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## Article

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Schmalenbach Journal of Business Research (SBUR)

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*Suggested Citation:* de Waal, André; van den Berg, Rivka (2025) : Increasing collaboration through silo-busting: A case study, Schmalenbach Journal of Business Research (SBUR), ISSN 2366-6153, Springer, Heidelberg, Vol. 77, Iss. 4, pp. 817-845, <https://doi.org/10.1007/s41471-025-00223-8>

This Version is available at:

<https://hdl.handle.net/10419/338953>

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# Increasing Collaboration Through Silo-busting: a Case Study

André de Waal · Rivka van den Berg

Received: 19 September 2024 / Accepted: 14 August 2025 / Published online: 18 September 2025  
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**Abstract** This study explores how the application of a silo-busting framework influences the actions an organization takes to improve internal collaboration, and identifies the contextual factors that shape its effectiveness. Addressing the persistent challenge of ‘silo working,’ where divisions operate independently, this research investigates the dynamics of implementing the framework in a rapidly growing family-owned company experiencing operational inefficiencies and collaboration issues. Using a single case study research design, including questionnaires, interviews, and network analysis, the study explores how the framework operates in practice and identifies contextual elements—such as leadership practices, cultural factors, and interdepartmental tensions—that influence its application. The findings refine theoretical insights into the mechanisms through which silos form and persist, advancing the ongoing development of the silo-busting framework. Recommendations include establishing collaboration as a core value, creating a structured framework for joint objectives, and tailoring leadership practices to enhance cross-functional cooperation. This research enhances the theoretical understanding of the mechanisms through which silos form and persist, contributing to the ongoing development of the silo-busting framework.

**Keywords** Silos · Silo-busting · Collaboration · Lessons learned · Case study

**JEL code** L.20

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## 1 Introduction

In recent decades, businesses have fundamentally shifted their approach to organizational development from traditional, hierarchical practices to adopting human-centered values and flexible operating principles, such as agile work environments, team networks, and collaborative tools (Hwang and Krackhardt 2020; Johnson 2023). Key activities for achieving the change include organizational learning and knowledge exchange, which help detect and correct errors, ensuring sustainable high performance (Cugueró-Escofet et al. 2019; Smith 2012). The necessity for organizational learning and knowledge exchange grows with the complexity, dynamism, and turbulence of an organization's environment (Pourdehnad and Smith 2012; Smith 2012).

Unfortunately, many organizations face 'silo working', where divisions or departments operate independently, inhibiting effective cross-boundary collaboration (Banerjee 2021; Vantaggiato et al. 2021). Collaboration refers to the process where individuals and departments work together with mutual understanding, a shared vision, resource sharing, and collective goal achievement to accomplish common objectives (Kahn and Mentzer 1996; Molek et al. 2023). Mutual understanding in this respect points to the extent to which individuals or departments comprehend and respect each other's perspectives, goals, and contributions in the collaborative process (Gulati et al. 2012). Common vision entails a shared outlook or strategic direction among collaborators, aligning their goals and actions toward the organization's overarching objectives (Kahn and Mentzer 1996). Resource sharing is the allocation and utilization of physical, financial, or intellectual resources across departments to achieve common goals and improve operational efficiency (Gittel 2016). Effective collaboration then indicates a state where people and departments interact seamlessly (Kahn and Mentzer 1996; Molek et al. 2023). Organizational silos, metaphorically derived from grain silos, lead to compartmentalization, segregation, and differentiation (Diamond and Allcorn 2009; Jeske and Olson 2024). Vantaggiato et al. (2021) describe silos as clusters of employees lacking communication with other parts of the organization, while Edwards (2020, p. 157) calls siloed teams "those which operate as sealed off windowless units within the business which focus inwards or internally". According to Molek et al. (2023), silos shape identities and create divisions between individuals or groups who perceive themselves as distinct from others within the organization. This mindset results in barriers, compartmentalized work, interprofessional frictions, and stressful situations, which in turn reduce motivation, create redundancies, frustrate clients, and hinder problem-solving and overall organizational success. Silos can form both vertically and horizontally within an organization. The horizontal dimension arises from the functional arrangement of departments and divisions, while the vertical dimension refers to the hierarchical levels within the organization (Molek et al. 2023).

While silos can improve efficiency by managing large groups and assigning responsibilities, they often foster a 'silo mentality,' where sharing skills, knowledge, or information across the organization is discouraged (Diamond et al. 2002; Molek et al. 2023; Porck et al. 2020). Jeske and Olson (2024, p. 2) define silo mentality in teams as "a situation where teams consider themselves as separate, distinct and potentially independent of other teams. This can lead to a stronger inward focus and

potentially insular behavior. Silo mentality is the phenomenon where teams often stop communicating or sharing information with other teams.” Alternatively, Caseiro and Meneses (2019) define silo mentality as a belief held by individuals or groups within an organization that perpetuates barriers to effective communication, information sharing, and collaboration. This silo mentality reinforces the fragmentation between departments and organizational levels, leading them to develop their own distinct cultures, work methodologies, goals, values, and time management practices over time, resulting in a negative impact on customer outcomes, innovation, performance, and the bottom line (Cilliers and Greyvenstein 2012; Gardner 2016).

Organizations in the knowledge-based economy are increasingly concerned about the silo effect and are continually seeking strategies to overcome it (Hadi et al. 2021). Combating siloed mindsets is therefore an urgent challenge for many organizations (Banerjee 2021). Unfortunately, according to Vantaggiato et al. (2021) silos are rarely investigated both theoretically and empirically, and questions, such as what silo-busting techniques are effective, remain unanswered. However, recently a silo-busting framework was theoretically developed (de Waal et al. 2019) which consists of a collection of techniques that mitigate and overcome silos. This framework, although developed on the basis of empirical data, has to the knowledge of the authors not been applied yet in a real-life situation at an organization. With our research, we aim to explore how the framework contributes to a deeper theoretical understanding of silo formation and resolution. Our research question is therefore: *How does the application of the silo-busting framework influence the actions an organization takes to improve internal collaboration, and what contextual factors shape the framework’s effectiveness in identifying and addressing silos?* Our research aligns with the call of Jeske and Olson (2024) to develop and refine theoretical frameworks that address the factors leading to silos. This article contributes to the ongoing theoretical development of the silo-busting framework by examining its applicability in a real-world organizational context and refining insights into silo formation and resolution mechanisms. Practically, the study’s findings will equip organizations and their executive leadership teams with effective, organization-wide techniques to enhance internal collaboration and, consequently, improve overall performance.

The remainder of this article is structured as follows. The next section provides an overview of silos: their pro’s and con’s, why they develop, and the frameworks available to combat them. The framework chosen for this research is then described in more detail. Subsequently, the research approach, measurement scale and case company are introduced. Then, the empirical research results are analyzed. The article ends with a discussion of the research’s contribution, limitations and opportunities for future research.

## 2 Silos and Silo-busting

### 2.1 Pro’s and Con’s of Silos

Organizational structures, whether vertical or horizontal, help delineate authority and responsibility, facilitating focus, identity, and accountability. Well-defined bound-

aries aid in quicker decision-making and rapid implementation of unit-specific goals by reducing distractions from other units (Fox 2010; Pittinsky 2010; Stone 2004). These boundaries also create psychological safety within a known group of people or community, enhancing engagement, motivation and commitment among employees (Porck et al. 2020; Stipp et al. 2018). Furthermore, smaller well-defined environments can mitigate the complexities and resource competitions prevalent in larger organizations (Fox 2010; Pittinsky 2010; Stone 2004).

However, when these same boundaries become overly insular, they turn into silos limiting organizational agility and collaboration necessary for adapting to rapid market changes (Barber and Goold 2014; Gardner 2016). In fact, silos can create several problems that lead to inefficient and even poor performance (Jeske and Olson 2024; Vantaggiato et al. 2021):

- **Fragmented focus:** Managers prioritize their unit's interests over the organization's, leading to missed cross-selling opportunities and overall revenue loss (Aaker 2008; Hansen 2009; Keller Johnson 2006; Porck et al. 2020; Scott and Hawkins 2008; Stone 2004; Sy and D'Annunzio 2005).
- **Political conflicts:** Siloed structures foster damaging politics and personal conflicts, reducing trust and collaboration (Stone 2004; Sy and D'Annunzio 2005; Vantaggiato et al. 2021; Willcock 2014).
- **Customer neglect:** Focus on internal politics over customer needs damages customer experience and organizational reputation (Aaker 2008; Banerjee 2021; Fox 2010; Keller Johnson 2006; Stone 2004; Willcock 2014).
- **Information hoarding:** Lack of communication between silos stifles innovation, learning, and timely threat recognition (Aaker 2008; Hansen 2009; Scott and Hawkins 2008; Stone 2004; Sy and D'Annunzio 2005; Willcock 2014).
- **Innovation inhibition:** Isolated pockets of excellence cannot be leveraged across the organization, preventing widespread high performance (Aaker 2008; Hansen 2009; Hwang and Krackhardt 2020; Molek et al. 2023).
- **Motivational issues:** Mixed messages and organizational dysfunction from silos lead to employee frustration, lower productivity, and higher turnover (Cilliers and Greyvenstein 2012; Fox 2010; Molek et al. 2023; Schütz and Bloch 2006; Stone 2004; Willcock 2014).

## 2.2 Reasons for Silos

Organizational silos emerge from a confluence of structural, cultural, leadership, and operational factors, often rooted in historical practices and compounded by contemporary challenges. Key contributors include (Cugueró-Escofet et al. 2019; Hwang and Krackhardt 2020; Jeske and Olson 2024; Keller Johnson 2006; Molek et al. 2023; Schütz and Bloch 2006; Stone 2004; Willcock 2014):

- **Reward Structures—**Incentive systems that prioritize individual or departmental outcomes over collective organizational success are significant drivers of silos. Such systems foster competition rather than collaboration, promoting behaviors

that prioritize unit-specific achievements at the expense of cross-functional alignment.

- **Leadership Dynamics**—Leadership issues, including power struggles, conflicting priorities among senior leaders, and inadequate interpersonal skills, exacerbate silo formation. Leaders who fail to model collaborative behavior or actively encourage turf wars inadvertently entrench siloed mentalities. Leadership that does not promote shared accountability further isolates departments.
- **Corporate Culture**—Competitive cultures that reward individual performance rather than team efforts discourage knowledge sharing and collaboration. A lack of unifying vision or strategy further reinforces this isolation, as teams focus on their immediate goals without considering broader organizational objectives.
- **Complexity and Geographical Dispersion**—Large organizations operating in multiple locations often face logistical challenges in maintaining connectivity. Disparate time zones, cultural differences, and operational variances hinder seamless communication and collaboration, increasing the likelihood of silo mentality.
- **Inefficient Communication Systems**—A lack of robust communication channels or protocols can create information bottlenecks and misunderstandings. Without clear and consistent communication, teams may operate in isolation, focusing on localized priorities.
- **Inadequate Change Management**—Organizations undergoing transformation without effective change management strategies often see increased uncertainty and resistance. Employees tend to fall back on familiar structures and alliances, reinforcing silos during times of flux.
- **Historical Legacies**—Legacy structures and processes that no longer align with contemporary business needs can perpetuate silos. These structures often remain unchallenged due to inertia, with their inefficiencies becoming entrenched over time.
- **Team and Structural Rigidity**—Hierarchical or rigid team structures limit cross-functional collaboration. When boundaries between departments are too tightly drawn, opportunities for innovation and collective problem-solving diminish.
- **Focus Divergence**—Silos shift organizational focus inward, often neglecting external priorities such as customer needs, market competition, and broader societal goals. This myopic approach is particularly damaging in dynamic and customer-centric industries.

Addressing the above drivers requires organizations to critically evaluate their reward structures, leadership practices, communication systems, and cultural norms. Proactively dismantling silos necessitates deliberate strategies that prioritize collaboration, transparency, and adaptability across all levels of the organization. By tackling both historical and contemporary causes, organizations can foster a unified vision that aligns individual and team efforts with broader strategic goals.

### 2.3 Available Silo-busting Frameworks

Given the increasing complexity of modern business environments, the need for comprehensive and actionable silo-busting frameworks has never been more crit-

**Table 1** Evaluation of available silo-busting frameworks

Framework	Key Features	Comprehensiveness	Practicality	Limitations
de Waal et al. (2019) Silo-busting Framework	Values, Collaborative Operating Model, Collaborative Environment, Leadership, People Reward and Development	Holistic, integrates cultural, structural, and leadership dimensions	Demands significant organizational commitment	Limited empirical validation, derived from 11 organizations
Hansen (2009) Collaboration Model	Addresses Not-Invented-Here Syndrome, Resource Hoarding, Search and Transfer Challenges	Focused on specific barriers	Practical solutions like unifying goals and T-shaped management	Lacks broader integration of cultural and leadership dimensions
Cross-Boundary Team Frameworks (Edmondson 2012)	Psychological Safety, Boundary-Spanning Leadership, Integrated Metrics	Effective at team level	Practical for fostering team-level collaboration	Does not scale well to organization-wide silos
Agile and Systems Thinking (Highsmith 2009; Senge 1990)	Iterative teamwork, mapping interdependencies, feedback loops	Comprehensive but abstract	Agile is practical for dynamic environments; Systems Thinking is complex	Systems Thinking difficult to operationalize, Agile lacks broad focus beyond project-based environments
Relational Coordination Framework (Gittell 2016)	High-quality relationships, shared goals, mutual respect, frequent and timely communication	Comprehensive, focused on relational dynamics	Practical for complex industries like healthcare	Limited focus on structural or technological elements
Collaborative Work Systems (Mohrman et al. 2003)	Integration of team structures with organizational processes	Comprehensive, emphasizes integration	Practical for large organizations focusing on learning and innovation	Requires strong leadership alignment
Lean Management Principles (Liker 2004)	Value stream mapping, iterative improvement, waste reduction	Comprehensive for operational efficiency	Practical and widely adopted in manufacturing and service sectors	Limited application to cultural or relational dimensions
Viable System Model (VSM) (Beer 1994)	Analyzing and redesigning subsystems for overall organizational viability	Holistic approach	Complex to implement due to abstract systems modeling	Requires significant expertise in systems thinking
Holacracy Framework (Robertson 2015)	Distributed authority, clear roles, decentralized decision-making	Comprehensive for modern, flexible organizations	Practical for dynamic, tech-oriented environments	Can be challenging for traditional hierarchical structures

ical. Despite this urgent need, the academic literature on silo-busting frameworks remains relatively sparse (Vantaggiato et al. 2021). While several approaches have been proposed, most frameworks focus narrowly on specific aspects such as leadership or team dynamics, without offering holistic solutions. This limited availability underscores the importance of critically evaluating existing frameworks to identify those that can effectively address the multifaceted nature of silos. Table 1 explores the primary silo-busting frameworks, evaluates their comprehensiveness and practicality, and recommends a pathway for advancing research and practice in this vital area.

Table 1 reveals the distinct strengths and limitations of each silo-busting framework. Based on the analysis of these strengths and weaknesses, the de Waal et al. (2019) framework emerges as the most promising foundation for further research and application. Its holistic nature addresses the critical drivers of silos, such as leadership, culture, and rewards. However, advancing research in this field requires addressing this framework's limitations through empirical validation.

### 3 The Silo-busting Framework

The de Waal et al. (2019) silo-busting framework was developed by integrating insights from academic and professional literature with empirical data collected from 11 UK organizations. These organizations, varying in size and industry, participated in a structured survey. The survey combined the High-Performance Organization (HPO) framework to assess organizational strength, silo-busting techniques derived from a systematic literature review, and measures of internal collaboration outcomes. Respondents rated their organizations on a 10-point scale, covering their perceptions of collaboration, application of silo-busting techniques, and organizational performance. A total of 869 responses were collected, and confirmatory factor analysis (CFA) validated the silo-busting framework's internal consistency. Relationships between HPO factors, silo-busting techniques, and collaboration results were modeled using structural equation modeling (SEM). The study highlights a positive correlation between silo-busting practices, HPO factors, and organizational collaboration.

The silo-busting framework identifies five critical factors that help break down silos and improve internal collaboration (in Appendix A the detailed characteristics can be found):

- *Collaborative values*: this factor contains characteristics that promote collaboration as a common value in the organization: a value that promotes a shared identity that brings organizational units together, creating a united collaborative mindset and creating clear unifying goals for people to work on together.
- *Collaborative operating model*: this factor contains characteristics that relate to how the organization's social, knowledge, and management infrastructure itself is organized and aligned in such a way that collaboration across units is facilitated and thus made easier. The level of capability an organization has to readily adapt itself to what is needed to survive and thrive in the environment is an indication of organizational enhancement and, finally, organizational success. Such characteris-

tics include creating clarity in the organization, embedding supporting processes for aligning, coordinating and facilitating collaboration between units, instigating cross-functional events and initiatives where people can interact, making sure conflicts between units can be resolved quickly, and putting information systems in place to enable and facilitate information sharing and communication across the organization.

- *Collaborative environment*: this factor contains characteristics that relate to fostering a collaborative mind-set, focus, behavior, and culture in the organization. This includes making sure all units are treated equally so there is no distrust between them, preventing collaboration; keeping units informed about other areas; cultivating and facilitating active cross-functional networks, communities, and events; and having physical spaces where people can actually meet and interact.
- *Collaborative leadership*: this factor (originally named Leadership, we changed that to better reflect the need for managers to have a collaborative nature) contains characteristics describing managers taking the lead in showing and promoting collaborative behavior; having responsibility for the results in their own area while sharing responsibilities elsewhere; and developing interpersonal skill sets to better enable them to collaborate and network.
- *Collaborative reward and development systems*: this factor (originally named People Reward and Development, we changed that to better reflect the need for organizations to have systems that promote and foster collaboration) contains characteristics focusing on rewarding people for collaborative behavior; giving them the authority and accountability to act in a collaborative manner; making sure they are capable of actually cooperating across unit boundaries; and only recruiting people with a collaborative mind-set and good networking skills.

The silo-busting framework aligns closely with the HPO factors, which emphasize continuous improvement, long-term orientation, openness, management quality, and employee quality. SEM analysis demonstrated that certain HPO factors, such as Continuous Improvement and Renewal, Long-Term Orientation, and Employee Quality, directly influence collaboration outcomes. The silo-busting framework, while grounded in theory and validated with data from 11 organizations, requires further empirical testing. Future research should, amongst others, examine the practical implementation and scalability of the silo-busting techniques in the framework.

## 4 Research Approach and Case Company

### 4.1 Case Study Protocol

This exploratory study employs a single case study approach to refine theoretical insights into silo formation, persistence, and resolution, using the silo-busting framework as an analytical lens. Researchers can derive significant academic insights from single-case studies for several compelling reasons (Ozcan et al. 2017). First, such studies enable an in-depth exploration of complex organizational phe-

nomena from diverse perspectives over an extended period. Second, single cases provide researchers with the opportunity to leverage exceptional access to phenomena that may be challenging for external observers to examine. Third, a single case may represent a rare or unique phenomenon or process, where the study of a single instance is sufficient to generate novel theoretical contributions. Fourth, single-case research allows for a detailed, fine-grained analysis that is often unattainable through multiple-case studies or broader statistical approaches involving large samples. Consequently, the justification for employing single-case research typically rests on satisfying one or more of the following conditions: (1) the case exemplifies a rare or unusual phenomenon, (2) the case offers previously unavailable access to researchers, or (3) the case can be observed longitudinally. In our case, condition 2 was particularly applicable, as one of us was employed at the case organization at the time of the research.

Following the prescription for high quality single case study approach of Ozcan et al. (2017), we applied the following choices:

- We used the embedded case design. This case design involves examining sub-units (e.g. divisions) within a larger case (the case company). The advantage of using this design is that examining the organizational units separately provided additional insight into the phenomenon of interest, i.e. silo-busting.
- Field access was acquired in an easy manner as one of us was employed at the case company at the time of our research.
- Data collection was done by distributing a questionnaire and conducting interviews. de Waal et al. (2019) created a silo-busting questionnaire to identify the techniques used by an organization to combat silos, and their level of implementation. In this questionnaire, respondents indicate whether their organization applies specific silo-busting techniques, using a scale of 1 ('we do not use this technique at all') to 10 ('we are using this technique fully and across the complete organization'). The underlying assumption is that if employees are unaware of these techniques being implemented, it suggests that the organization is not actively pursuing silo-busting efforts, thereby allowing silos to persist. We employed this questionnaire during our empirical research. We distributed the questionnaire to all employees of the case company, both online and physically (in the factory), both in the English (for the USA location) and in the Dutch languages. The physical questionnaire for the factory was simplified to ensure comprehensibility, as many practically trained employees may find complex language challenging. We received 139 valid responses, which entailed a 70% response rate. In addition, we conducted semi-structured interviews (Yilmaz 2013).

We conducted four group interviews in which in total 14 people originating from all divisions participated (see Table 2 for information on the participants). All participants were either in leadership roles in the division, and as such much involved in collaboration with other the other divisions, or in positions that required them to collaborate much with people from other divisions. The duration of each interview sessions was three hours. In addition to the discussion leader (one of the authors), a secretary was present, who subsequently worked out her notes in a discussion report.

**Table 2** Information on the group interview participants

Division	Participants
1. Commercial	A. Product Manager B. Inside Sales Coordinator C. Marketing & Communications Manager D. Inside Sales Manager
2. Operations	A. Procurement manager B. Planner/work preparer C. Workshop team leader D. R&D draftsman
3. Americas	A. Business Administrator B. Strategic Purchasing Manager Administrative C. Assistant
4. Support	A. Executive Assistant/Team leader Secretariat B. Finance & Control Manager C. Financieel Administratief Medewerkster

- Data analysis was conducted using the ‘Gioia method’ (Gioia et al. 2013). We first performed a first-order analysis, identifying categories based on information given by the interviewees. The, in a second-order analysis, we explored connections among these initial categories, incorporating the results of the questionnaire, to arrive at a set of themes. Finally, these second-order themes were integrated into the higher-level theoretical dimensions of the silo-busting framework. In addition, we performed a network analysis. In case the silo-busting research showed that there were indeed silos in the case company (which we expected), a network analysis can be used to indicate what those silos look like, by calculating modularity and which people are central to the network (Chiesi 2001; Wichmann and Kaufmann 2016). Those people can then be deployed to improve collaboration, as they have the most information and connections in the organization.
- Data presentation was done by providing a series of illustrative figures that were subsequently discussed by us.

## 4.2 Measurement Scales

In this research, collaboration was operationalized through a combination of quantitative measures (questionnaire items rating collaboration efforts on scales) and qualitative insights (semi-structured interviews to understand perceptions of collaboration). Specifically, questionnaire items captured perceptions of mutual understanding, goal alignment, resource sharing, and achievement of collective goals. Network analysis further operationalized collaboration by measuring the extent and structure of information flows across organizational divisions. We used the silo-busting questionnaire of de Waal et al. (2019). The silo-busting factors, and their accompanying characteristics, from the silo-busting framework were put by these researchers in a so-called silo-busting questionnaire, together with four items that measure the results of collaboration: the departments within the organization work

better with other departments; the organization has increased its efficiency; the organization has more satisfied customers; and the organization has increased flexibility. The silo-busting questionnaire can be used by organizations to evaluate their successful application of silo-busting techniques.

For the purpose of the network analysis, in the questionnaire we asked the following two questions to the respondents: “With which (max. 20) colleagues do you regularly share information?” and “Are you mainly giving information to that person, are you mainly receiving information, or is the information going both ways?”. With the network analysis program ‘Gephi’ modularity (the strength of division of a network into clusters; see Newman 2006) and centrality (the degree to which a person is central based on their connections within the network structure; see Yadav 2023) were calculated on the basis of the responses.

### 4.3 The Case Company

The case company, which preferred to stay anonymous, is a family-owned manufacturing company that provides products and services worldwide. With 200 employees, the company is headquartered in the Netherlands and has a subsidiary in North America. It has a global distribution network that spans more than 90 countries across five continents. The company, now led by the fourth-generation CEO, has an informal culture and flat organization that reflects the family feeling. The company contributes to initiatives such as healthy agriculture, effective water management, and safe infrastructure through innovative real-time data equipment, expertise, training, and provision of maintenance. The company consists of four divisions: Americas, Commercial (including the business units (BUs) sales, marketing, business development), Operations (including the business units assembly, logistics, maintenance, services, procurement, engineering) and Support (IT, HR, legal, finance, facility).

The reason to undertake the silo-busting research was that the company had experienced rapid growth for a number of years that, although resulting in a healthy revenue stream, had caused for a number of reasons low liquidity (as turnover increases, stocks also increases and the working capital requirement becomes greater), a high workload for the employees, and inefficient operational processes. At the time of our research the company had taken a ‘stability year’ in which more time was to be spend on increasing the quality of the internal processes. Not much had come of it yet because revenue kept increasing and the company experienced difficulties with the implementation of a new ERP IT system. During that year it also became apparent that bottlenecks in internal information sharing and collaboration caused many problems. This was particularly noticeable in the fact that, although everyone in the organization worked passionately on all processes to ensure that the organization could continue to grow, teams regularly did the same work as other teams because they were unable to find and connect with each other. Each department had its own plans and goals, but when it came time to work together they just did their own thing, sending the results onward without considering the impact on the rest of the company. This situation had to be addressed to enhance process efficiency, which was urgently needed in order to support the expected further growth of the company. After a short investigation on what possible remedies could be, the management de-

cided therefore to initiate an investigation into silo-busting in the company, using the scientifically grounded silo-busting framework (de Waal et al. 2019).

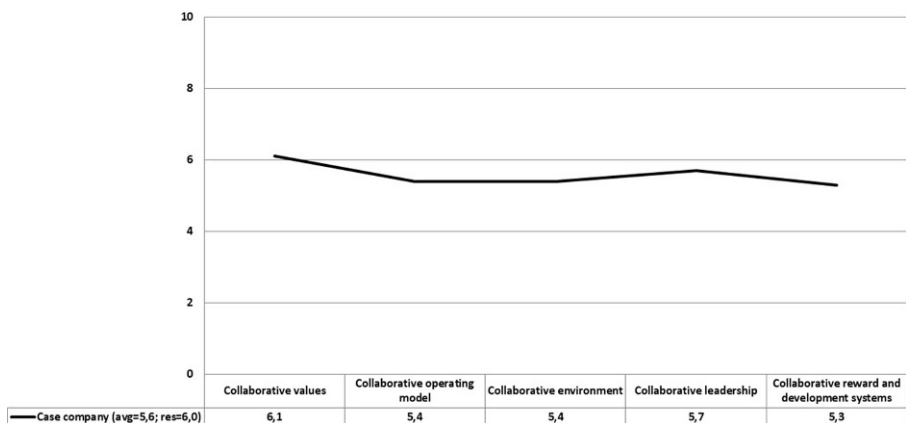
## 5 Research Results and Analysis

### 5.1 Research Results

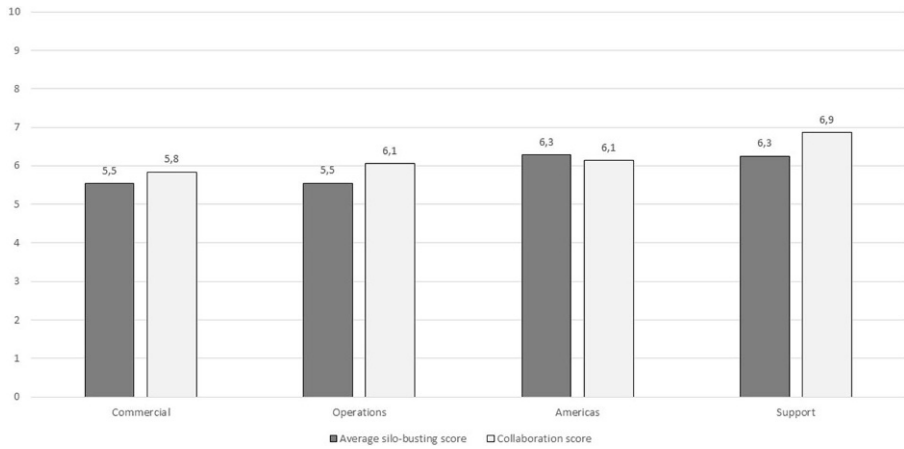
Figure 1 depicts the silo-busting scores of the case company. Appendix A provides the detailed scores.

Figure 1 shows that the case company does not excel in internal collaboration and that it does suffer from silos to a certain extent. Given the relative high score for silo-busting factor Collaborative Values (6.1), the company certainly intends to foster collaboration but looking at the other silo-busting factors it seems it is as of yet not extremely successful with that. Specifically its collaborative operating model needs an upgrade in this respect.

Looking further in the data, Fig. 2 shows that it seems divisions Commercial and Operations experience the most problems with internal collaboration. Division Support scores the best, which was to be expected because its departments are there to support the other divisions and therefore naturally have to cooperate with other departments (this is supported by the network analysis which showed that this division had a central place in the information flows in the company). In addition, operational departments often experience higher stress levels, more demanding work environments, and fewer resources than supporting departments. These departments typically have more repetitive and physically demanding tasks, leading to lower job satisfaction and engagement. In contrast, supporting departments often enjoy better work-life balance, recognition, career growth opportunities, and access to resources, contributing to higher morale and satisfaction (Huebner and Zacher 2021; Pecino et al. 2019).

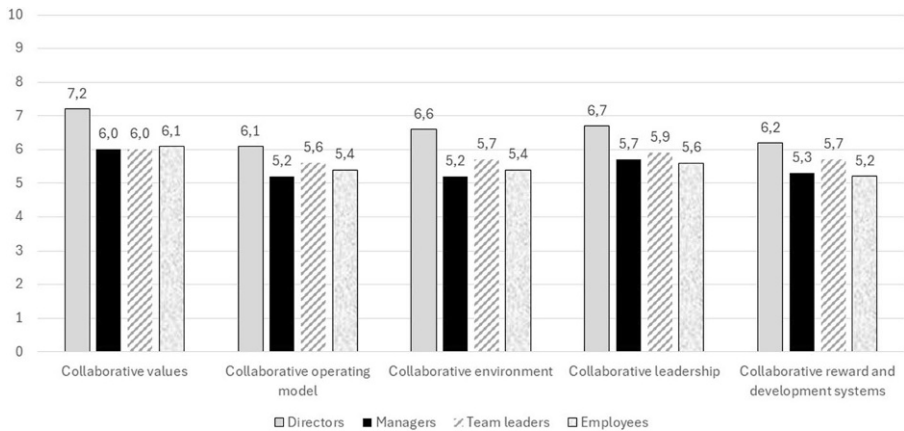


**Fig. 1** Silo-busting scores of the case company



**Fig. 2** Average silo-busting and collaboration scores of the four divisions

Figure 3 indicates a difference between how Directors and the rest of the case company (managers, team leaders and employees) assess how far the company has progressed with silo-busting and how successful the internal collaboration is. This result is in line with other studies that separate scores according to function levels. In the majority of those studies the scores of the highest management level is significantly higher than those of lower function levels. This is caused by those managers having more autonomy and freedom to set the agenda of the organization and allocate budget and resources; differences in role expectations, personality traits, and engagement in organizational processes; their involvement in the follow-up and implementation of survey feedback which fosters a more favorable view of the survey process; and their greater job security (Church and Waclawski 2017; de Waal 2020; Huebner and Zacher 2021; Kerr et al. 2018).



**Fig. 3** Silo-busting factor scores per level

**Fig. 4** Result of the network analysis (each node is an employee, each edge is an information flow)

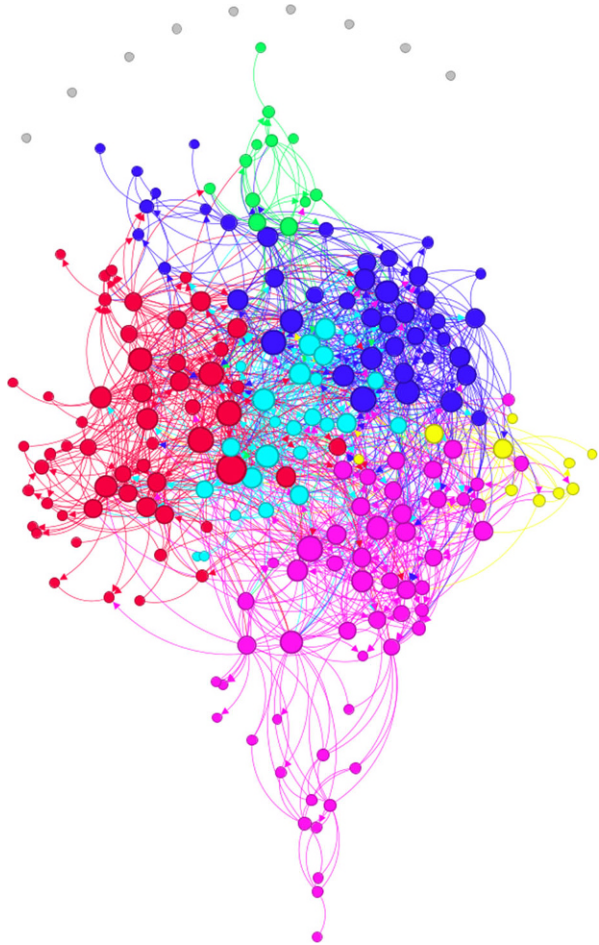


Figure 4 shows the results of the network analysis. This figure graphically represents silos (i.e. clusters) by showing how the information flows within the case company, where clusters of information arise, which persons have a central function in knowledge sharing, and where bottlenecks and opportunities for knowledge sharing lie. Appendix B provides detailed information on the nodes.

The modularity score ranges between  $-1$  to  $1$ . It indicates whether the information network is distributed randomly (score  $< 0$ ) or very structured ( $1$  = there are strongly separated clusters in the network). A score of  $> 0.3$  is a good indicator of the existence of meaningful clusters in a network (Clauset et al. 2004). The modularity score for the case company is  $0.366$ , meaning that clusters can be distinguished, but these are not that strongly separated that there is no information sharing between them at all. It is logical that the modularity is above  $0$ : organizations are divided into components to make business operations easier. The fact that it is not  $1$  means that there are indeed information flows between the different clusters. The colours in Fig. 4 illustrate the clusters identified through modularity analysis using Gephi. A comparison of these

**Table 3** Proportion of division members in the identified clusters

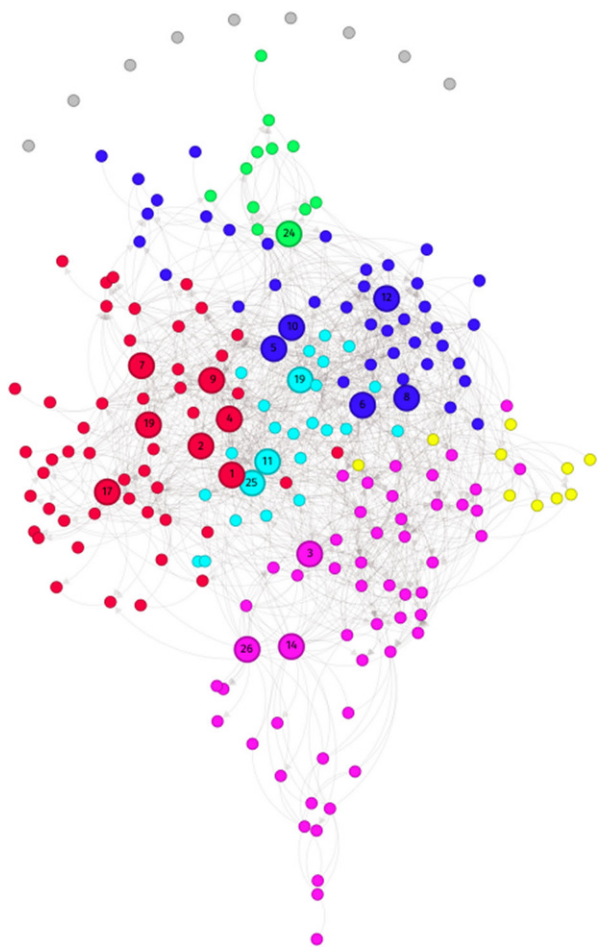
Cluster	Number of people	Division	Division representation %
Pink	54	Operations (location 1)	87
Red	54	Operations (location 2)	80
Dark blue	43	Commercial + Americas	86
Light blue	25	Support	76
Green	12	Operations (location 3)	100
Yellow	10	Operations (location 4)	90

clusters with the company's divisions reveals a clear correspondence, indicating that the clusters represent the divisions. Table 3 details the specific clusters associated with each division. Notably, multiple clusters correspond to the Operations division. To further distinguish these Operations clusters, they were also analysed based on the different locations (buildings or offices) within the company where personnel are stationed. This analysis demonstrates that the information network is clustered not only by divisions but also by location.

Centrality identifies individuals who hold crucial positions within an organizational network. Three types of centrality were measured: degree centrality, betweenness centrality, and closeness centrality. 'Degree centrality' quantifies the number of direct connections a person has within the network. It highlights individuals who are highly connected, likely possess the most information, and can swiftly establish connections across the broader network. 'Betweenness centrality' measures the frequency with which a person appears on the shortest path between other nodes. The betweenness score ranges from 0 (indicating the person is never on the shortest path and thus has no influence over the information flow) to 1 (indicating the person lies on all the shortest paths, thereby having maximum control over the information flow). 'Betweenness centrality' identifies individuals who act as bridges within the network. This is essential for communication between different clusters. It also reveals vulnerabilities: if such individuals were to leave, information sharing between clusters would be disrupted. 'Closeness centrality' assesses a person's overall position within the network, indicating how quickly they can reach other individuals. The closeness score ranges from 0 (the person is not reachable from any other person in the network) to 1 (the person is directly connected to all other individuals). 'Closeness centrality' highlights those who are best positioned to reach the entire network quickly, making them ideal for roles in internal communication, such as change management (Tabassum et al. 2018).

To identify the most central individuals in the organization, a ranking list was created for each of the three centrality variables, focusing on the top 23 individuals with the highest scores. This selection represents 10% of the total network, rounded up due to several individuals having identical scores. Points were assigned based on the ranking: the highest-ranked individual received 23 points, while the lowest-ranked received 1 point. Individuals with the same rank received the same number of points. The points from the three centrality variables were then summed to produce an overall centrality ranking, with each variable weighted equally. Figure 5 illustrates the 19 most central individuals in the organizational network. This includes the top

**Fig. 5** Central people in the organizational network



10 individuals with the highest overall centrality scores, as well as those who, while not in the top 10 overall, ranked in the top 10 for at least one centrality variable. Each number in the figure represents an anonymized person. All centrality scores, rankings and anonymized people can be found in Appendix B.

Upon closely examining the central people of the case company, it turned out that they were mainly the departmental managers. This suggests that on employee level there was minimal exchange of information and therefore probably little cooperation. It is a common occurrence, unfortunately, that information remains stuck in the management layer and hardly or not at all reaches the employees. Reasons that information gets stuck at the management level are the information overload managers suffer, limited cognitive processing capacity they might have, and resource constraints they experience such as time and budget. Hierarchical organizational structures and cultures that do not promote open communication also contribute to this issue. These factors collectively hinder the effective dissemination of important information to employees (Eppler and Mengis 2004). Another result that was notice-

able was that only half of the management team members belonged to the central persons, while one would expect that each management team member would have a central role in the provision of information for his or her division.

The network analysis results underscore the silo-busting factor scores, confirming that the case company experiences silos to some extent. Additionally, the network analysis reveals the nature of these silos, showing that they align with both the company's divisions and locations. Furthermore, the centrality measures from the network analysis offer valuable insights that can complement silo-busting techniques to break down these silos. Key individuals can be utilized to disseminate information more broadly across silos, while those in significant positions who are not yet central, such as management team members, should be repositioned in the network to enhance information distribution throughout the organization.

## 5.2 Analysis

The analysis of the interview data employed the Gioia Methodology (Gioia et al. 2013), which facilitated the identification of first-order concepts, their organization into second-order themes, and their alignment with theoretical dimensions from the de Waal et al. (2019) silo-busting framework. This approach ensured that participants' perspectives were rigorously analyzed and connected to the study's theoretical constructs. To integrate the quantitative and qualitative data, a mixed-methods triangulation approach was used. Quantitative data from the silo-busting questionnaire highlighted measurable trends and variances in collaboration levels across departments, identifying specific areas of strength and weakness. The qualitative data, collected through semi-structured interviews, complemented these findings by providing narrative context, explaining why certain scores were high or low, and revealing underlying causes such as cultural clashes, leadership practices, and operational inefficiencies. Integration occurred during the second-order analysis phase, where numerical patterns were aligned with interview themes to form cohesive findings. For instance, low scores in the Collaborative Operating Model dimension were contextualized through interview insights, which pointed to inconsistencies in IT platform use and differing work cultures between departments. Together, the quantitative and qualitative data provided a comprehensive understanding of silo dynamics, with the quantitative results offering breadth and the qualitative insights delivering depth. This integrated approach not only strengthened the robustness of the findings but also provided actionable insights into the interplay between organizational structure and collaboration.

Our general conclusion was that the different parts of the organization operated as islands and as such basically were silos. The silo-busting scores specifically showed that the company paid little attention to structurally improving collaboration; the network analysis clearly pointed out that the divisions were clusters and thus silos. The interviews provided confirmation of these results and added some context, such as that the collaboration within divisions differed. Specifically, in Operations, most processes were up-and-running much better than in the past because of the merging of several BUs. As one respondent noted, "The merger helped streamline our workflows, but the gaps in communication with other divisions remain a big challenge"

(Interview 2, Respondent A). In Commercial, there was a lot of ad hoc work and improvisation with little coordination of plans, with one participant stating, “We often operate in reaction mode, focusing on immediate needs rather than aligning with Operations or Marketing” (Interview 1, Respondent B). In Support, there was much contact between everybody in the division. A respondent observed, “Support is a central hub. We are in touch with nearly every department, but that doesn’t mean collaboration is smooth; it’s often reactive” (Interview 4, Respondent A). In the Americas, there was good collaboration in a close-knit team, though challenges arose when dealing with Dutch colleagues. One participant explained, “Within the division Americas, we collaborate well internally, but working with the Dutch teams can be frustrating due to time zones and unclear responsibilities” (Interview 3, Respondent A).

Interestingly, these differences in collaboration seemed to originate from different views on cooperation, resulting in tensions between the divisions, which did not help inter-divisional collaboration. Especially between Operations and Commercial, the ad hoc work in Commercial clashed with the ongoing processes in Operations. A respondent from Operations highlighted, “Sales’ unpredictable demands often disrupt our workflows, which are carefully planned to maximize efficiency” (Interview 2, Respondent B). Similarly, the close-knit team in the Americas clashed with the largely unknown Dutch colleagues in the other three divisions. One respondent shared, “It sometimes feels like we’re treated as another distributor rather than an integral part of the company, which hampers true collaboration” (Interview 3, Respondent A).

The effects of the suboptimal collaboration and silos were quite severe for the case company: higher operational costs caused by plans which had already incurred costs but often remained half finished; unrest among employees due to a lot of ad hoc work and people not knowing what to expect when resulting in higher employee absenteeism and turnover; and lower efficiency as the company was not able to make optimal use of the expertise of its employees because these were not optimally deployed due to poor cooperation.

Per silo-busting factor the following observations and suggestions for improvement were made:

- *Collaborative values*—Observation: the case company does strive for collaboration, but this is not reflected in the values, identity, or objectives of the company. One respondent remarked, “Collaboration is something we do unconsciously, it’s not explicitly emphasized as part of our values” (Interview 4, Respondent C). The company introduced the ‘One Company’ initiative a few years ago to focus on more collaboration, but in practice, people see that little attention is paid to structurally improving collaboration. As one participant put it, “The ‘One Company’ initiative feels like a good idea on paper, but it hasn’t really translated into visible changes in how we work together” (Interview 3, Respondent B). Another employee observed, “We’re good at collaborating within teams, but the organization doesn’t seem to prioritize or reward cross-department collaboration as a key value” (Interview 1, Respondent A).

- Possible improvements: formulate collaboration as a core value for the company, and convey this core value as much as possible in image, word, and deed; make collaboration an integral part of the company’s ‘way of working.’ As one respondent suggested, “We need leadership to demonstrate collaboration as a priority and reflect it in their actions and communication” (Interview 2, Respondent C).
- *Collaborative operating model*—Observation: collaboration is not an integral part of the operational model as there are no specific preconditions set for it, in the sense of collaboration processes, integrated IT, specific roles defined for it, and central coordination. One participant noted, “We don’t have a structured way to collaborate; it’s more informal and ad hoc, which leads to inefficiencies” (Interview 3, Respondent B). Resources are not made available specifically for fostering cooperation, and there is no guiding framework for collaboration provided by management. As one respondent remarked, “Collaboration doesn’t seem to be prioritized in our planning. Targets are set, but how we achieve them together isn’t defined” (Interview 4, Respondent B). Each year, revenue targets are announced, but without an explicit framework to support them: which products and markets are the focus, which companies are collaboration targets, and which innovations are needed. Additionally, the plans and targets change quickly. A participant described this dynamic, stating, “We receive goals that shift frequently, and every department works independently to meet them, often clashing with others” (Interview 2, Respondent A). As a result, each department works independently without too much regard for the other departments. For example, Sales wants to respond to market opportunities as quickly as possible and show a prototype of a product at a trade fair. R&D would rather test the prototype further and finish it. Marketing would rather draw up a solid marketing plan. One participant summarized, “Sales pushes for speed, R&D focuses on perfection, and Marketing wants detailed preparation. There’s no shared plan, so nothing moves forward” (Interview 1, Respondent C). The complete picture is not looked at, and as a result, a stalemate occurs. Finally, there is no mechanism for when collaboration goes wrong. A participant noted, “When conflicts arise, there’s no formal way to resolve them. It’s left to the individuals involved to figure it out” (Interview 3, Respondent A).
- Possible improvements: draw up a focused framework with a limited number of joint financial, operational, and commercial objectives, and monitor this framework closely; release the resources to satisfy the preconditions to be able to successfully implement the framework; map the place of each department in the value chain and identify who is influenced (both upstream and downstream) by each department. As one respondent suggested, “Departments need clear roles and responsibilities in the collaboration process, and management needs to enforce this through consistent planning and communication” (Interview 4, Respondent A). Coordinate department plans to ensure that each plan is structured in the same way, use a checklist that the plan must comply with, and always include (and implement) joint actions with other departments in the plans; and draw up job descriptions for each department with specific collaboration tasks and requirements included. Provide a ‘mediator’ where bottlenecks and conflicts can be discussed and resolved quickly.

- *Collaborative environment*—Observation: the case company had not created an environment that promoted collaboration. As one respondent remarked, “We operate in silos, so most of the time, we don’t even know what other departments are working on until there’s a problem” (Interview 1, Respondent A). As a result, people lacked information about each other, had little contact with each other outside of existing processes, and projects were not focused on cooperation. A participant noted, “We rarely communicate beyond our immediate teams, and even when we do, it’s usually task-specific rather than relationship-building” (Interview 3, Respondent B). Another respondent commented, “Without structured opportunities to connect, we end up working in isolation, which limits creativity and shared problem-solving” (Interview 4, Respondent C).
  - Possible improvements: determine what each department needs to know about the other departments and set up the information provision accordingly. One suggestion from a participant was, “A shared dashboard or regular updates on key projects from other departments could help us align better” (Interview 2, Respondent A). Provide ‘active exposure platforms’ where people from different departments can meet each other and exchange information and knowledge. Another respondent proposed, “We need more cross-departmental meetings or informal gatherings to break down these barriers and build relationships” (Interview 1, Respondent C). Introduce ‘peeping at the neighbors’ so people can see what other departments are doing. A participant suggested, “Job shadowing or temporary exchanges could give us insight into how other teams work and what challenges they face” (Interview 3, Respondent A). Finally, organize staff activities for the entire company. As one respondent stated, “Company-wide events or team-building activities would help build trust and improve communication across the board” (Interview 4, Respondent B).
- *Collaborative leadership*—Observation: managers felt responsible for their own results but not for the total result of the company. One respondent remarked, “Our focus is always on meeting our department’s KPIs. Cross-departmental goals are rarely part of the discussion” (Interview 1, Respondent B). Another participant observed, “Managers are too siloed in their thinking, focusing on their team’s success rather than the overall company performance” (Interview 3, Respondent C). This lack of shared responsibility has contributed to fragmentation and limited collaboration across divisions.
  - Possible improvements: introduce ‘T-shaped management’ (Hansen 2009) where it is decided who is responsible for what and the assessment cycle can be set accordingly. One participant suggested, “If managers were held accountable for collaboration goals alongside organizational targets, it would encourage them to think beyond their own silos” (Interview 4, Respondent A). Strictly responsible for the results of the department means the manager is on the vertical beam of the T, representing the department, but being jointly responsible for the company results means the manager is on the horizontal beam of the T. A respondent noted, “We need leaders who prioritize company-wide results and set an example by working closely with their peers across departments” (Interview 2, Respondent B). Let the management team work together visibly for the company, thus fulfilling their role model in this respect.

As one interviewee put it, “When leaders visibly collaborate and share the same message across departments, it sets the tone for the rest of us to follow” (Interview 3, Respondent A). Another participant added, “A unified leadership approach would make collaboration feel like a company-wide priority, not just an individual effort” (Interview 4, Respondent B).

- *Collaborative reward and development systems*—Observation: collaboration is not rewarded at the case company, and people are not hired for their collaboration skills nor are they trained in these. One respondent commented, “We’re evaluated solely on individual performance metrics, and collaboration isn’t part of the equation” (Interview 3, Respondent B). Another participant noted, “During recruitment, the focus is more on technical expertise rather than how well someone can work in a team or across departments” (Interview 1, Respondent C). The lack of training on collaboration skills was also highlighted, with one participant stating, “We are expected to figure out how to collaborate on our own, but there’s no structured guidance or training” (Interview 4, Respondent A).
  - Possible improvements: make collaboration efforts and results part of the evaluation and reward cycle. A respondent suggested, “Incorporating collaboration metrics into performance reviews would send a clear message that teamwork is valued here” (Interview 2, Respondent B). Adjust the selection and recruitment process specifically to hire on collaboration competence. As one participant remarked, “When hiring, we should assess how well candidates can build relationships and work with diverse teams” (Interview 3, Respondent A). Organize regular ‘refresher courses’ in the field of collaboration (with concrete examples from daily practice). One interviewee proposed, “Workshops or training sessions with real-life scenarios would help employees understand how to collaborate effectively across departments” (Interview 4, Respondent B). Another participant added, “It’s not enough to talk about collaboration, we need practical exercises and case studies to embed it into our culture” (Interview 1, Respondent D).

The next step after the analysis was to establish a focus group with representatives from each division. This group should study the research results in more detail, prioritize the improvements, supervise the implementation of the improvements by the departments, and provide periodic feedback to the management on progress, bottlenecks and results achieved. In addition, a second silo-busting diagnosis was planned for after two years, to evaluate progress and results achieved.

## 6 Summary, Limitations and Future Research

This study investigated the impact of silo-busting techniques on organizational collaboration. Many organizations face ‘silo working,’ where divisions operate independently, inhibiting cross-boundary collaboration. Silos create compartmentalization and interprofessional frictions, reducing overall performance. The research aimed to test a silo-busting framework in a real-life organizational setting, addressing the question: *How does the application of the silo-busting framework influence organiza-*

*tional collaboration, and what contextual factors shape its effectiveness in identifying and addressing silos?* The framework consists of techniques based on empirical data but had not been applied in a practical scenario until this study. Using a single case study research approach, the study employed both quantitative and qualitative methods, including questionnaires and semi-structured interviews. The case study was conducted in a family-owned company experiencing rapid growth, leading to operational inefficiencies and internal collaboration issues. The findings revealed that the company struggled with silos, leading to higher operational costs, employee unrest, and lower efficiency. Recommendations to combat the silos included establishing collaboration as a core value, creating a framework for joint objectives, setting up information-sharing platforms, and introducing ‘T-shaped management’ to enhance collaborative leadership. The research provides empirical insights that refine and extend the theoretical understanding of silo-busting mechanisms, highlighting contextual factors that shape their application in practice. The study thus provides empirical insights that refine and extend the theoretical understanding of silo-busting mechanisms, highlighting contextual factors that shape their application in practice.

This research contributes to the theoretical refinement of the de Waal et al. (2019) silo-busting framework by providing new insights into the contextual factors shaping silo formation and resolution. This framework, which had been theoretically developed based on insights from academic literature and a study of 11 organizations, had not previously been applied in practice. By exploring its application and identifying contextual factors that shape its effectiveness, this research enriches the theoretical development of the framework. Specifically, it contributes to the understanding of:

- silo dynamics: the research findings deepen theoretical insights into the mechanisms through which silos form and persist, particularly emphasizing cultural, structural, and leadership dimensions;
- framework refinement: the research enhances the theoretical understanding of silo-busting techniques by identifying the contextual conditions that influence their applicability and effectiveness;
- integrative methods: by using a mixed-methods approach combining network analysis, questionnaires, and interviews, the study introduces a robust methodology for studying silos, which can be replicated in future research.

These contributions align with recent calls in the literature (e.g., Jeske and Olson 2024) to investigate both theoretical frameworks and their practical application in combating organizational silos.

Regarding the practical contribution of the research, this comes in the shape of a roadmap for organizations seeking to improve internal collaboration through actionable recommendations derived from empirical data. These contributions include:

- framework implementation: by illustrating how the de Waal et al. (2019) framework can be applied, the research provides organizations with a clear path to addressing silos, emphasizing collaborative values, leadership, operating models, environments, and reward systems.

- diagnostic tools: the use of the silo-busting questionnaire and network analysis enables organizations to identify and quantify silos within their structure, offering a systematic approach to diagnose collaboration issues.
- customizable solutions: the study highlights the importance of tailoring silo-busting efforts to the specific context of the organization, addressing unique challenges such as leadership dynamics, departmental tensions, and cultural variations.
- actionable steps: the recommendations provide detailed guidance, including establishing collaboration as a core value, creating structured frameworks for joint objectives, and implementing leadership and reward systems that promote cross-departmental collaboration.
- roadmap for practice: the study proposes the creation of a focus group and periodic re-evaluation, offering organizations a practical process for monitoring and refining their collaboration strategies over time.

There are several limitations to our study, that in itself provide opportunities for future research. The main limitation is that this study provides a snapshot of the framework's application rather than tracking its long-term evolution. Future research could build on these insights through longitudinal studies to further refine the framework. This study contributes to analytical generalization by offering insights into how silo-busting strategies manifest in practice, providing a foundation for future comparative case studies and theoretical refinement. Future research should explore diverse organizational settings to further develop the theoretical understanding of silo dynamics and the applicability of silo-busting techniques in varying contexts. These studies could also be conducted in other countries than the Netherlands, to evaluate whether cultural issues play a role in silo-busting. Additionally, the simplified physical questionnaire provided to factory workers, tailored to accommodate varying educational backgrounds, may have introduced inconsistencies in how questions were understood. This could potentially affect the reliability of the data. Future research should aim to use a standardized questionnaire for all participants, while still allowing for translation into different languages, to enhance the uniformity and validity of the findings. The network analysis also has some limitations. In the questionnaire, participants could list a maximum of 20 names with whom they share information. In practice, this number can be much higher. Moreover, employees who did not complete the questionnaire were automatically assigned fewer connections, creating a simplified and incomplete view of the company's information network. Future research could include other data collection methods as well, such as using email communication data (Rafiq et al. 2016), to capture a more comprehensive view of the organizational network.

## 7 Appendix

### 7.1 Appendix A

In this Appendix, the scores of the case company for the silo-busting factors and characteristics and the collaboration results are provided (Table. A.1).

**Table A.1** Silo-busting factors

Silo-busting factors	No	Silo-busting characteristics	Scores
Collaborative values	1	The organization has a set of values that support collaboration	6.2
Collaborative values	2	The organization promotes a shared identity that brings organizational units together	4.6
Collaborative values	3	It is clear to people why collaboration is important	5.7
Collaborative values	4	People have clear unifying goals to work on together	5.2
Collaborative operating model	5	Cross-organizational unit collaboration is carefully coordinated by designated individuals	5.9
Collaborative operating model	6	Processes, procedures and roles are standardized across organizational units to foster collaboration	4.7
Collaborative operating model	7	Processes and systems are integrated across organizational units	4.6
Collaborative operating model	8	Plans and reviews of all organizational units are interdependent and therefore aligned	5.2
Collaborative operating model	9	Collaboration is stimulated by cross-organizational unit programs and projects	5.4
Collaborative operating model	10	Time and space are given to people to conduct cross-organizational unit experimentation and innovation	6.0
Collaborative operating model	11	There are clear methods for resolving cross-organizational unit conflict and disagreement and to build trust	5.9
Collaborative operating model	12	Performance indicators measure the quality and success of collaboration	5.2
Collaborative operating model	13	Common IT-platforms and systems have been installed across all organizational units	5.0
Collaborative operating model	14	The organization uses IT systems to enable better information sharing across organizational units	5.8
Collaborative environment	15	All organizational units are treated equally and in a just manner	6.4
Collaborative environment	16	Information on goals, plans and results of all organizational units is shared with people	5.4
Collaborative environment	17	People are informed about the goals and status of other organizational units	6.8
Collaborative environment	18	Knowledge, practice and experience is shared across organizational units through special communities and networks	6.0
Collaborative environment	19	Cross-organizational unit training and events are organized to build inter-organizational unit respect, understanding and trust	6.6
Collaborative environment	20	People are able to collide and bond with each other in communal physical spaces	4.2

**Table A.1** (Continued)

Silo-busting factors	No	Silo-busting characteristics	Scores
Collaborative environment	21	People are encouraged to spend time with colleagues from other organizational units	4.7
Collaborative leadership	22	The management are responsible for the results of both their own areas and of the complete organization	6.0
Collaborative leadership	23	Senior leaders show that they enjoy working together across the organization	4.7
Collaborative leadership	24	Managers' interpersonal skill sets are developed so that they are better able to collaborate and network	5.8
People reward and development	25	The organization specifically recruits people with a collaborative mind-set and good networking skills	6.5
People reward and development	26	People are provided with training to further develop their collaborative and networking skills	6.4
Collaborative reward and development systems	27	People are given the authority and accountability to act in a collaborative manner	5.1
Collaborative reward and development systems	28	Cross-organizational unit collaborative efforts and results are rewarded	4.9
Collaborative reward and development systems	29	Cross-organizational unit collaborative efforts and results are recognized	5.2
Collaboration Results	a	We have good internal cooperation with other organizational units	5.9
Collaboration Results	b	Cooperation with other organizational units has increased the efficiency of the organizational unit	5.9
Collaboration Results	c	Cooperation with other organizational units has increased the satisfaction of the customers	6.2
Collaboration Results	d	Cooperation with other organizational units has increased the competitive position of the organization	6.0
Collaboration Results	e	Cooperation with other organizational units has increased the profitability of the organization	6.1

## 7.2 Appendix B

In this Appendix, the scores and rankings of the centrality measures of the e analysis are provided. The names of the people are left out for anonymity reasons (Table B.1).

**Table B.1** Centrality rankings

Person	Degree centrality (number of connections)	Betweenness centrality	Closeness centrality	Points
Person 1	48	0.057	0.544	68
Person 3	39	0.029	0.503	59
Person 6	38	0.033	0.495	57
Person 2	39	0.023	0.503	51
Person 9	35	0.028	0.488	49
Person 4	38	0.021	0.485	43
Person 7	35	0.027	0.483	43
Person 17	30	0.046	0.477	40
Person 5	38	0.016	0.490	39
Person 14	31	0.081	0.471	39
Person 20	29	0.035	0.472	33
Person 10	33	0.011	0.485	31
Person 11	33	0.015	0.485	31
Person 19	29	0.023	0.485	31
Person 25	27	0.034	0.482	30
Person 8	35	0.015	0.469	21
Person 24	21	0.036	0.441	20
Person 22	29	0.021	0.472	18
Person 21	29	0.024	0.450	16
Person 26	20	0.031	0.434	16
Person 16	30	0.012	0.471	15
Person 23	29	0.012	0.476	15
Person 12	33	0.011	0.457	14
Person 27	24	0.025	0.433	12
Person 13	32	0.011	0.462	11
Person 34	28	0.014	0.480	11
Person 28	23	0.025	0.449	11
Person 15	30	0.011	0.467	10
Person 29	20	0.024	0.446	9
Person 18	29	0.009	0.468	8
Person 30	18	0.021	0.442	5
Person 31	25	0.020	0.446	3
Person 35	20	0.011	0.468	3
Person 32	23	0.019	0.450	2
Person 33	15	0.019	0.382	1

**Funding** The authors did not receive support from any organization for the submitted work.

**Data Availability Statement** Data and survey materials are not available as the case company and its employees were promised anonymity.

## Declarations

**Conflict of interest** A. de Waal and R. van den Berg declare that they have no competing interests.

**Ethical standards** The study meets the ethical standards of the corresponding author's company

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