	Requesting information on project status	

Table F.1 Second-level themes, First-level themes, Action verbs (cont’d)

Exploring Constraints, Seeking Clarification and Information	Seeking opinion	
Exploring Constraints, Seeking Clarification and Information	Seeking understanding of the partner's proposal	
Exploring Constraints, Seeking Clarification and Information	Requesting feedback on proposed date	
Artefacts, Information and Resource Sharing	**Artefacts, Information and Resource Sharing**	**Communicate, Exchange, Propose, Inform, Request, Suggest, Provide, Clarify, Expect, Involve, Need**
Artefacts, Information and Resource Sharing	Communicating through an artefact, e-mail, and documents	
Artefacts, Information and Resource Sharing	Exchanging artefacts on adjacent project	
Artefacts, Information and Resource Sharing	Proposing an artefact to accelerate progress	
Artefacts, Information and Resource Sharing	Informing while requesting information	
Artefacts, Information and Resource Sharing	Informing and suggesting action at the same time	
Artefacts, Information and Resource Sharing	Providing complementary information	
Artefacts, Information and Resource Sharing	Providing template	
Artefacts, Information and Resource Sharing	Informing partner of expert's opinion	
Artefacts, Information and Resource Sharing	Internally clarifying proposal scope	
Artefacts, Information and Resource Sharing	Providing an artifact and by default expecting it to be adopted by partners	
Artefacts, Information and Resource Sharing	Providing an artifact as a team	
Artefacts, Information and Resource Sharing	Providing artifact elements	

Table F.1 Second-level themes, First-level themes, Action verbs (cont'd)

Artefacts, Information and Resource Sharing	Providing context	
Artefacts, Information and Resource Sharing	Providing information in support of actions taken	
Artefacts, Information and Resource Sharing	New Partner suggesting that they are ready, and that others are not	
Artefacts, Information and Resource Sharing	New project resource needs more than an e-mail forward to understand the project	
Artefacts, Information and Resource Sharing	Need more information	
Artefacts, Information and Resource Sharing	Need to involve others	
Requesting and Providing Information Clarifications and Advice	**Requesting and Providing Information Clarifications and Advice**	**Justify, Request, Affirm, Send, Seek, Highlight, Make, Coordinate, Provide, Facilitate, Show**
Requesting and Providing Information Clarifications and Advice	Justify request of information	
Requesting and Providing Information Clarifications and Advice	Requesting information and affirming engagement	
Requesting and Providing Information Clarifications and Advice	Requesting clarification on procedure and scope	
Requesting and Providing Information Clarifications and Advice	Sending a ping reminder	
Requesting and Providing Information Clarifications and Advice	Seeking clarification on new proposal, given the different internal interpretation of the offer	
Requesting and Providing Information Clarifications and Advice	Requesting clarification on the value, cost of the proposal	
Requesting and Providing Information Clarifications and Advice	Seeking information on the true value of a proposed deal highlighting added value	

Table F.1 Second-level themes, First-level themes, Action verbs (cont’d)

Requesting and Providing Information Clarifications and Advice	Justify request of information	
Requesting and Providing Information Clarifications and Advice	Requesting guidance	
Requesting and Providing Information Clarifications and Advice	Requesting advice	
Requesting and Providing Information Clarifications and Advice	Requesting support and advice from expert	
Requesting and Providing Information Clarifications and Advice	Requesting inputs	
Requesting and Providing Information Clarifications and Advice	Making recommendations to expert to accelerate the process	
Requesting and Providing Information Clarifications and Advice	Internal facilitator seeking information and coordinating stakeholders	
Requesting and Providing Information Clarifications and Advice	Requesting artefact to use for guidance	
Requesting and Providing Information Clarifications and Advice	Providing new useful information to facilitate and show interest	
Expressing Intentions to Support, Promote Understanding	**Expressing Intentions to Support, Promote Understanding**	**Seek, Emphasize, Make, Communicate, Clarify, Express, Understand, Summarize, Help, Wish, Advance, Wait, Confirm, Hope, Need, Transarency, Disengage**
Expressing Intentions to Support, Promote Understanding	Seeking internal support	
Expressing Intentions to Support, Promote Understanding	Seeking understanding	
Expressing Intentions to Support, Promote Understanding	Emphasize importance	
Expressing Intentions to Support, Promote Understanding	Make assumptions	
Expressing Intentions to Support, Promote Understanding	Emphasize understanding	
Expressing Intentions to Support, Promote Understanding	Make constructive suggestions	

Table F.1 Second-level themes, First-level themes, Action verbs (cont’d)

Expressing Intentions to Support, Promote Understanding	Communicate Limits and Constraints	
Expressing Intentions to Support, Promote Understanding	Clarifying proposal scope	
Expressing Intentions to Support, Promote Understanding	Express uncertainty	
Expressing Intentions to Support, Promote Understanding	We now understand	
Expressing Intentions to Support, Promote Understanding	Summarizing understanding of the situation	
Expressing Intentions to Support, Promote Understanding	We will help	
Expressing Intentions to Support, Promote Understanding	We wish to work with you	
Expressing Intentions to Support, Promote Understanding	We've advanced, we're waiting for them	
Expressing Intentions to Support, Promote Understanding	We have advanced on our side, have you	
Expressing Intentions to Support, Promote Understanding	We confirm our interest if collaborating with you in the future	
Expressing Intentions to Support, Promote Understanding	We hope you understand	
Expressing Intentions to Support, Promote Understanding	We need your support	
Expressing Intentions to Support, Promote Understanding	Transparency on limits of own expertise	
Expressing Intentions to Support, Promote Understanding	Communicating bad, disengaging news	

Table F.1 Second-level themes, First-level themes, Action verbs (cont'd)

Stakeholder Engagement, Building and Demonstrating Trust	**Stakeholder Engagement, Building and Demonstrating Trust**	**Demonstrate, Strengthen, Leverage, Confirm, Guide, Encourage, Request, Promote, Offer, Provide, Extend, Direct, Delegate, Participate, Communicate, Support, Seek, Show, Reassure, Accelerate, Partner, Set, Interpret, Suggest**
Stakeholder Engagement, Building and Demonstrating Trust	My part, your part	
Stakeholder Engagement, Building and Demonstrating Trust	Demonstrate Trust	
Stakeholder Engagement, Building and Demonstrating Trust	Strengthening relationship through adjacent activities	
Stakeholder Engagement, Building and Demonstrating Trust	Leveraging stories to discover insights	
Stakeholder Engagement, Building and Demonstrating Trust	Confirm background action taken	
Stakeholder Engagement, Building and Demonstrating Trust	Guide	
Stakeholder Engagement, Building and Demonstrating Trust	Encouraging	
Stakeholder Engagement, Building and Demonstrating Trust	Requesting support	
Stakeholder Engagement, Building and Demonstrating Trust	Promoting exchange of a standard artefact	
Stakeholder Engagement, Building and Demonstrating Trust	Offering support	
Stakeholder Engagement, Building and Demonstrating Trust	Guiding	
Stakeholder Engagement, Building and Demonstrating Trust	Providing guidance through an illustration	
Stakeholder Engagement, Building and Demonstrating Trust	Offering support and extending invitation to contact stakeholder	
Stakeholder Engagement, Building and Demonstrating Trust	Direction	

Table F.1 Second-level themes, First-level themes, Action verbs (cont’d)

Stakeholder Engagement, Building and Demonstrating Trust	Delegate	
Stakeholder Engagement, Building and Demonstrating Trust	Confirm meeting participation	
Stakeholder Engagement, Building and Demonstrating Trust	Communicate availability	
Stakeholder Engagement, Building and Demonstrating Trust	Requesting support and advice from expert	
Stakeholder Engagement, Building and Demonstrating Trust	Support	
Stakeholder Engagement, Building and Demonstrating Trust	Seeking external support	
Stakeholder Engagement, Building and Demonstrating Trust	Showing care about the other party	
Stakeholder Engagement, Building and Demonstrating Trust	Supporting	
Stakeholder Engagement, Building and Demonstrating Trust	Offering support during tough situations	
Stakeholder Engagement, Building and Demonstrating Trust	Reassuring internal stakeholders	
Stakeholder Engagement, Building and Demonstrating Trust	Reassuring of artefact compliance with agreements to accelerate progress	
Stakeholder Engagement, Building and Demonstrating Trust	Providing collaboration artefacts to new team	
Stakeholder Engagement, Building and Demonstrating Trust	Offering support to new team	
Stakeholder Engagement, Building and Demonstrating Trust	Partner requesting guidance	
Stakeholder Engagement, Building and Demonstrating Trust	Providing guidance through examples	
Stakeholder Engagement, Building and Demonstrating Trust	Providing guidance with caveats	
Stakeholder Engagement, Building and Demonstrating Trust	Internal ally providing advice based on history and experience	

Table F.1 Second-level themes, First-level themes, Action verbs (cont'd)

Stakeholder Engagement, Building and Demonstrating Trust	Internal facilitator setting expectations with partners	
Stakeholder Engagement, Building and Demonstrating Trust	Providing interpretations	
Stakeholder Engagement, Building and Demonstrating Trust	Providing guidance and suggesting direction	
Emotions and Emotional Intelligence	**Emotions and Emotional Intelligence**	**Express, Partner, Persevere, Feel, Accept, Reassure, Build, Confirm, Clarify, Apologize, Temper, Demonstrate, Elevate, Communicate, Greet, Overcome, Made, Happen**
Emotions and Emotional Intelligence	Sense of accomplishment	
Emotions and Emotional Intelligence	Express frustration	
Emotions and Emotional Intelligence	Long term thinking	
Emotions and Emotional Intelligence	Partner still engaged even after bad news	
Emotions and Emotional Intelligence	Partner upset that they have been excluded from discussions	
Emotions and Emotional Intelligence	Express Surprise	
Emotions and Emotional Intelligence	Express humbleness	
Emotions and Emotional Intelligence	Perseverance in pursuing collaboration	
Emotions and Emotional Intelligence	Politeness with new resource	
Emotions and Emotional Intelligence	Polite request for action	
Emotions and Emotional Intelligence	Positivity	
Emotions and Emotional Intelligence	Gentleness	

Table F.1 Second-level themes, First-level themes, Action verbs (cont’d)

Emotions and Emotional Intelligence	Feeling guilty	
Emotions and Emotional Intelligence	Feeling of being excluded	
Emotions and Emotional Intelligence	Humbly accepting being corrected	
Emotions and Emotional Intelligence	Express humbleness	
Emotions and Emotional Intelligence	Uncertainty	
Emotions and Emotional Intelligence	Express (best) wishes	
Emotions and Emotional Intelligence	Express hope	
Emotions and Emotional Intelligence	Express commitment	
Emotions and Emotional Intelligence	Express interest	
Emotions and Emotional Intelligence	Express desire to keep in touch - future exchanges	
Emotions and Emotional Intelligence	Reassuring	
Emotions and Emotional Intelligence	Building goodwill	
Emotions and Emotional Intelligence	Building relationship	
Emotions and Emotional Intelligence	Express disappointment-dissatisfaction	
Emotions and Emotional Intelligence	Confirm-clarify doubts-uncertainty	
Emotions and Emotional Intelligence	Express excuses	
Emotions and Emotional Intelligence	Apologize	

Table F.1 Second-level themes, First-level themes, Action verbs (cont’d)

Emotions and Emotional Intelligence	Indirectly trying to temper moods and clarify negotiation stance	
Emotions and Emotional Intelligence	Feeling vindicated	
Emotions and Emotional Intelligence	Demonstrating goodwill	
Emotions and Emotional Intelligence	Demonstrating agreement	
Emotions and Emotional Intelligence	Apologizing for delay	
Emotions and Emotional Intelligence	Apologies for delays in communications	
Emotions and Emotional Intelligence	Express excitement	
Emotions and Emotional Intelligence	Politeness	
Emotions and Emotional Intelligence	Apologizing	
Emotions and Emotional Intelligence	Elevating the relationship	
Emotions and Emotional Intelligence	Express satisfaction	
Emotions and Emotional Intelligence	Honest communication	
Emotions and Emotional Intelligence	Expressing gratitude	
Emotions and Emotional Intelligence	Personal Greetings	
Emotions and Emotional Intelligence	Message to partners, it was difficult, run through overcome obstacles, we made it happen together	

Table F.1 Second-level themes, First-level themes, Action verbs (cont’d)

Recognition and Respect	**Recognition and Respect**	**Recognize, Elevate, Respect, Reiterate, Congratulate, Give, Highlight**
Recognition and Respect	Recognition of efforts and expertise	
Recognition and Respect	Recognition of the partner's expertise	
Recognition and Respect	Elevating the relationship	
Recognition and Respect	Respect the track record of stakeholders	
Recognition and Respect	Recognizing the partner's interest in the collaboration	
Recognition and Respect	Partner reiterating his confidence in his resources after verbal discussion with partners got emotional between the parties	
Recognition and Respect	Reiterating in writing the will to collaborate	
Recognition and Respect	Congratulate for the work done	
Recognition and Respect	Give credit for the work done	
Recognition and Respect	Highlighting an achievement	
Recognition and Respect	Respect	
Challenges and Concerns	**Challenges and Concerns**	**Communicate, Send, Follow, Assure, Lack, Highlight, Express, Understand, Seek**
Challenges and Concerns	Communicating frustration with process	
Challenges and Concerns	Communicating understanding of discussions for confirmation	
Challenges and Concerns	Sending reminder and request action to be taken	

Table F.1 Second-level themes, First-level themes, Action verbs (cont’d)

Challenges and Concerns	Transparency why we're late	
Challenges and Concerns	Following up internally on artefact	
Challenges and Concerns	Following up on a new collaboration starting from the same e-mail thread as current collaboration discussions	
Challenges and Concerns	No conflict of interest assurance message	
Challenges and Concerns	Lack of greetings after communicating bad news	
Challenges and Concerns	Horror story of multi-party collaboration yielding zero outcomes except great travel and meetings	
Challenges and Concerns	Highlight lack of key artefact	
Challenges and Concerns	Highlighting misunderstanding in good faith	
Challenges and Concerns	Internal stakeholder Not excited about finding out about this project	
Challenges and Concerns	Internally expressing frustration with partners' proposal	
Challenges and Concerns	Highlighting a challenging task	
Challenges and Concerns	I understand	
Challenges and Concerns	New project resource seeking clarifications on project scope	
Challenges and Concerns	Internal facilitator seeking information on internal practices and procedures	
Challenges and Concerns	Here is what is in the collaboration for this partner	

Table F.1 Second-level themes, First-level themes, Action verbs (cont'd)

Challenges and Conflict Management	**Challenges and Conflict Management**	**Deliberate, Communicate, Blame, Inform, Seize, Facilitate, Introduce, Suggest, Reject, Communicate, Exclude, Express, Lack, Explain, Highlight, Identify, Seek, Negotiate, Propose**
Challenges and Conflict Management	Internal deliberation on the value of continuing the collaboration in its current form	
Challenges and Conflict Management	Partner specialized resource communicating bad news to funding entity, blaming industrial partner, not informing industrial partner	
Challenges and Conflict Management	Person facilitating giving the recommended answer to be returned officially back to him for official records	
Challenges and Conflict Management	Introduction of new project team	
Challenges and Conflict Management	Introductions of new stakeholder	
Challenges and Conflict Management	Suggesting alternatives	
Challenges and Conflict Management	Rejection but honest on why	
Challenges and Conflict Management	Indirectly communicating frustration with process	
Challenges and Conflict Management	Excluding stakeholder from communications	
Challenges and Conflict Management	Not communicating reason behind constraint	
Challenges and Conflict Management	Express doubts	
Challenges and Conflict Management	Lack of greetings during the last miles	
Challenges and Conflict Management	Explaining the reason behind the confusion	

Table F.1 Second-level themes, First-level themes, Action verbs (cont'd)

Challenges and Conflict Management	Highlighting differences and suggesting that perhaps there is a common ground	
Challenges and Conflict Management	Identifying problems and seeking advice	
Challenges and Conflict Management	Negotiating	
Challenges and Conflict Management	Explaining limitations	
Challenges and Conflict Management	Do not accept meeting, but propose new timeframe	
Partner and Stakeholder Engagement Dynamics	**Partner and Stakeholder Engagement Dynamics**	**Communicate, Share, Provide, Request, Take, Move, Inform, Keep**
Partner and Stakeholder Engagement Dynamics	Communicating good news	
Partner and Stakeholder Engagement Dynamics	Sharing good news with internal stakeholders	
Partner and Stakeholder Engagement Dynamics	Sharing information with all partners	
Partner and Stakeholder Engagement Dynamics	Sharing good news	
Partner and Stakeholder Engagement Dynamics	Sharing accomplishment with internal stakeholders	
Partner and Stakeholder Engagement Dynamics	Sharing information with internal stakeholders to gauge interest in collaborating	
Partner and Stakeholder Engagement Dynamics	Providing advice on how to collaborate	
Partner and Stakeholder Engagement Dynamics	Partner communicating the interest of another partner to collaborate	
Partner and Stakeholder Engagement Dynamics	Requesting support and advice from partner on the next steps	

Table F.1 Second-level themes, First-level themes, Action verbs (cont’d)

Partner and Stakeholder Engagement Dynamics	Partners specialized resource boss taking lead to move negotiations forward and communicating directly with boss on industry side	
Partner and Stakeholder Engagement Dynamics	Industrial partner with, this is our final offer type, but let's put that out to our partners in nicer words	
Partner and Stakeholder Engagement Dynamics	Informing external facilitator on other partners' interests to collaborate	
Partner and Stakeholder Engagement Dynamics	Informing external facilitator that we have selected a new organization and new project set-up	
Partner and Stakeholder Engagement Dynamics	Keep the communication channel open	
Partner and Stakeholder Engagement Dynamics	Keeping partners informed of changes to the team	
Partnership Dynamics, Design	**Partnership Dynamics, Design**	**Design, Discuss, Upset, Exclude, Commit, Build, Facilitate, Contact, Prompt, Inform**
Partnership Dynamics, Design	Partner designing the collaboration to meet consortium requirements without consulting with other partners	
Partnership Dynamics, Design	Partner discussing internally other collaboration options and not sharing with rest	
Partnership Dynamics, Design	Partner upset that they have been excluded from discussions	
Partnership Dynamics, Design	Partner discussing internally that they are not fully committed to collaborating with one of the other partners	
Partnership Dynamics, Design	Building relationship through involvement in action	
Partnership Dynamics, Design	Indirectly prompting action	

Table F.1 Second-level themes, First-level themes, Action verbs (cont'd)

Partnership Dynamics, Design	Indirectly informing of leadership role on adjacent project	
Partnership Dynamics, Design	Facilitating organization contacting the project hierarchy team	
Internal Negotiation Dynamics and Accountability	**Internal Negotiation Dynamics and Accountability**	**Discuss, Communicate, Provide, Tempt**
Internal Negotiation Dynamics and Accountability	Internal Not my action, it is your action	
Internal Negotiation Dynamics and Accountability	Internal discussions on our position on IP, communicating through an artefact, e-mail, and documents	
Internal Negotiation Dynamics and Accountability	Internal communicating disagreement with artefact proposed by partners	
Internal Negotiation Dynamics and Accountability	Facilitator organization providing standard guidelines	
Internal Negotiation Dynamics and Accountability	Partner discussing internally benefits of potential new collaborator	
Internal Negotiation Dynamics and Accountability	Tempting internal collaborator with potential rewards	
Internal Negotiation Dynamics and Accountability	Internal discussions on the received artefact	
Feedback, Improving, Follow-Up, and Reminding	**Feedback, Improving, Follow-Up, and Reminding**	**Follow, Send, Confirm, Commit, Give, Inform, Complete, Seek, Request, Provide, Explain**
Feedback, Improving, Follow-Up, and Reminding	Partner following up on artefact status	
Feedback, Improving, Follow-Up, and Reminding	Sending a ping reminder	
Feedback, Improving, Follow-Up, and Reminding	Confirm and commit to follow-up	
Feedback, Improving, Follow-Up, and Reminding	Following up on artefact	
Feedback, Improving, Follow-Up, and Reminding	Give heads-up and commit to follow-up	

Table F.1 Second-level themes, First-level themes, Action verbs (cont'd)

Feedback, Improving, Follow-Up, and Reminding	Informing of completed action item	
Feedback, Improving, Follow-Up, and Reminding	Completing artefact	
Feedback, Improving, Follow-Up, and Reminding	Completing action item and informing stakeholder	
Feedback, Improving, Follow-Up, and Reminding	Seeking clarification on constraints	
Feedback, Improving, Follow-Up, and Reminding	Requesting clarification on procedure and process	
Feedback, Improving, Follow-Up, and Reminding	Requesting guidance on artefact from specialized stakeholders in their organization	
Feedback, Improving, Follow-Up, and Reminding	Partner seeking funding/budget information clarification	
Feedback, Improving, Follow-Up, and Reminding	Seeking advice on proposed solution and challenge, in particular IP	
Feedback, Improving, Follow-Up, and Reminding	Requesting feedback on the artefact	
Feedback, Improving, Follow-Up, and Reminding	Providing feedback	
Feedback, Improving, Follow-Up, and Reminding	Expert Providing feedback on artefact	
Feedback, Improving, Follow-Up, and Reminding	Providing feedback on the artefact	
Feedback, Improving, Follow-Up, and Reminding	Request feedback on artefact	
Feedback, Improving, Follow-Up, and Reminding	Give positive feedback	
Feedback, Improving, Follow-Up, and Reminding	Requesting feedback	
Feedback, Improving, Follow-Up, and Reminding	Providing arguments in support of strong opinion	

Table F.1 Second-level themes, First-level themes, Action verbs (cont'd)

Feedback, Improving, Follow-Up, and Reminding	Explaining reason behind modifications to artefact	
Stakeholder Engagement, Mobilizing, Persistence	**Stakeholder Engagement, Mobilizing, Persistence**	**Set, Need, Communicate, Request, Discuss, Accept, Invite, Show, Finish, Wait, Persist, Demonstrate, Mobilize, Remind, Express, Proactive, Build, Re-engage, Propose, Engage, Respond, Accept, Availability, Support, Request**
Stakeholder Engagement, Mobilizing, Persistence	Setting partners' expectations and providing options	
Stakeholder Engagement, Mobilizing, Persistence	We mutliparty collaborations we will need to have separate work packages	
Stakeholder Engagement, Mobilizing, Persistence	Partner communicating interest to collaborate	
Stakeholder Engagement, Mobilizing, Persistence	Partner requesting guidance from facilitator organization	
Stakeholder Engagement, Mobilizing, Persistence	Partner 1 discussing with Partner 2 that Partner 3 wants to collaborate for other reasons than the project itself, which seems to be okay for partners	
Stakeholder Engagement, Mobilizing, Persistence	Partner accepting politely bad news and communicating will to continue relationship	
Stakeholder Engagement, Mobilizing, Persistence	Facilitator organization requesting additional information	
Stakeholder Engagement, Mobilizing, Persistence	Inviting to professional event, sign of goodwill	
Stakeholder Engagement, Mobilizing, Persistence	The show must go on	
Stakeholder Engagement, Mobilizing, Persistence	We finish step 1 will allow us to get to step 2	
Stakeholder Engagement, Mobilizing, Persistence	Setting progress expectations	
Stakeholder Engagement, Mobilizing, Persistence	We've advanced, we're waiting for them	

Table F.1 Second-level themes, First-level themes, Action verbs (cont’d)

Stakeholder Engagement, Mobilizing, Persistence	Urgent but comfortable	
Stakeholder Engagement, Mobilizing, Persistence	Persistence in finding a common time to bring the team together	
Stakeholder Engagement, Mobilizing, Persistence	Project PM demonstrating leadership	
Stakeholder Engagement, Mobilizing, Persistence	Requesting action to be taken by specialized resource	
Stakeholder Engagement, Mobilizing, Persistence	Mobilizing	
Stakeholder Engagement, Mobilizing, Persistence	Reminding team of their commitments	
Stakeholder Engagement, Mobilizing, Persistence	Internal facilitator seeking information and coordinating stakeholders	
Stakeholder Engagement, Mobilizing, Persistence	Expressing engagement and willing to collaborate	
Stakeholder Engagement, Mobilizing, Persistence	Flexibility on logistics	
Stakeholder Engagement, Mobilizing, Persistence	Requesting specialized support within organization	
Stakeholder Engagement, Mobilizing, Persistence	Seeking support	
Stakeholder Engagement, Mobilizing, Persistence	Proactive follow-up on project by funding entity	
Stakeholder Engagement, Mobilizing, Persistence	Proactive follow-up on project of interest by technical lead	
Stakeholder Engagement, Mobilizing, Persistence	Seeking to build value, justify, having a convenience partner onboard	
Stakeholder Engagement, Mobilizing, Persistence	Re-Engaging with partner	
Stakeholder Engagement, Mobilizing, Persistence	It is a person communicating	
Stakeholder Engagement, Mobilizing, Persistence	Act	

Table F.1 Second-level themes, First-level themes, Action verbs (cont'd)

Stakeholder Engagement, Mobilizing, Persistence	Propose support in exchange for collaboration	
Stakeholder Engagement, Mobilizing, Persistence	Partner seeking funding/budget information clarification	
Stakeholder Engagement, Mobilizing, Persistence	Partner demonstrating re-engagement	
Stakeholder Engagement, Mobilizing, Persistence	Partner providing many options to set-up timely discussions	
Stakeholder Engagement, Mobilizing, Persistence	Partner still engaged even after bad news	
Stakeholder Engagement, Mobilizing, Persistence	Pomptly responding to invitation	
Stakeholder Engagement, Mobilizing, Persistence	Accepting Invitation	
Stakeholder Engagement, Mobilizing, Persistence	Availability to support	
Stakeholder Engagement, Mobilizing, Persistence	Requesting artefact from partner even after bad and disengaging news	
Accountability, Conflict Management, Coordination, Strategy	**Accountability, Conflict Management, Coordination, Strategy**	**Help, Celebrate, Remind, Maintain, Coordinate, Facilitate, Confuse, Discord, Discuss, Prioritize, Intercept, Suggest, Give**
Accountability, Conflict Management, Coordination, Strategy	I can personally help as long as it does not affect me personally	
Accountability, Conflict Management, Coordination, Strategy	Not celebrating after good engaging news	
Accountability, Conflict Management, Coordination, Strategy	Celebrating good news	
Accountability, Conflict Management, Coordination, Strategy	Reminding team of responsibilities	
Accountability, Conflict Management, Coordination, Strategy	Maintaining paperwork to date	
Accountability, Conflict Management, Coordination, Strategy	Reminding the partner of own action items	

Table F.1 Second-level themes, First-level themes, Action verbs (cont'd)

Accountability, Conflict Management, Coordination, Strategy	Reminding the team of agreed actions	
Accountability, Conflict Management, Coordination, Strategy	Project leader coordinating parallel efforts	
Accountability, Conflict Management, Coordination, Strategy	Project leaders as facilitators	
Accountability, Conflict Management, Coordination, Strategy	Internal confusion about collaboration project scope and relation to internal efforts	
Accountability, Conflict Management, Coordination, Strategy	Internal discord on commitment to partner A or partner B	
Accountability, Conflict Management, Coordination, Strategy	Let's discuss internally before we talk to the partners and prioritize our short term win	
Accountability, Conflict Management, Coordination, Strategy	Internal discussions on the value of the contribution to the collaboration project	
Accountability, Conflict Management, Coordination, Strategy	Here is our commitment and assumptions requiring your commitments	
Accountability, Conflict Management, Coordination, Strategy	Internal project leader intercepting invitation to discuss project with facilitating organization; Talk to me not the hierarchy of the project	
Accountability, Conflict Management, Coordination, Strategy	Internal SMEs suggesting to soften our position on IP and providing suggestions	
Accountability, Conflict Management, Coordination, Strategy	Giving polite indication for action to be taken (hierarchical request)	
Structure, Manage, and Coordinate	**Structure, Manage, and Coordinate**	**Define, Set, Communicate, Propose, Form, Assemble, Request, Provide, Emphasize, Suggest, Make**
Structure, Manage, and Coordinate	Defining Project Scope Given fluid partnerships discussions	

Table F.1 Second-level themes, First-level themes, Action verbs (cont'd)

Structure, Manage, and Coordinate	Setting expectations on negotiation outcomes	
Structure, Manage, and Coordinate	Set and communicate project objectives	
Structure, Manage, and Coordinate	Proposing a new alternative to accelerate progress	
Structure, Manage, and Coordinate	Proposing alternative to already agreed modification	
Structure, Manage, and Coordinate	Setting facilitator partner expectations and providing options	
Structure, Manage, and Coordinate	New Project Scope	
Structure, Manage, and Coordinate	Form a powerful guiding coalition, assembling people who can work well together	
Structure, Manage, and Coordinate	Requesting guidance	
Structure, Manage, and Coordinate	Providing prompt information	
Structure, Manage, and Coordinate	Set expectations	
Structure, Manage, and Coordinate	Emphasize timeline	
Structure, Manage, and Coordinate	Proposing a way forward	
Structure, Manage, and Coordinate	Suggesting next steps	
Structure, Manage, and Coordinate	Set time constraints	
Structure, Manage, and Coordinate	Proposing different options to come up with an agreement on IP	
Structure, Manage, and Coordinate	Suggesting advancements	

Table F.1 Second-level themes, First-level themes, Action verbs (cont'd)

Structure, Manage, and Coordinate	Propose an alternative solution to standard process	
Structure, Manage, and Coordinate	Requesting Information	
Structure, Manage, and Coordinate	Requesting inputs	
Structure, Manage, and Coordinate	Requesting action to be taken by specialized resource in other partners organization	
Structure, Manage, and Coordinate	Proposing way forward to new team	
Structure, Manage, and Coordinate	Making recommendations to expert to accelerate the process	
Facilitating, Logistics and Planning Dynamics	**Facilitating, Logistics and Planning Dynamics**	**Follow, Set, Kick-off, Lay, Facilitate, Meet, Contact, Request, Define, Negotiate, Send, Offer, Caution, Highlight, Discuss, Accelerate, Exchange, Introduce, Justify, Make, Explain, Inquire, Illustrate, Clarify**
Facilitating, Logistics and Planning Dynamics	Following up on action	
Facilitating, Logistics and Planning Dynamics	Setting expectations on review process	
Facilitating, Logistics and Planning Dynamics	Kick-off logistics	
Facilitating, Logistics and Planning Dynamics	Laying out next steps	
Facilitating, Logistics and Planning Dynamics	Facilitating logistics	
Facilitating, Logistics and Planning Dynamics	Finally meeting the main collaborator after contract signature	
Facilitating, Logistics and Planning Dynamics	Facilitating meeting logistics	

Table F.1 Second-level themes, First-level themes, Action verbs (cont'd)

Facilitating, Logistics and Planning Dynamics	Facilitating organization contacting the project hierarchy team	
Facilitating, Logistics and Planning Dynamics	Facilitator organization requesting call to discuss project	
Facilitating, Logistics and Planning Dynamics	Signature logistics	
Facilitating, Logistics and Planning Dynamics	Specialized resource providing information on procedures	
Facilitating, Logistics and Planning Dynamics	Defining Project Scope Given fluid partnerships discussions	
Facilitating, Logistics and Planning Dynamics	Specialized resource communicating disagreement with proposal	
Facilitating, Logistics and Planning Dynamics	Partner organization want to negotiate with right specialized expertise in other organization	
Facilitating, Logistics and Planning Dynamics	Requesting artefact to use for guidance	
Facilitating, Logistics and Planning Dynamics	Sending completed and signed artefact	
Facilitating, Logistics and Planning Dynamics	Offering support and at the same time cautioning to operate within constraints	
Facilitating, Logistics and Planning Dynamics	Highlighting the need to consult partner, need information from partner	
Facilitating, Logistics and Planning Dynamics	Internal discussions on our position on IP	
Facilitating, Logistics and Planning Dynamics	Facilitating to accelerate process	
Facilitating, Logistics and Planning Dynamics	Facilitator organization providing standard guidelines	
Facilitating, Logistics and Planning Dynamics	Following up on request	
Facilitating, Logistics and Planning Dynamics	Internal discussions on the received artefact	

Table F.1 Second-level themes, First-level themes, Action verbs (cont'd)

Facilitating, Logistics and Planning Dynamics	Facilitator organization setting expectations	
Facilitating, Logistics and Planning Dynamics	Facilitator providing many options to set-up timely discussions	
Facilitating, Logistics and Planning Dynamics	Exchanging artefacts with new project team	
Facilitating, Logistics and Planning Dynamics	Introducing formally new project resource to main stakeholders	
Facilitating, Logistics and Planning Dynamics	Explicit reason in writing justifying actions for the benefits of the project	
Facilitating, Logistics and Planning Dynamics	Making sure of common understanding	
Facilitating, Logistics and Planning Dynamics	Explaining limitations	
Facilitating, Logistics and Planning Dynamics	Inquiring	
Facilitating, Logistics and Planning Dynamics	Exchanging project artefact forms	
Facilitating, Logistics and Planning Dynamics	Informing of completed action item	
Facilitating, Logistics and Planning Dynamics	Following up	
Facilitating, Logistics and Planning Dynamics	Illustrating the benefits of an action	
Facilitating, Logistics and Planning Dynamics	Urgent but comfortable	
Facilitating, Logistics and Planning Dynamics	Flexibility on logistics	
Facilitating, Logistics and Planning Dynamics	Facilitating	
Facilitating, Logistics and Planning Dynamics	Clarifying and communicating practice	

Table F.1 Second-level themes, First-level themes, Action verbs (cont'd)

Leading, Learning, and Reflecting	**Leading, Learning, and Reflecting**	**Reflect, Learn, Congratulate, Exchange, Guide, Strengthen, Provide, Recommend, Propose, Discover, Prepare, Remind, Aware**
Leading, Learning, and Reflecting	More work to come	
Leading, Learning, and Reflecting	Reflecting on situation	
Leading, Learning, and Reflecting	Learning from experience	
Leading, Learning, and Reflecting	Congratulating on good news	
Leading, Learning, and Reflecting	Exchanging artefact to freely share information	
Leading, Learning, and Reflecting	Guiding by illustrating and providing samples	
Leading, Learning, and Reflecting	Strengthening relationship through adjacent activities	
Leading, Learning, and Reflecting	Providing artefact	
Leading, Learning, and Reflecting	Recommending	
Leading, Learning, and Reflecting	Proposing modification to artefact	
Leading, Learning, and Reflecting	Preparing for audience	
Leading, Learning, and Reflecting	Providing artefact to new project team	
Leading, Learning, and Reflecting	Reminder for actions to be taken by internal facilitator	
Leading, Learning, and Reflecting	Discover	
Leading, Learning, and Reflecting	Propose	

Table F.1 Second-level themes, First-level themes, Action verbs (cont'd)

Leading, Learning, and Reflecting	Not aware of standard artefacts	
Leadership and Partners Dynamics	**Leadership and Partners Dynamics**	**Lead, Advance, Meet, Discuss, Communicate, Leave, Need, Exchange, Explain, Expect, Introduce, Take, Own, Delegate, Manage, Empower, Take, Use, Negotiate, Facilitate**
Leadership and Partners Dynamics	Leading	
Leadership and Partners Dynamics	I am advancing	
Leadership and Partners Dynamics	Let's meet and discuss way forward	
Leadership and Partners Dynamics	Heads up	
Leadership and Partners Dynamics	Internal project leader communicating their frustration with the process	
Leadership and Partners Dynamics	Main stakeholder leaving	
Leadership and Partners Dynamics	Need to have artefacts in place to exchange information freely	
Leadership and Partners Dynamics	Explaining process to new team	
Leadership and Partners Dynamics	Expect actions on your side	
Leadership and Partners Dynamics	Introducing a new internal facilitator	
Leadership and Partners Dynamics	Taking ownership of the process	
Leadership and Partners Dynamics	Delegating meeting, call	
Leadership and Partners Dynamics	Leading and managing project or team dynamics	
Leadership and Partners Dynamics	Empowering and providing guidance, giving clear directions	

Table F.1 Second-level themes, First-level themes, Action verbs (cont'd)

Leadership and Partners Dynamics	Communicate operating constraints	
Leadership and Partners Dynamics	Taking concrete actions	
Leadership and Partners Dynamics	Using formal greetings after tough negotiations	
Leadership and Partners Dynamics	Exchanging artefacts with new project team	
Leadership and Partners Dynamics	Facilitating to accelerate process	
Strategy, Leadership, Partners Management, and Risk, Opportunity Recognition	**Strategy, Leadership, Partners Management, and Risk, Opportunity Recognition**	**Risk, Emphasize, Set, Commit, Take, Consolidate, Acknowledge, Provide, Facilitate, Coordinate, Demonstrate, Communicate, Introduce, Escalate, Influence, Lead, Advance, Meet, Discuss, Expect, Explain, Need, Recognize**
Strategy, Leadership, Partners Management, and Risk, Opportunity Recognition	Emphasize risk	
Strategy, Leadership, Partners Management, and Risk, Opportunity Recognition	Setting meeting expectations	
Strategy, Leadership, Partners Management, and Risk, Opportunity Recognition	Setting internal negotiation expectations	
Strategy, Leadership, Partners Management, and Risk, Opportunity Recognition	Commit to verify availability for meeting	
Strategy, Leadership, Partners Management, and Risk, Opportunity Recognition	The same person who is informal internally is very formal with partners	

Table F.1 Second-level themes, First-level themes, Action verbs (cont'd)

Strategy, Leadership, Partners Management, and Risk, Opportunity Recognition	Taking ownership of the artefact	
Strategy, Leadership, Partners Management, and Risk, Opportunity Recognition	Consolidate answers and communicate them to the stakeholders	
Strategy, Leadership, Partners Management, and Risk, Opportunity Recognition	We acknowledge your leadership	
Strategy, Leadership, Partners Management, and Risk, Opportunity Recognition	Providing guidance on meeting logistics	
Strategy, Leadership, Partners Management, and Risk, Opportunity Recognition	Facilitating organization providing guidance and tools outside of standard practice to facilitate collaboration set-up	
Strategy, Leadership, Partners Management, and Risk, Opportunity Recognition	Internal facilitator coordinating, facilitating stakeholders meeting, call, logistics	
Strategy, Leadership, Partners Management, and Risk, Opportunity Recognition	Internal project leader demonstrating business savvy and value for overall organization	
Strategy, Leadership, Partners Management, and Risk, Opportunity Recognition	Lead industrial partner communicate their commitment to continue supporting already engaged resources on the project	
Strategy, Leadership, Partners Management, and Risk, Opportunity Recognition	Introducing oneself and role	
Strategy, Leadership, Partners Management, and Risk, Opportunity Recognition	External facilitator escalating indirectly	

Table F.1 Second-level themes, First-level themes, Action verbs (cont’d)

Strategy, Leadership, Partners Management, and Risk, Opportunity Recognition	External project leader communicating bad news on behalf of all the partners	
Strategy, Leadership, Partners Management, and Risk, Opportunity Recognition	External project leader communicating their position to lead industrial partner; They supports our position vs other partner	
Strategy, Leadership, Partners Management, and Risk, Opportunity Recognition	Indirectly influencing internal stakeholders by holding them accountable to external partners	
Strategy, Leadership, Partners Management, and Risk, Opportunity Recognition	Leading	
Strategy, Leadership, Partners Management, and Risk, Opportunity Recognition	I am advancing	
Strategy, Leadership, Partners Management, and Risk, Opportunity Recognition	Let's meet and discuss way forward	
Strategy, Leadership, Partners Management, and Risk, Opportunity Recognition	Heads up	
Strategy, Leadership, Partners Management, and Risk, Opportunity Recognition	Internal project leader communicating their frustration with the process	
Strategy, Leadership, Partners Management, and Risk, Opportunity Recognition	Main stakeholder leaving	
Strategy, Leadership, Partners Management, and Risk, Opportunity Recognition	Need to have artefacts in place to exchange information freely	

Table F.1 Second-level themes, First-level themes, Action verbs (cont'd)

Strategy, Leadership, Partners Management, and Risk, Opportunity Recognition	Explaining process to new team	
Strategy, Leadership, Partners Management, and Risk, Opportunity Recognition	Expect actions on your side	
Strategy, Leadership, Partners Management, and Risk, Opportunity Recognition	Introducing a new internal facilitator	
Strategy, Leadership, Partners Management, and Risk, Opportunity Recognition	Partner recognizing relevance of artefact through the information it contained	
Strategy, Leadership, Partners Management, and Risk, Opportunity Recognition	Prompt action given the opportunity	
Strategy, Leadership, Partners Management, and Risk, Opportunity Recognition	Not my project, but it is an opportunity for me to reduce my budget	
Strategy, Leadership, Partners Management, and Risk, Opportunity Recognition	Opportunity for collaboration highlighted	
Strategy, Leadership, Partners Management, and Risk, Opportunity Recognition	Finding value in an adjacent collaboration opportunity	
Strategy, Leadership, Partners Management, and Risk, Opportunity Recognition	Recognizing the opportunity	
Recognizing opportunity to augment the project with additional resources	**Recognizing opportunity to augment the project with additional resources**	**Exchange, Explore, Come Up, Agree, Consider, Offer, Perceive, Receive, Disengage, Provide, Engage, Negotiate, Facilitate, Move, Suggest, Expedite, Progress**

Table F.1 Second-level themes, First-level themes, Action verbs (cont'd)

Recognizing opportunity to augment the project with additional resources	Exchanging artefacts on adjacent project	
Recognizing opportunity to augment the project with additional resources	Exploring different options to come up with an agreement on IP	
Recognizing opportunity to augment the project with additional resources	Considering new collaboration set-up	
Recognizing opportunity to augment the project with additional resources	Partner offer perceived negatively by the other partner, receiving partner disengaged given offer	
Recognizing opportunity to augment the project with additional resources	Partner providing many options to set-up timely discussions	
Recognizing opportunity to augment the project with additional resources	Partner still engaged even after bad news	
Recognizing opportunity to augment the project with additional resources	Negotiated non-standard practice proposed to facilitate moving the collaboration project forward	
Recognizing opportunity to augment the project with additional resources	Politetly suggesting alternative	
Recognizing opportunity to augment the project with additional resources	Suggesting several alternatives to expedite the first phase	
Recognizing opportunity to augment the project with additional resources	Suggesting a solution to progress faster	
Proposing, Planning, Negotiation, Influencing, Decision Making	**Proposing, Planning, Negotiation, Influencing, Decision Making**	**Act, Escalate, Pressure, Negotiate, Offer, Provide, Propose, Decide, Make, Suggest, Explain, Set, Start, Communicate, Accept, Exchange, Justify**
Proposing, Planning, Negotiation, Influencing, Decision Making	We will act now	
Proposing, Planning, Negotiation, Influencing, Decision Making	Escalating	
Proposing, Planning, Negotiation, Influencing, Decision Making	Pressuring	

Table F.1 Second-level themes, First-level themes, Action verbs (cont’d)

Proposing, Planning, Negotiation, Influencing, Decision Making	Negotiating	
Proposing, Planning, Negotiation, Influencing, Decision Making	Offering a solution above and beyond obligations	
Proposing, Planning, Negotiation, Influencing, Decision Making	Providing an ultimatum if no response	
Proposing, Planning, Negotiation, Influencing, Decision Making	Proposing alternative contact point to move project forward	
Proposing, Planning, Negotiation, Influencing, Decision Making	Decide	
Proposing, Planning, Negotiation, Influencing, Decision Making	Making the partners feel that the proposal is in their best interest	
Proposing, Planning, Negotiation, Influencing, Decision Making	Propose support in exchange of collaboration	
Proposing, Planning, Negotiation, Influencing, Decision Making	Suggesting face to face to accelerate	
Proposing, Planning, Negotiation, Influencing, Decision Making	Explaining the benefits of collaborating on this complementary project	
Proposing, Planning, Negotiation, Influencing, Decision Making	Suggesting that it is better to agree than escalate	
Proposing, Planning, Negotiation, Influencing, Decision Making	Propose an artifact	
Proposing, Planning, Negotiation, Influencing, Decision Making	Setting expectations on negotiation outcomes	
Proposing, Planning, Negotiation, Influencing, Decision Making	Start with a short term interim collaboration with one partner only	
Proposing, Planning, Negotiation, Influencing, Decision Making	Partner communicating an official artefact to highlight their offer	
Proposing, Planning, Negotiation, Influencing, Decision Making	Accept proposal, but request changes	
Proposing, Planning, Negotiation, Influencing, Decision Making	Suggesting making a recommendation to the partner to accelerate the process	

Table F.1 Second-level themes, First-level themes, Action verbs (cont’d and end)

Proposing, Planning, Negotiation, Influencing, Decision Making	Exchanging project artefact forms	
Proposing, Planning, Negotiation, Influencing, Decision Making	Explicit reason in writing justifying actions for the benefits of the project	

APPENDIX G –ACTION VERBS AS AFFORDANCES AND COLLABORATION VOCABULARY

Table G.1 Action verbs as affordances and collaboration vocabulary

ACTION VERBS AFFORDANCES	COUNT	ACTION VERBS AFFORDANCES	COUNT	ACTION VERBS AFFORDANCES	COUNT	ACTION VERBS AFFORDANCES	COUNT	ACTION VERBS AFFORDANCES	COUNT	ACTION VERBS AFFORDANCES	COUNT
Provide	38	Change	5	Offer	2	Are you	1	Confront	1	Can	1
Request	30	Take	5	Advice	2	Dismiss	1	Modify	1	Design	1
Inform	24	Remind	5	Open	2	Surprise	1	Include	1	Prepare	1
Communicate	24	Advance	5	Address	2	Invest	1	Motivate	1	Specify	1
Acknowledge	20	Prepare	5	Direct	2	Initiate	1	Challenge	1	Prioritize	1
Share	18	Make	5	Sign	2	Do	1	Converge	1	Stop	1
suggest	18	Invite	4	Get back	2	Reduce	1	Valorize	1	Produce	1
Propose	16	Strengthen	4	Expect	2	Barter	1	Coordinate	1	Celebrate	1
Need	16	Send	4	Anchor	2	Replace	1	Wait	1	Progress	1
Set	14	Keep	4	Talk	2	Doing	1	evaluate	1	Hope	1
Facilitate	14	Support	4	Propose	2	get going	1	Inquire	1	Expedite	1
Plan	12	Lead	4	Validate	2	Draw attention	1	Adds	1	Ideate	1
Explain	12	Update	4	Announce	2	Give and take	1	Finding	1	Prompt	1
Seek	11	Move	4	Respecting Not	2	Elevate	1	Offer	1	Sympathize	1
Accept	11	Start	4	Congratulate	2	Show me	1	Recommend	1	Admit	1
Seek	10	Accommodate	4	Affirm	2	Keep	1	Exclude	1	Take	1
Exchange	10	Suggest	4	Rally	2	Articulate	1	Reflect	1	Commit	1
Build	10	Discuss	4	Correct	2	Console	1	Orchestrate	1	Impact	1
Apologize	9	Provide	4	Ramp-up	2	Taking position	1	Refocus	1	Prototype	1
Agree	9	Complete	4	Escalate	2	Empathy	1	Organize	1	Translate	1
Influence	9	Ensure	3	Realize	2	Use not	1	Reject	1	Bridge	1
Accelerate	9	Meet	3	Show	2	Emphasize	1	Overcome	1	Discover	1
Confirm	8	Solicit	3	Brief	2	Welcome	1	Deflect	1	Expose	1
Reassure	7	Establish	3	Volunteer	2	Augment	1	override	1	Use	1
Make	7	Encourage	3	Document	2	Flatter	1	Re-plan	1	Provide Not	1
Follow up	7	Require	3	Work	2	Leave	1	Own	1	Informal	1
Highlight	7	Care	3	Reiterate	2	Reflect	1	Forecast	1	Pursue	1
Consult	7	Guide	3	Explain Not	2	Leave out	1	paramount	1	Informed	1
Prompt	7	Disagree	3	Empathize	2	Remain	1	Gage	1	Put on hold	1
Create	7	Help me	3	Look forward	2	Enable	1	Partner	1	Wait	1
Appreciate	7	Consult	3	Hold	2	Delay	1	Respect	1	Question	1
Express	7	Deflect	3	Maintain	2	Made	1	Persevere	1	Want	1
Involve	7	Recognize	3	Request	2	Compare	1	Give	1	Rally	1
Ask	6	Help you	3	Authorize	2	Adapt	1	Persist	1	Wish	1

Table G.1 Action verbs as affordances and collaboration vocabulary (cont'd and end)

Approve	6	Entice	3	Bring	2	Satisfy	1	Scope	1	Decide	1
Act	6	Set-up	3	Value	2	Contact	1	Allow	1	Defend	1
Demonstrate	6	Justify	3	Re-sign	2	Select	1	Give	1	Lay out	1
Empower	6	Follow-up	3	Respect	2	Control	1	Plan	1	Write	1
Understand	6	Justify	3	Know	2	Set	1	Self initiate	1	Intend	1
Respond	5	Sharing	2	Trust	1	Make sure	1	Point	1	Iterate	1
Summarize	5	Delegate	2	Apologize Not	1	Demobilized	1	Give back	1		
Illustrate	5	Learn	2	Follow	1	Enticing	1	Politeness	1		
Collaborate	5	Feel	2	Insist	1	Determine	1	Giving	1		
Introduce	5	Comfort	2	Hold	1	Mobilize	1	Practice	1		
Consider	5	Blame	2	Inspire	1	Strategize	1	Grow	1		
Clarify	5	Criticize	2	Communicate Not	1	Mobilize	1	Prefer	1		
Think	5	Negotiate	2	Worry	1	Hoping	1	Causes	1		
Share	5	Explore	2	Frame	1	Mobilizing	1				

APPENDIX H –GENERAL COLLABORATION AFFORDANCES AS AFFORDANCES AND COLLABORATION VOCABULARY

Table H.1 General collaboration affordances as affordances and collaboration vocabulary

GENERAL COLLABORATION AFFORDANCES	CNT	GENERAL COLLABORATION AFFORDANCES	CNT	GENERAL COLLABORATION AFFORDANCES	CNT	GENERAL COLLABORATION AFFORDANCES	CNT	GENERAL COLLABORATION AFFORDANCES	CNT	GENERAL COLLABORATION AFFORDANCES	CNT
Information	32	Tardiness	2	Must Be Win-Win	1	Prompt	1	All Partners	1	Cooperative Attitude	1
Artefact	32	Responsibility	2	Understanding Of Situation	1	Support Request	1	Feedback	1	For Collaboration Reason	1
Support	22	Timeline	2	Mutual Pleasure	1	New POC	1	Change	1	Correction	1
Progress	19	Review	2	Valuable Inputs	1	Support, Phase 1	1	First Phase	1	For Preferences	1
Action	18	To Partner	2	Partners Experts	1	Limit Of Expertise	1	Change	1	Credibility	1
Expectations	15	Partner	2	We Are Serious	1	More	1	For The Known Scope	1	For This Type Of Collaboration	1
Guidance	13	Ultimatum	2	Partners On Adjacent Project	1	Proposed Date	1	All Project Stakeholders	1	Afraid	1
Relationship	10	Sense Of Urgency	2	With Additional Resources	1	Long-Term	1	From Collaboration	1	Formal Externally	1
Team	9	New POC	2	Passive Control	1	Proposed Way Forward	1	Changing Minds	1	Damage	1
Alternatives	9	Short Term Interim Collaboration	2	Working With You	1	Team Changes	1	Gentleness	1	Agreed Artefact	1
Internal Stakeholders	9	Value	2	Past Bad Experience	1	New Project Plan	1	Advancing	1	Date	1
Meeting	8	New Plan	2	Sensitive	1	Teams	1	Guarantee	1	Friendly Tone	1
Logistics	8	Limitations	2	My Choice	1	Rational	1	Clarification On Project Scope	1	Deciders	1
Stakeholder	8	Options	2	No Alternatives	1	Technical Directions	1	Hinders Progress	1	From Experts	1
Not	8	Preference	2	Permission	1	Ready	1	Clarification Request	1	Approval Process	1
Partner	8	Something	2	No Manners	1	The Best We Can Do	1	Illustration, Examples	1	Full Context	1
Process	8	Project Resources	2	Personality Clash	1	Reason	1	Allies	1	Later	1
Understanding	7	Impasse	2	Specific Reason	1	Third Party	1	Attention	1	Artefact Review Process	1
Solution	7	Final Artefact	2	Personal Efforts	1	Reason Behind	1	Already Committed	1		1
Project	7	Interest	2	Non-Expert Validation, Gut Feeling	1	Time	1	Information On Project	1	Future Support Later	1
New Resource	7	Ability	2	Phone Conversation	1	Reason Behind Decision	1	Collaboration Artefacts	1	Defensive	1
Next Steps	7	At The Same Time	2	Stakeholders Feelings	1	Not My Priority	1	Instructions	1	Good Deal	1
Constraints	7	Collaboration Artefact	2	Physical Presence	1	Reasonable Timeframe	1	Collaboration Candidate	1	Defensive And Protective	1
Modification	6	Chance	2	Status Update Items	1	Timely Response	1	Being Creative	1	Adjacent Activities	1

Table H.1 General collaboration affordances as affordances and collaboration vocabulary (cont'd)

Partners	6	Collaboration Decision	2	My Commitments	1	Reasons	1	Collaboration Culture	1	Are You Advancing	1
Plan	6	Ahead	2	Not Complete	1	To Already Discussed Modifications	1	Internally	1	Good Faith	1
Efforts	6	Advancements	2	Plan And Next Steps	1	Reasons Behind	1	Advanced	1	Delicate Balance	1
Delay	6	Advice	2	Suggested Choice	1	To Come	1	Key Resources	1	Growth Potential	1
Stakeholders	5	Collaboration; Make work projects	2	Need	1	Meeting logistics	1	Collaboration Interest	1	Different options	1
New team	5	Availability	2	Support and advice	1	to Information	1	Bluntly	1	Adjacent collaborations	1
Transparency	5	Commitment	2	Need others	1	Receipt of Artefact	1	Collaboration key stakeholder	1	Difficult times	1
New project resource	5	Caveats	2	Support with own logistics	1	to work with you	1	artefact Elements	1	Happy	1
Opportunity	5	Committed	2	Negotiating party	1	New project scope	1	Collaboration PM	1	Diligence	1
Feedback	5	Inputs	2	More agendas	1	Too formal	1	Facts and questions	1	Artefacts audience	1
approval	5	Approval of artefact	2	Polite	1	Recommendation to partner	1	Collaboration project	1	direction	1
Collaboration	5	Adjacent project	2	Team together	1	Transition	1	Additional SME	1	As required	1
Empathy	5	Arguments	2	Negotiation outcomes	1	Recommendations	1	Alternative collaborations	1	Direction vs. Consensus	1
Way forward	4	Face to face	2	Template	1	Trust	1	First bridge	1	Honest	1
Success	4	Artefact quality	2	Negotiations progress	1	Recommendations to expert	1	Collaboration project vs. Internal project	1	Directive communication	1
Opinion	4	Flexibility	2	Through sharing information	1	Inability to take action	1	Flexible	1	How to collaborate	1
Scope	4	Confusion	2	Positive message	1	Meetings	1	Collaboration willingness	1	Adjacent relationship	1
Project plan	4	Future collaborations	2	Timely information	1	Unnecessary actions	1	For others	1	I was right	1
Situation	4	Consequences	2	Positivity	1	Relationship with partner	1	Alternative solutions	1	Directive statement	1
Other party	4	Help	2	Not prompt with response	1	Understanding of scope	1	Form and details of Information	1	Assumptions	1
Politely	4	Issue	2	Possible	1	Relevant information	1	Collaborative	1	Disagreements	1
Project scope	4	Illustration	2	Now	1	Understanding stakeholder	1	Freedom	1	I'm advancing	1
Benefits	4	Lack	2	Potential Benefits	1	Reminder	1	Collaborator	1	Disappointment	1
Good news	4	Blame	2	Track record	1	Updated	1	Frustration	1	Implicit reason	1
Feedback on artefact	4	Decision	2	Potential consequences	1	New scope	1	Collaboration benefit	1	Discreetly	1
Discussions	4	Informal information	2	of new information	1	Urgency	1	Future scope	1	Important for progress	1
Agreement	4	Action items	2	Nest steps	1	Requirements	1	Accomplishment	1	After Contract signature	1
Expert	4	Informed decision	2	Official artefact	1	On artefact baseline	1	Good decision	1	Agreed actions	1
challenges	4	Discussion	2	Preferences	1	Respect of constraints	1	Commitment to project	1	Accountable to external partners	1

Table H.1 General collaboration affordances as affordances and collaboration vocabulary (cont'd)

actions	4	Intentions	2	Upcoming actions	1	On progress	1	Agile management	1	Indirectly Internal stakeholders	1
Decision making	4	Access	2	Preferred plan	1	Merits	1	Commitments	1	Do more together	1
Status	3	Internal expert	2	Urgent	1	Verbal commitments	1	guilty	1	Audience	1
Questions	3	Additional artefact	2	preparation	1	Responsibilities	1	Although not expert	1	Doing our best	1
Ownership	3	Internal support	2	Verbal agreement	1	warm wishes	1	Help	1	Adjacent opportunities	1
No New POC	3	Expert	2	Pressure	1	Responsibility	1	Common	1	Dynamics of new collaboration	1
Receipt of Information	3	All stakeholders	2	way forward	1	One partner	1	Honesty	1	Information for decision making	1
Plan forward	3	Expertise	2	Pride	1	New successor	1	Common time	1	Eager	1
Strong opinion	3	Cynical	2	Why change on me	1	One to one collaboration	1	If no choice	1	Information with internal stakeholders	1
POC	3	Directive proposal	2	Priorities	1	Review process	1	Another artefact	1	Effort	1
Politeness	3	No excuse	1	Win-win proposal	1	Will help	1	At partner's organization	1	Available	1
New Stakeholder	3	Together	1	Proactive	1	Right people	1	Common understanding plan	1	Actions decisions	1
Invitation	3	Support efforts	1	Oneself	1	Willingness	1	Important others	1	Initiative	1
Helpful	3	Openness	1	New alternative	1	Risk	1	answer	1	Egocentric	1
Forward	3	Will to collaborate	1	Work	1	Wishes	1	Informal	1	Instead of escalation	1
Alternative	3	More information on complementary project	1	Professional communication	1	Role	1	Communication Channel	1	Email is not enough	1
Indirectly	3	Starting point	1	Open	1	With our artefact	1	Information	1	Intent	1
Artefacts	3	Opportunity	1	Main Stakeholder	1	Roles and responsibilities	1	Compensation	1	Emotion	1
Confidence	3	The show must go on	1	Methodology	1	with question	1	Access to resources	1	Ball in your court	1
Changes	3	Opportunities	1	Progress of negotiations	1	Sample	1	Complementary information	1	Empathizing	1
Goodwill	3	Updated artefact	1	Separate work packages	1	with stakeholders	1	Awareness	1	Intermediate artefact	1
Clarification	3	More parties	1	Progress rapidly	1	Message in artefact	1	Complementary project	1	Activity based	1
In writing	3	Sense of right time	1	Signatures	1	Workaround	1	Backdoor request	1	Internal Confusion	1
Collaboration Project Manager	3	Optimal	1	New collaboration artefact	1	Second-hand	1	Completed	1	Evaluation of LOE	1
Informed	3	Stable collaboration	1	Skeptical	1	your artefact	1	Internal approval	1	Internal logistics	1
Common understanding	3	Low Engagement	1	Project	1	Sense of accomplishment	1	Completed action	1	Evidence	1
Communication	3	Not expensive	1	Solutions	1	Sense of commitment	1	Internal procedures	1	Internal project decision	1
Action item	3	Move forward	1	Project context for understanding	1	Leadership	1	Completed and Signed	1	Example	1
Systematically	2	Team and project	1	Specialized Artefacts	1	Project Resources, Main stakeholders	1	Accountable with external partners	1	Benefit	1

Table H.1 General collaboration affordances as affordances and collaboration vocabulary (cont'd)

specialized expertise	2	Others	1	Project cost and scope	1	Facilitators	1	Complex Multiparty collaboration	1	Examples	1
Uncertainty	2	To advance	1	Specific questions	1	Important Challenge	1	Better choice	1	Internal Win-Win	1
With partner	2	Other Preferences	1	Project cost plan	1	Further action	1	Complex multiparty collaborations	1	Exchange, review, approval procedures	1
Leadership role	2	of Past bad experience	1	Specific timeframe	1	Boss	1	Key project stakeholder	1	Interpretations	1
Misunderstanding	2	Our changes to these	1	Project costs	1	Internal resource managers	1	Concern with future challenges	1	Excluded	1
To artefact	2	on understanding	1	stage	1	Budget	1	Kick-off	1	Involving all partners	1
Not in our control	2	move forward despite challenges	1	Project history and context	1	For collaboration	1	Apology	1	Excitement	1
Vision	2	With specialized expertise	1	stakeholder	1	Budget opportunity	1	Lack of information	1	Key project leaders	1
Project leaders	2	Outcomes	1	Project Lead	1	Heads up	1	Appreciation	1	Additional	1
New team member	2	Minor	1	Stakeholders	1	But valuable	1	Experts	1	Key project stakeholders	1
Not my decision	2	Outside parties	1	New collaboration resource	1	Informed evaluation	1	Accountable	1	Experience	1
suggestions	2	Learning	1	Stalled	1	by example	1	Explicit	1	key stakeholder	1
New collaboration	2	Moving forward	1	Project management	1	Knowledge	1	Consequences to internal stakeholders	1	Artefact as starting point	1
Multiparty	2	Legacy	1	Not a must	1	by the hand	1	Facilitation	1	Knowing someone more	1
Project Status	2	Own project	1	New information	1	Feelings	1	Constraint	1	Artefact compliance with agreements	1
Own action items	2	still	1	Step 1	1	Calm and reassuring	1	facts	1	Adjacent support request	1
Promptly	2	Main collaborator	1	Project PM	1	Formally	1	Approval by default	1	Expert agreements	1
Validation	2	Support of event	1	Strategy	1	Cannot advance	1	Faster	1	Last minute	1
Proposal	2	Paperwork	1	Your commitments	1	Good progress	1	Context	1	Expert opinion	1
What is in it for the partner	2	Supporting	1	Strong reaction	1	Caring	1	Additional Information	1	Artefact credibility	1
Partners constraints	2	Part of negotiation process	1	your proposal	1	Humbly	1	Convenience	1	Decisions	1
More information	2	Technical aspects	1	Suggested	1	Cause	1	Feedback on progress	1	Follow-up timeline	1
Receipt	2	Participation	1	New Internal Stakeholder	1	Informal internally	1	Convenient	1	Convincing argument	1
Patience	2	timeframe in mind	1	Not happy more workload	1	All internal stakeholders	1	Artefact forms	1	Explanation	1
Pleasure	2	Multiparty collaboration	1	Me personally	1	Interests	1	Converge	1		
Our side	2	To expert	1	Not immediate returns	1	Challenge	1	First contact	1		

Table H.1 General collaboration affordances as affordances and collaboration vocabulary (cont'd and end)

Not my fault	2	Multiplayer	1	Project vision	1	Better understanding	1	Conversation	1		
More to come	2	obligations	1	Support and understanding	1	Accuracy of Artefact	1	Artefact producer	1		
Request	2										