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How to manage global partner relationships to achieve sustainability goals: A decision support system using the Best-Worst Method and applied to cargo airlines

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Abstract – The urgency of sustainability in aviation has led to a focus on operational activities, especially in the global supply chain of cargo airlines. This study introduces a Decision Support System (DSS) to improve Partner Relationship Management. The DSS helps partners work toward sustainability goals. It uses the Best-Worst Method in a Multi-Criteria Decision-Making framework. The DSS segments partners based on their sustainability capabilities and willingness. It also proposes targeted strategies. The system was applied to a cargo airline aiming for zero emissions and zero waste, managing Ground Handling Agents across 168 outstations. The application showed the effectiveness of partner segmentation, with most partners demonstrating high capability and willingness. A step-by-step strategy was developed to implement sustainability practices, including a checklist for performance assessment. The study concludes that the DSS and strategy offer a structured and actionable approach that can be adapted for other cargo airlines. Future research is recommended to validate the DSS in other industries, explore alternative segmentation methods, and refine strategies considering partner size and impact.

Keywords: Decision support system (DSS); partner relationship management (PRM); sustainability goals; cargo airlines; multi-criteria decision making (MCDM); Best-Worst Method (BWM)

1. Introduction

The urgency of addressing environmental sustainability within the aviation industry has never been more critical. With the sector contributing approximately 2% to the global greenhouse emissions (International Energy Agency, 2023), efforts to reduce its environmental impact are essential for meeting net-zero emissions by 2050 (United Nations, 2015). This figure takes on even greater importance when considering the challenges associated with decarbonising the aviation industry (Ovdiienko et al., 2021). However, the focus on sustainability within aviation must extend beyond the airlines themselves. The broader operational activities associated with aviation, including ground operations and logistical support, play a substantial role in the industry's overall environmental footprint (Rodríguez-Sanz et al., 2020).

Within the complex logistics operations that categorise global supply chains, achieving sustainability is complicated due to the increased number of involved partners, each with the potential to contribute to achieving sustainability goals (Sharma et al., 2022). These partners, ranging from Ground Handling Agents (GHAs) to various logistical service providers, are integral to the efficient functioning of cargo airlines. Consequently, managing these relationships effectively ensures that sustainability objectives are met across the entire supply chain (Mangla et al., 2014).

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Despite the importance of these relationships, the current literature on Partner Relationship Management (PRM)—which focuses on building collaborative relationships with existing partners through effective and reliable processes (Suh et al., 2005)—has largely overlooked PRM towards achieving sustainability goals within a global supply chain. While PRM is crucial for aligning the efforts of diverse partners towards common objectives, there is a noticeable gap in research regarding integrating sustainability into existing relationships with partners. Several studies explore supplier relationship management (SRM) and supplier selection processes, focusing on aspects such as risk mitigation, supplier segmentation, and decision-making techniques (Lajimi & Majidi, 2021; Lajimi et al., 2021; Hennink, 2024; Rahmawati & Salimi, 2022; Vaandrager, 2024). Some of these studies also highlight the importance of incorporating sustainability objectives into the supplier selection process, recognising the growing need to integrate environmental and social criteria into SRM strategies (Hennink, 2024; Rahmawati & Salimi, 2022). However, while these works have significantly advanced the understanding of SRM, few have addressed the integration of sustainability within PRM frameworks, which extend beyond suppliers to include a broader range of strategic partners, particularly in the aviation sector.

Therefore, this study aims to develop a Decision Support System (DSS) to enhance the relationship management of existing global partners. The DSS will first focus on categorising partners, which is essential because managing a large number of partners individually is not efficient (Panizzolo, 1998). By categorising them based on their potential to contribute to sustainability, the DSS enables more targeted and effective strategies for collaboration. This allows for the second focus of the development of a strategy for each category, improving sustainability through effective PRM. Partner segmentation and supplier segmentation are well-established methods in managing business relationships, allowing organisations to create segments that distinguish partners and suppliers into categories with comparable properties. This study will apply the Portfolio Purchasing Model (PPM) of Kraljic (1983), which provides a foundational framework for segmenting suppliers based on their strategic importance and the complexity of their supply market. The developed DSS will then be applied to a cargo airline.

The next section (Section 2) provides a literature review. Section 3 outlines the methodology employed in this study. In Section 4, the DSS is introduced with its components. Section 5 details the application of the DSS to a cargo airline, including data collection, analysis and results including the strategies. Section 6 discusses the research. Finally, Section 7 concludes the study with key findings and suggestions for future research.

2. Literature review

This chapter reviews the key concepts from the literature that form the foundation of this study: sustainability, Partner Relationship Management, the segmentation of partners based on capabilities and willingness and the initial components of strategies tailored to different partner segments.

2.1. Sustainability

Sustainability is a multifaceted concept often defined as "*development that meets the needs of the present generation without compromising the ability of future generations to meet their needs*" (Thomsen, 2013, p.2358). It is typically framed around three key pillars: social, economic, and environmental sustainability.

(1) Social sustainability: This pillar focuses on maintaining and improving social quality, including aspects such as equity, access to resources, health, and education. It is essential to ensure that development benefits society as a whole, particularly marginalized groups.

(2) Economic sustainability: This pillar ensures that economic activities are conducted in a financially viable long-term way. It focuses on creating economic value without depleting resources or causing harm to the environment and society.

(3) Environmental sustainability: This pillar involves protecting the natural environment to support the well-being of current and future generations. It includes practices that reduce pollution, conserve natural resources, and maintain biodiversity.

The interdependence of these pillars underscores the complexity of sustainability, requiring a balanced approach that does not prioritize one at the expense of the others (Thomsen, 2013).

2.2. Partner relationship management

PRM is a strategic approach focused on "*building collaborative relationships with partners through effective and reliable processes*" (Suh et al., 2005, p.50). In the context of supply chains, effective PRM is crucial for ensuring that all partners align with the overarching goals of an organisation, including sustainability objectives. PRM's role in promoting collaboration is particularly important as it enables companies to work closely with their partners to enhance sustainability within their operations (Fabbe-Costes, et al., 2014). By managing these relationships strategically, companies can foster mutual benefits and improve their collective performance in meeting sustainability (Luthra et al., 2017).

Within the area of PRM, segmentation has emerged as a powerful tool, especially within the framework of the PPM by Kraljic (1983). The PPM categorises suppliers based on their strategic importance and the complexity of the supply market, allowing companies to prioritise and manage supplier relationships more effectively. Segmentation is particularly ideal for situations where a large number of partners need to be managed (Panizzolo, 1998). Although segmentation is traditionally used during the partner selection process, it can also be applied effectively to evaluate current, existing partners. By categorising partners into distinct segments, companies can tailor their management strategies to each segment's specific needs and characteristics, thereby enhancing the overall effectiveness of PRM. Building on the foundational work of Kraljic, Rezaei and Ortt (2012) have adapted the segmentation model by introducing two key axes for evaluation: capabilities and willingness. This adaptation shifts the focus from purely economic factors to include the partners' ability and motivation to contribute to specific goals, such as sustainability. The definition of the capabilities and the willingness of a partner to enhance sustainability can be adapted and specified from Rezaei and Ortt (2012) and defined as follows:

- **Capabilities:** The capabilities of a partner to enhance sustainability are complex bundles of skills and accumulated knowledge, exercised through organisational processes that enable firms to coordinate activities and make use of their assets in different business functions with the goal to engage in sustainability practices.

- **Willingness:** The willingness of a partner to enhance sustainability is confidence, commitment and motivation to engage in sustainability practices.

Evaluating partners based on these dimensions has proved to be highly effective (Akhavan, Shahabipour, & Hosnavi, 2018; ul-haque & Siddiqui, 2019). Companies can gain a deeper understanding of where each partner stands in terms of sustainability and can develop more targeted strategies to enhance their performance.

2.3. Sustainability criteria

An extensive literature review was conducted to develop a comprehensive evaluation framework to identify relevant sustainability criteria aligned with the capabilities and willingness axes. These criteria form the basis for assessing partners and are crucial for effectively segmenting and managing partner relationships in the context of sustainability. The capabilities and willingness criteria to enhance sustainability presented in Table 1 are derived from the table of (Rezaei & Ortt, 2013a, p. 76-77) and supplemented with the research of the Almeida et al. (2021), Corral (2003), Meier et al. (2023), and Kannan and Tan (2002). Appendix A provides an explanation of all the capabilities and willingness criteria.

2.4. Initial components of strategies

Based on the capabilities and willingness criteria, partners can be segmented. Since segmentation has already been conducted using the two dimensions of capabilities and willingness, the literature provides valuable insights into potential strategies for improving both dimensions according to the specific segment. Therefore, an overview of initial components of strategies, derived from existing literature, is provided based on segmentation into four distinct segments. These initial strategies can be tailored when applying the DSS developed in this study to address the specific needs and characteristics of the partners. The four segments commonly found in the literature are:

- Type I: low capabilities and low willingness
- Type II: low capabilities and high willingness
- Type III: high capabilities and low willingness
- Type IV: high capabilities and high willingness

The initial components of strategies for each segment are informed by existing research on supplier segmentation, based on the literature of Rezaei and Ortt (2013a), Rezaei, Wang, and Tavasszy (2015), Rezaei and Lajimi (2019), and Bai, Rezaei, and Sarkis (2017). These strategies provide a foundational framework that can be refined and specified during the practical application of the DSS.

Table 1. List of capabilities and willingness criteria to enhance sustainability

Capabilities criteria	Willingness criteria
Collaborative capability	Attitude
Financial position	Commitment to continuous improvement in process
Geographical location capability	Dependency
Innovation management capability	Economic opportunities
Knowledge management capability	Environmental concerns
Management and organisation	Ethical standards
Measurement capability	Government grants
Position in industry	Honest and frequent communications
Technological capability	Long-term relationship
	Market pressure
	Mutual respect and honesty
	Regulatory pressure
	Relationship closeness
	Strict contract terms and conditions
	Willingness to co-design and participate in new sustainability practices
	Willingness to invest in specific equipment
	Willingness to share information, ideas, and technology

2.4.1. Type I: low capabilities and low willingness

For this segment, the primary component of the strategy is to consider replacement due to their limited utility (Bai et al., 2017; Rezaei & Lajimi, 2019; Rezaei & Ortt, 2013a; Rezaei et al., 2015). However, if immediate replacement is not feasible (e.g., because of supply chain constraints), implement developmental measures which are aimed at gradually improving both the partner's willingness and capability (Rezaei & Lajimi, 2019; Rezaei & Ortt, 2013a). According to Rezaei et al. (2015), it is advisable to first improve partners' willingness in this segment before improving capabilities. This could involve partner assessment and feedback mechanisms, small-scale financial incentives, or technical support introducing basic practices (Rezaei & Ortt, 2013a).

2.4.2. Type II: low capabilities and high willingness

This segment, characterised by its high willingness but low capabilities, is ideal for substantial development investments. Tailored training programs that focus on specific practices, technical assistance and sharing of best practices can be highly effective (Bai et al., 2017; Rezaei et al., 2015). Forming cross-functional teams to address specific challenges collaboratively can also be beneficial (Rezaei & Ortt, 2013a). This approach enhances their capabilities but also reinforces their commitment, using the partner's willingness to improve.

2.4.3. Type III: high capabilities and low willingness

Partners in this segment possess the required capabilities but lack the motivation. Strategies should, therefore, focus on incentivising engagement through mutually beneficial initiatives (Rezaei & Ortt, 2013a). Encouraging a partnership by demonstrating loyalty and offering long-term commitments can be effective (Rezaei et al., 2015). Additionally, engaging partners in strategic decision-making may help align their objectives, as they see the direct benefits of their involvement and the importance of these objectives (Rezaei & Lajimi, 2019).

2.4.4. Type IV: high capabilities and high willingness

Partners in this segment are the most aligned with the organisation's goals and, thus, should be engaged in strategic collaborations. Initiatives include co-developing new products, sharing resources for joint research, and integrating them into the core processes of the company's agenda (Bai et al., 2017; Rezaei & Ortt, 2013a). Maintaining these relationships through regular recognition programs, shared successes, and even co-marketing initiatives can reinforce their commitment and show their role as leaders within the supply chain (Rezaei et al., 2015).

3. Methodology

This study employs a Multi-Criteria Decision-Making (MCDM) approach to address the complexities of guiding PRM towards achieving sustainability goals in the operations of cargo airlines. "*MCDM is concerned with structuring and solving decision and planning problems involving multiple criteria. The purpose is to support decisionmakers facing such problems*." (Majumder, 2015, p. 35).

MCDM enables selecting criteria, scoring partners based on those criteria, and illustrating the trade-offs between different criteria (Triantaphyllou, 2000). For this study, the criteria have been selected to reflect both willingness and capabilities to enhance sustainability. This allows for creating a matrix to segment the partners into different categories (structuring decision problems), following a framework similar to the Kraljic Matrix (Kraljic, 1983). By creating a matrix and segmenting partners based on their willingness and capabilities, cargo airlines can adopt strategies to guide PRM toward achieving sustainability goals.

Within the MCDM framework, criteria are chosen, partners are scored, the weights of the criteria are determined, and finally, the partners are segmented. For the specific part within the MCDM that determines the weights of the different criteria, the Best-Worst Method is utilised. BWM is an efficient and reliable method that involves pairwise comparisons between the best and worst criteria to derive the weights for each criterion. The relative importance of the selected criteria is calculated by BWM based on input from one or more experts. This approach is particularly advantageous for this study as it reduces the number of comparisons required, thus minimising the cognitive load on experts while ensuring consistency in the results. Besides that, BWM also minimises bias, which can occur during the involvement of experts to determine weights for criteria (Rezaei, 2021; Rezaei, Arab, & Mehregan, 2022). Rezaei (2016b) provides an Excel solver that supports the method's straightforward application. (Rezaei, 2020; Wu, Liu, Zhou, Qin, & Rezaei, 2024). An overview of the steps and models used in this study is presented below, derived from Rezaei (2015).

Step 1: From the list of capabilities and willingness criteria, a set of relevant criteria needs to be determined for capabilities $C_1^C, C_2^C, \dots, C_n^C$ and for willingness $C_1^W, C_2^W, \dots, C_n^W$.

Step 2: The best and the worst criteria have to be determined based on the set of chosen capabilities criteria and based on the set of willingness criteria.

Step 3: The preference of the best criterion over all the criteria is determined. This is done by scoring the best criterion with a score from one to nine over the other criteria. A score of 'one' means that the best criterion is of equal importance to the other criteria. A score of 'nine' means that the best criterion is absolutely more important than the other criterion. The definition of the scale from one to nine is provided in the Excel solver (Rezaei, 2016b).

The best-to-others vector which is obtained from this step is: $A_B = (a_{B1}, a_{B2}, \dots, a_{Bn})$ with a_{Bj} is the preference from one to nine of the best criterion B over criterion j.

Step 4: For the worst criterion, the same needs to be done for the preference of the other criteria over the worst criterion with a score from one to nine. The others-to-worst vector from this step is: $A_W = (a_{1W}, a_{2W}, \dots, a_{nW})^T$.

Rezaei (2016a, p. 130) provides the linear model of BWM, which is the used model in the Excel solver (Rezaei, 2016b).

Step 5 (linear): The optimal weights $(w_1^*, w_2^*, \dots, w_n^*)$ for the criteria can be calculated with the following models.

$$\min \max_j \{|w_B - a_{Bj} w_j|, |w_j - a_{jW} w_W|\}$$

such that

$$\sum_j w_j = 1$$
$$w_j \geq 0, \text{ for all } j$$

(1)

Transforming Model (1) into a linear programming problem:

$$\min \xi^L$$

such that

$$|w_B - a_{Bj} w_j| \leq \xi^L, \text{ for all } j$$
$$|w_j - a_{jW} w_W| \leq \xi^L, \text{ for all } j$$
$$\sum_j w_j = 1$$
$$w_j \geq 0, \text{ for all } j$$

(2)

When Model (2) is solved, the optimal weights $(w_1^*, w_2^*, \dots, w_n^*)$ and ξ^{L*} are acquired. The Excel solver automatically calculates the optimal weights after steps 1 to 4 have been executed by the expert. The solver supports evaluating three to nine criteria (more than nine criteria are possible, but then clustering is recommended). Additionally, the solver calculates the input-based consistency ratio, which indicates the consistency level of the input provided by the expert. This ratio is crucial for verifying the logical consistency of pairwise comparisons, ensuring reliable results. The input-based consistency ratio is calculated as follows (Liang, Brunelli, & Rezaei, 2020, p. 3):

$$CR^I = \max_j CR_j^I$$

where

$$CR_j^I = \begin{cases} \dfrac{|a_{Bj} \cdot a_{jW} - a_{BW}|}{a_{BW} \cdot a_{BW} - a_{BW}}, & a_{BW} > 1 \\ 0, & a_{BW} = 1 \end{cases}$$

(3)

Table 2 shows the different thresholds for the input-based consistency measurement. This threshold value depends on the number of criteria evaluated and the scale evaluation. The pairwise comparison consistency level is considered acceptable if the input-based consistency ratio, which can be calculated using Formula (3), is lower than the associated threshold found in the table. (Liang et al., 2020).

Table 2. Thresholds for the different combinations of input-based consistency ratio

Scales	Criteria						
	3	4	5	6	7	8	9
3	0.1667	0.1667	0.1667	0.1667	0.1667	0.1667	0.1667
4	0.1121	0.1529	0.1898	0.2206	0.2527	0.2577	0.2683
5	0.1354	0.1994	0.2306	0.2546	0.2716	0.2844	0.2960
6	0.1330	0.1990	0.2643	0.3044	0.3144	0.3221	0.3262
7	0.1294	0.2457	0.2819	0.3029	0.3144	0.3251	0.3403
8	0.1309	0.2521	0.2958	0.3154	0.3408	0.3620	0.3657
9	0.1359	0.2681	0.3062	0.3337	0.3517	0.3620	0.3662

4. Result 1: Decision support system

Figure 1 illustrates the developed DSS designed to enhance sustainability in the operations of cargo airlines by creating a step-by-step partner strategy. This strategy is based on the segmentation results derived from the BWM within the MCDM method.

Within the DSS, the green boxes represent the input and output: the goal of enhancing sustainability and the resulting step-by-step partner strategy. The sustainability goal guides the entire process, while the step-by-step strategy serves as the actionable plan for managing partners based on their capabilities and willingness to achieve the specified sustainability objectives.

The yellow boxes highlight the foundational elements derived from the literature review. These include the two axes of capabilities and willingness for which the list of criteria is made (Table 1). Also, the initial components of strategies are derived from the literature (Section 2.4), which are intended to improve the capabilities and/or the willingness. These strategies are based on the standard 2x2 segmentation model. These inputs form the theoretical underpinning of the DSS and ensure that the strategy is grounded in established research.

The blue boxes indicate the inputs that need to be specified based on the specific application of the DSS. This includes the detailed sustainability goals relevant to the organisation and the associated partners to be evaluated. These inputs are crucial for tailoring the DSS to the particular context in which it is applied, ensuring relevance and applicability.

The DSS process begins with selecting and specifying criteria from Table 1 corresponding to the specified sustainability goal. This step aligns with the first step of the BWM. Following this, partners are scored on a scale from 1 to 5 (ranging from 'very low' to 'very high') based on the specified partners in the application. Importantly, partners are scored before determining the trade-offs between criteria to prevent bias in the evaluation process.

Next, steps 2 to 5 of the BWM are executed to establish the trade-off between the selected criteria. This step ensures that the criteria are weighed accurately, reflecting their relative importance in achieving the sustainability goals.

The resulting segmentation of partners based on these weighted criteria allows for a nuanced understanding of each partner's capabilities and willingness. This segmentation informs the subsequent step, where the initial components of strategies are specified according to the focused sustainability goal during the DSS application.

A checklist is then used to determine the extent to which each partner has already implemented sustainability initiatives beyond merely assessing their capabilities and willingness. The checklist is a single box within the DSS and is only dependent on the specific sustainability goal. Once the sustainability goal is specified, the checklist

can already be created and information about the current sustainability level of partners can already be collected. This additional evaluation ensures that the strategy accounts for the current status of sustainability practices within the partner network.

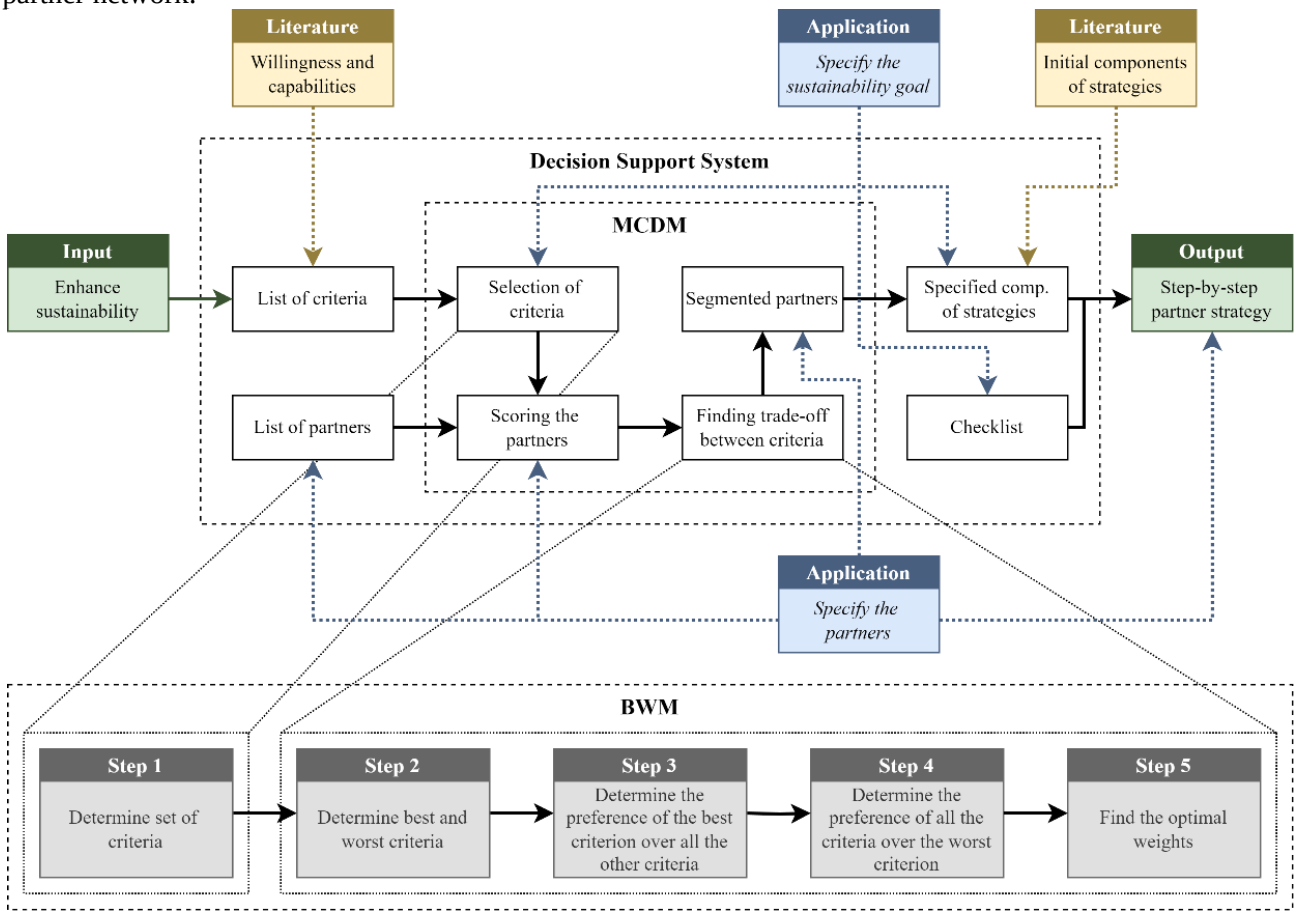

Figure 1. Conceptual overview of the DSS

The final output of the DSS is a step-by-step partner strategy tailored to the specific sustainability goals and the segmentation results. This strategy provides a clear and actionable roadmap for managing partners in a way that aligns with and enhances the organisation's sustainability objectives.

5. Result 2: Application of the decision support system

The DSS developed in this study has been applied to the operations of a cargo airline. As outlined earlier, the DSS requires the specification of key elements within the blue boxes, which are the specific sustainability goals and the relevant partners. For this particular cargo airline, the sustainability goals were set as zero emissions and zero waste, with the target year for achieving these goals still under consultation.

The focus of this application was on the GHAs operating at various outstations. GHAs are service providers responsible for a wide range of ground support services at airports, which are crucial for both passenger and cargo airlines. GHAs play a vital role in ensuring the smooth functioning of airline operations on the ground, helping airlines maintain their schedules and properly handle cargo. An outstation refers to any airport from which the airline operates outside of its main base or hubs. These outstations are critical nodes in the airline's global network. This makes the effective management of GHAs at these locations essential for achieving the airline's overall sustainability goals. The application of the DSS aims to systematically evaluate and manage these partners to drive the airline towards its sustainability targets of zero emissions and zero waste. (Swissport, n.d.)

5.1. Data collection

Data collection for the application of the DSS involved analysing 168 outstations where the cargo airline was transporting goods. These outstations were geographically distributed across four areas as shown in Table 3: Asia (22 outstations), Africa (34 outstations), America (49 outstations), and Europe (63 outstations).

Table 3. Distribution of the 168 scored outstations per market and area

Area	Market	Number of stations	Total
Asia	Greater China	4	22
	Japan - Korea	4	
	Middle east	4	
	India	3	
	Southeast Asia	7	
Africa	Sub-Sahara	13	34
	Northwest Africa and Levant	8	
	Eastern and Southern Africa and Indian Ocean (ESAIO)	13	
America	North American Market	30	49
	South American Market	19	
Europe	Central and Eastern Europe	12	63
	Iberia	5	
	Italy and Switzerland	4	
	German and Austria	11	
	Great Britain and Ireland (GBI)	10	
	Belgium, Netherlands and Luxembourg (Benelux)	3	
	Nordic	8	
	France	10	
Total			168

The selection of relevant criteria for evaluating the capabilities and willingness of GHAs at the outstations was performed by two experts. These experts were an Area Operations Director (AOD) and a Procurement Unit Manager of the cargo airline, providing complementary perspectives. Both experts were separately asked to assess which criteria from the full list of sustainability criteria found in the literature as shown in Table 1 should be taken into account, using a 'yes', 'maybe', or 'no' approach. Criteria marked as 'yes' by both experts or as 'yes' by one expert and 'maybe' by the other were included.

For five criteria, the experts initially disagreed, with one expert saying 'yes' and the other 'no'. These criteria were revisited in a second round of communication, during which the expert's line of reasoning for their respective decisions were shared. Following this discussion, both experts agreed to leave these criteria out, concluding that a smaller, more focused set of criteria would make the scoring process more clear and efficient. The final selected criteria are presented in Table 4.

Table 4. Selected sustainability capabilities and willingness criteria

	Selected capabilities criteria		Selected willingness criteria
C_1^C	Collaborative capability	C_1^W	Commitment to continuous improvement in process
C_2^C	Financial position	C_2^W	Economic opportunities
C_3^C	Knowledge management capability	C_3^W	Environmental concerns
C_4^C	Management and organisation	C_4^W	Ethical standards
C_5^C	Measurement capability	C_5^W	Government grants
C_6^C	Technological capability	C_6^W	Market pressure
		C_7^W	Regulatory pressure
		C_8^W	Willingness to invest in specific equipment

Following the selection of criteria, AODs were tasked with scoring the outstations within their respective areas. The scoring was based on the chosen criteria, using a scale from 1 to 5, where 1 represented 'very low' performance and 5 represented 'very high' performance. Each AOD was responsible for scoring the outstations within their designated area. Before the scoring process started, a consensus-building exercise was conducted by the researcher to ensure consistency. A GHA operating across all four areas was identified, and one of the corresponding outstations per area was scored by the AODs. Two criteria which were scored the same for all four outstations were discussed collectively, and the AODs confirmed that the interpretations of the criteria and scoring were consistent across the different areas. The results of the scoring of all the outstations are presented in Appendix B.

Subsequently, the same two experts who initially selected the criteria were interviewed again. This time, the objective was to collect pairwise comparison data for the identified criteria, following the BWM structure as outlined by Rezaei (2015). This data was crucial for determining the relative weights of the criteria within the MCDM framework. Since it is possible for an expert to both score the partners and select and determine the relative weights of the criteria, it is important that the weighing process occurs after the scoring. In this study, one of the two experts was involved in both processes. To prevent bias—where knowledge of the weights could influence how partners are scored—the weights were determined only after the scoring had been completed, as shown in the DSS (Figure 1).

Finally, to specify the components of strategies tailored to the cargo airline's operations, a focus group was convened with the AODs. During this session, the segmentation results and initial components of strategies were presented. The AODs discussed these elements to refine and specify the strategies, ensuring they were suited to the cargo airline's specific operational context.

5.2. BWM results

The results of the BWM are presented in Tables 5 and 6, which show the weights assigned to the capabilities and willingness criteria as determined by the two experts involved in the study. For both sets of criteria, the geometric mean of the weights provided by the experts was calculated. These geometric means were then normalised so that the weights of the capabilities criteria sum up to 1 and the weights of the willingness criteria sum up to 1, providing the final weights used in the analysis.

Table 5. Capabilities criteria weights

Capabilities criteria	Expert 1	Expert 2	Geometric mean	Normalised weights
C_1^C	0.282	0.094	0.162	0.175
C_2^C	0.282	0.187	0.230	0.247
C_3^C	0.166	0.112	0.137	0.147
C_4^C	0.066	0.112	0.086	0.093
C_5^C	0.039	0.043	0.041	0.044
C_6^C	0.166	0.451	0.274	0.294

Table 6. Willingness criteria weights

Willingness criteria	Expert 1	Expert 2	Geometric mean	Normalised weights
C_1^W	0.177	0.323	0.239	0.255
C_2^W	0.059	0.079	0.068	0.073
C_3^W	0.295	0.131	0.197	0.210
C_4^W	0.118	0.098	0.108	0.115
C_5^W	0.071	0.131	0.096	0.103
C_6^W	0.071	0.028	0.045	0.048
C_7^W	0.034	0.131	0.066	0.071
C_8^W	0.177	0.079	0.118	0.126

The input-based consistency ratios for the pairwise comparisons provided by the two experts were evaluated for both the capabilities and willingness criteria. In both cases, the consistency ratios were found to be acceptable, falling below the threshold as specified by Liang et al. (2020) as shown in Table 7. This indicates that the comparisons made by the experts were consistent, which shows the reliability of the derived weights.

Table 7. Input-based consistency ratio of the pairwise comparison

	Expert 1		Expert 2	
	Input-based CR	**Threshold**	**Input-based CR**	**Threshold**
Capabilities criteria	0.3000	0.3044	0.3036	0.3154
Willingness criteria	0.2619	0.3251	0.2222	0.3620

5.3. Aggregated scoring results

To determine the overall score for each outstation j for both capabilities and willingness, the normalized weights of the criteria w_i as shown in Table 5 and 6 were multiplied by the score s_{ij} of each outstation on each criterion. The aggregated scores *S* were calculated using Formula (4):

$$\text{Aggregated score } (S_j) = \sum_{i=1}^{n} w_i \cdot s_{ij} \quad (4)$$

Appendix C presents the aggregated capabilities and willingness scores for each of the 168 outstations, organised per area, along with the area averages. Figure 2 and Table 8 illustrate the segmentation of outstations into four distinct segments based on their capabilities and willingness scores. Notably, no outstations were classified into Type II (low capabilities, high willingness). The largest segment was Type IV (high capabilities, high willingness), followed by Type I (low capabilities, low willingness), and then Type III (high capabilities, low willingness).

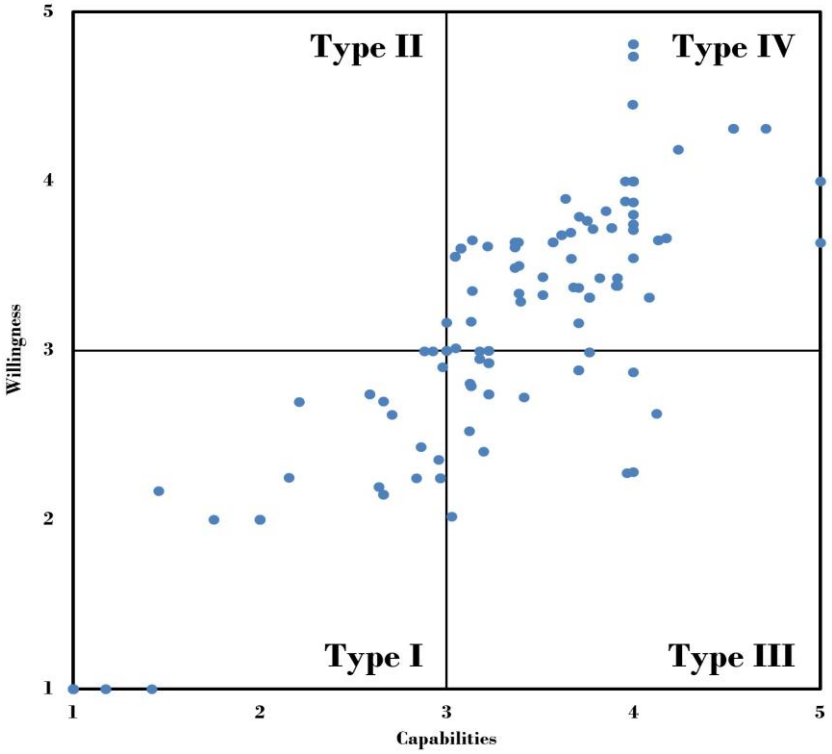

Figure 2. The segmented outstations

Table 8. The segmented outstations

Segments	No. of outstations	Outstation no.
Type I	39	15, 19, 20, 21, 22, 24, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 41, 42, 43, 52, 53, 54, 59, 61, 66, 69, 71, 74, 83, 84, 85, 86, 95, 98, 118, 146
Type II	0	-
Type III	26	9, 13, 14, 18, 23, 26, 44, 47, 55, 56, 60, 62, 64, 72, 78, 90, 91, 92, 93, 96, 97, 107, 117, 131, 143, 144
Type IV	103	1, 2, 3, 4, 5, 6, 7, 8, 10, 11, 12, 16, 17, 25, 40, 45, 46, 48, 49, 50, 51, 57, 58, 63, 65, 67, 68, 70, 73, 75, 76, 77, 79, 80, 81, 82, 87, 88, 89, 94, 99, 100, 101, 102, 103, 104, 105, 106, 108, 109, 110, 111, 112, 113, 114, 115, 116, 119, 120, 121, 122, 123, 124, 125, 126, 127, 128, 129, 130, 132, 133, 134, 135, 136, 137, 138, 139, 140, 141, 142, 145, 147, 148, 149, 150, 151, 152, 153, 154, 155, 156, 157, 158, 159, 160, 161, 162, 163, 164, 165, 166, 167, 168

Furthermore, when combining the segmentation information with the geographical areas where the outstations operate, Figure 3 was generated, demonstrating how the outstations in each area are segmented. The detailed distribution of outstations per area by segment is shown in Tables 9 and 10.

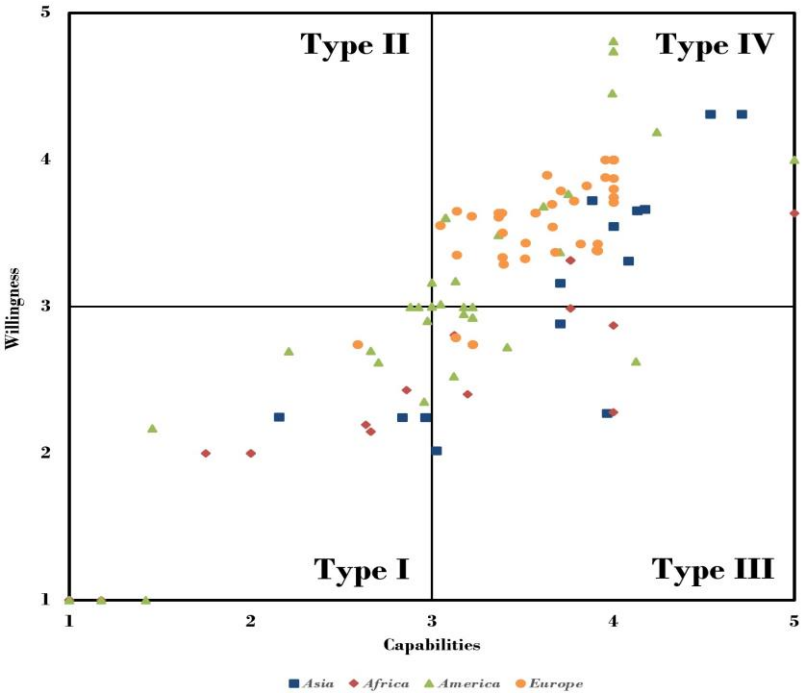

Figure 3. The segmented outstations per area

Table 9. The number of segmented outstations

	Asia	Africa	America	Europe
Type I	5	20	12	2
Type II	0	0	0	0
Type III	4	6	11	5
Type IV	13	8	26	56
Total	**22**	**34**	**49**	**63**

Table 10. The segmented outstations per area per area in percentage

	Asia	Africa	America	Europe
Type I	23%	59%	24%	3%
Type II	0%	0%	0%	0%
Type III	18%	18%	22%	8%
Type IV	59%	24%	53%	89%
Total	**100%**	**100%**	**100%**	**100%**

Another perspective on the results is achieved by categorising the outstations according to the GHA managing them. When a GHA operates at ten or more outstations, it is considered a category. This categorisation is depicted in Figure 4 and detailed in Tables 11 and 12.

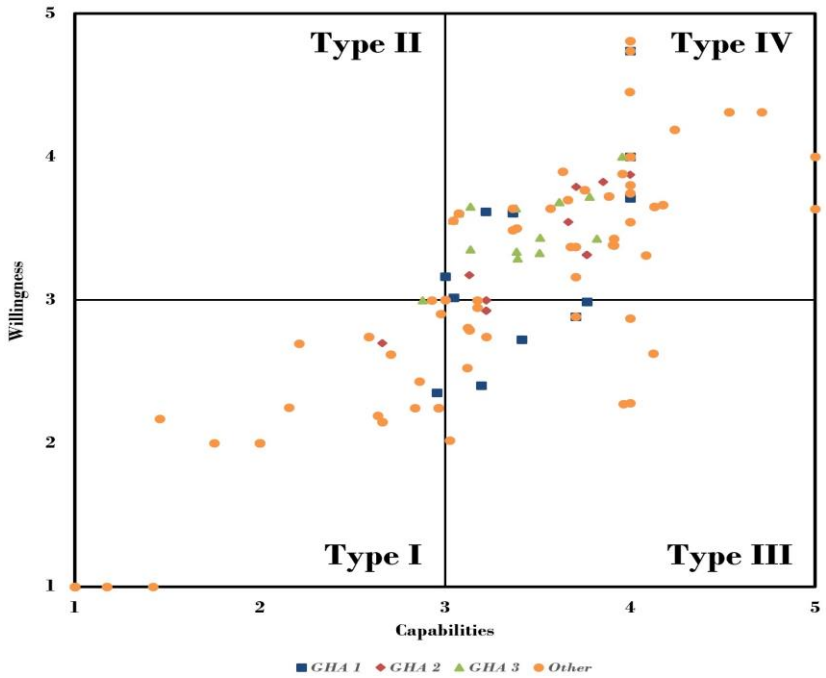

Figure 4. The segmented outstations per GHA

Table 11. The number of segmented outstations per GHA

	GHA 1	GHA 2	GHA 3	Other
Type I	1	3	1	34
Type II	0	0	0	0
Type III	5	8	0	13
Type IV	8	24	18	53
Total	**14**	**35**	**19**	**100**

Table 12. The segmented outstations per GHA in percentage

	GHA 1	GHA 2	GHA 3	Other
Type I	7%	9%	5%	34%
Type II	0%	0%	0%	0%
Type III	36%	23%	0%	13%
Type IV	57%	69%	95%	53%
Total	**100%**	**100%**	**100%**	**100%**

5.4. Specified components of strategies

The focus group provided valuable insights into tailoring the initial components of strategies for the different partner segments based on their capabilities and willingness to enhance sustainability. Initially, the components of strategies were specified within the sustainability context. These initial strategies were then presented to the focus group, who were asked to review and provide feedback. For each strategy, the focus group agreed with the initial components of strategies found in the literature specified for sustainability and supplemented it with additional insights to further refine the strategies. The focus group results are outlined below, detailing the specified components of strategies for each segment.

5.4.1. Type I: low capabilities and low willingness (n=39)

For partners with low capabilities and low willingness, the focus group agreed with the following initial components of strategies specified for sustainability: *The primary component of the strategy is to consider replacement due to their limited utility in advancing sustainability goals. However, if immediate replacement is not feasible (e.g., because of supply chain constraints), implement developmental measures which are aimed at gradually improving both the partner's willingness and capability. It is advisable to first improve the willingness of partners in this segment before improving capabilities. This could involve partner assessment and feedback mechanisms, small-scale financial incentives, or technical support that introduces basic sustainable practices. Basic sustainability development activities might make these partners minimally compliant with certain sustainability goals, thus improving their sustainability performance.*

In addition, the focus group recommended implementing a bonus-malus system for partners with low capabilities and low willingness to incentivise sustainable practices. Outstations that meet or exceed specific sustainability goals would be rewarded, while those failing to do so may face penalties. Additionally, recognising progress through tokens or gift cards could motivate further efforts.

Direct engagement was also emphasised. Representatives from the central organisation should visit outstations as guest speakers or lecturers, providing direct support and reinforcing the importance of sustainability goals. While this direct engagement is crucial, supplementary one-pagers highlighting key sustainability practices and updates should be regularly distributed. Education plays a key role in this strategy. Masterclasses on sustainable practices, supported by technical assistance, will help partners effectively implement these practices.

Finally, a certification program could be established to evaluate and recognise the sustainability efforts of GHAs at outstations, serving as a benchmark for sustainability and aiding in the selection of new GHAs during the procurement process.

5.4.2. Type II: low capabilities and high willingness (n=0)

For partners with low capabilities and high willingness, the focus group agreed with the following initial components of strategies specified for sustainability: *This segment is ideal for substantial development investments. Tailored training programs that focus on sustainable practices, technical assistance and sharing of best practices can be highly effective. Forming cross-functional teams to address specific sustainability challenges collaboratively can also be beneficial. This approach enhances their capabilities but also reinforces their commitment to sustainability, using the partner's willingness to improve.*

In addition, the focus group recommended collaboration with local management and government to explore potential subsidies or grants, encouraging collective efforts towards sustainability. Capability-building initiatives, such as training sessions and best practice sharing, should be implemented to provide immediate benefits and demonstrate the return on investment in sustainability efforts.

The cargo airline can also assist partners in developing solid business cases for sustainable investments, showing the long-term benefits and cost savings. Partnerships with non-governmental organisations and local organisations committed to sustainability can provide additional support and resources, enhancing the impact of sustainability initiatives.

5.4.3. Type III: high capabilities and low willingness (n=26)

For partners with high capabilities and low willingness, the focus group agreed with the following initial components of strategies specified for sustainability*: Strategies should focus on incentivising engagement through mutually beneficial sustainability initiatives. Encouraging a partnership by demonstrating loyalty and offering long-term commitments can be effective. Additionally, engaging partners in strategic decision-making processes may help in aligning their objectives with sustainability goals, as they see the direct benefits of their involvement and the importance of those goals.*

In addition, the focus group recommended to focus on highlighting the return of investment and long-term commitments. Emphasising the return on investment of sustainability initiatives can influence these partners' willingness to engage. Although they have the capabilities to invest, highlighting the potential gains from sustainability effort can motivate them to take action. Outstations demonstrating strong commitments to sustainability should be offered longer-term contracts, while those without such commitments are only offered shorter-term contracts.

Standardising contracts to include mandatory sustainability commitments ensures that sustainability remains a key factor in procurement decisions. Additionally, conducting benchmark studies to compare these outstations with other market players who prioritise sustainability can provide constructive pressure to increase their commitment.

5.4.4. Type IV: high capabilities and high willingness (n=103)

For partners with high capabilities and high willingness, the focus group agreed with the following initial components of strategies specified for sustainability: *Partners in this segment are the most aligned with the organisation's sustainability goals and, thus, should be engaged in strategic collaborations. Initiatives include co-developing new sustainable products, sharing resources for joint sustainability research, and integrating them into the core processes of the company's sustainability agenda. Maintaining these relationships through regular recognition programs, shared successes, and even co-marketing initiatives can reinforce their commitment and show their role as sustainability leaders within the supply chain.*

In addition, the focus group stated that effective communication and recognition are crucial. Sharing best practices and success stories publicly can motivate continuous improvement and encourage a culture of sustainability. Outstations performing well should be publicly recognised, creating a positive feedback loop that encourages others to join these sustainability efforts.

In regions where multiple outstations operate, leveraging the success of well-performing outstations to inspire and improve the performance of others in lower-performing segments can be highly effective. Demonstrating the achievements and benefits experienced by these outstations can serve as a practical example and inspiration for others to enhance their own practices.

5.4.5. Additional remarks

The focus group also highlighted the necessity of a checklist to ensure that sustainability practices have been effectively implemented. This checklist would serve as a tool to verify the actual adoption of sustainable practices at outstations, going beyond assessing capabilities and willingness. The importance of this checklist is further emphasised in the step-by-step strategy, where it plays a critical role in ensuring that sustainability goals are being met across all partner segments.

5.5. Step-by-step strategy

As an outcome of the DSS, a step-by-step strategy can be developed, providing clear and actionable steps for enhancing sustainability among partners. This strategy leverages the segmentation results and insights from the focus group, making it both practical and adaptable. While the step-by-step strategy is tailored for the cargo airline in this study, its general principles allow for broader application across different contexts.

The strategy is designed to guide the process of improving sustainability performance among partners by systematically addressing their capabilities and willingness. Although specific examples from the cargo airline

application are provided, the steps are described in a way that ensures their applicability to other scenarios. Figure 5 shows a conceptual overview of the step-by-step strategy.

5.5.1. Step 1: Segmentation and checklist

The first step in the strategy involves the execution of the segmentation as provided in the DSS. The focus group showed the importance of deploying a comprehensive checklist that assesses the current state of sustainability practices at each partner location. This checklist, filled in by the partners and tailored to the specific sustainability goals (in this application, filled in by the outstations and tailored for the goals of zero emissions and zero waste), serves as a diagnostic tool to identify both strengths and areas needing improvement. The checklist is essential for gaining an overview of the partners' current sustainability efforts, establishing a baseline from which future implementations can be tracked and progress, therefore, can be effectively monitored. The first step in the strategy is foundational, as it informs all subsequent actions by providing a clear picture of where each partner actually stands, besides their capabilities and willingness to enhance sustainability.

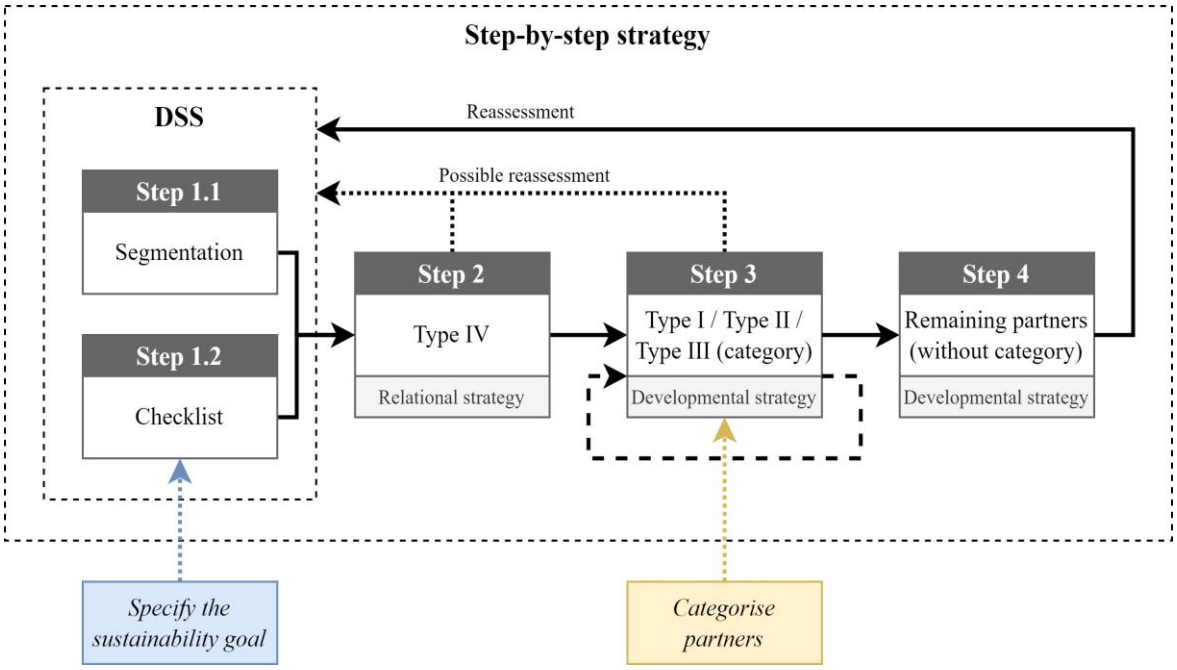

Figure 5. Step-by-step strategy

5.5.2. Step 2: Focus on Type IV partners

Next, the strategy prioritises Type IV partners, who exhibit both high capabilities and high willingness. These partners are selected first because they represent the quickest opportunity to implement impactful sustainability initiatives and, therefore, a quick win. Even though these partners are already well-positioned to support sustainability goals, the checklist will determine whether they have fully implemented the necessary practices to achieve them. The focus here is on leveraging their strengths to achieve early success, which can then serve as a model for other partners.

5.5.3. Step 3: Address Type I, II, and III partners by category

In the third step, the strategy shifts to Type I, II, and III partners, using a developmental approach. These partners are addressed by categorising them according to relevant factors, such as geographical area or overarching management structures. This categorisation allows for targeted comparisons, enabling the cargo airline to use well-performing Type IV partners as benchmarks for lower-performing segments within the same category. For

instance, in the application, both geographical areas and GHAs were used to group partners. This made it possible to leverage high-performing Type IV outstations within each area or GHA to inspire and improve the performance of Type I, II, and III outstation in the same category, as this is seen as a highly effective component of strategy based on the results of the focus group. As an example, within the category of GHA, it can be seen that for GHA 3, 18 out of the 19 outstations are classified as Type IV segment, while the remaining one is in Type 1. Within this GHA category, it is possible to leverage the 18 well-performing outstations and discuss with overarching management why the one outstation is performing significantly worse, using the successful practices of the higher-performing partners to improve the lower-performing one.

This step is iterative and can be repeated for different categories to ensure that all relevant factors are considered. Each iteration focuses on applying the most appropriate strategies for the identified categories, helping to elevate the performance or lower-performing partners by learning from those who excel in similar contexts. In the cargo airline application, the categorisation based on overarching GHAs proved highly effective and was used first. High-performing outstations could be leveraged to improve the performance of lower-performing outstations within the same GHA. Performing this step again by iterating resulted in the categorisation within the same area.

5.5.4. Step 4: Focus on remaining partners

The final step in the strategy is to concentrate on the remaining partners who could not be addressed through categorisation, such as those based on geographical area or overarching management. These partners typically present the most significant challenges, as there are no well-performing partners to leverage as example within the same category. As a result, these partners require the most intensive support and developmental strategies. The goal is to gradually build their sustainability capabilities and willingness through targeted interventions, tailored to their specific needs. After implementing these strategies, a reassessment is necessary to evaluate progress and make any necessary adjustments. Reassessment can occur after every step, depending on the time elapsed and the extent of changes that need to be evaluated.

6. Discussion

The segmentation analysis results reveal that most of the cargo airline's partners (approximately 61%) fall into the Type IV segments, characterised by high capabilities and high willingness. These findings suggest that most partners are both capable and willing to contribute to achieving sustainability goals, such as zero emissions and zero waste. Interestingly, no partners were categorised into the Type II segment, which indicates low capabilities but high willingness. About 23% and 15% of partners were found in the Type I (low capabilities, low willingness) and Type III (high capabilities, low willingness) segments, respectively.

The absence of partners in Type II and the significant presence in Type IV suggest that partners are generally aligned with the airline's sustainability objectives. However, this does not necessarily mean that sustainability practices have already been implemented; rather, it indicates potential for implementation of sustainability practices. This alignment offers a promising starting point for implementing sustainability strategies.

The consistency of scoring across several criteria for some outstations, as shown by the identical scores in both capabilities and willingness, indicates that the weighing of criteria did not influence the aggregated score for these specific partners. While this consistency might raise questions about potential bias or simplicity in the scoring process, it is crucial to note that the majority of outstations exhibited varying scores across criteria. This variation justifies the use of BWM for determining weights, as different weights still play a significant role in these cases. Therefore, the structured approach to evaluating the sustainability performance which BWM offers remains valid and appropriate for this context.

Further analysis of the results by geographical area and GHAs showed that segmentation varies significantly depending on the region and the GHA in charge. This area-based and GHA-based segmentation provides valuable insights for tailoring sustainability strategies to specific contexts.

The validation of the results by one of the two experts who also selected and weighed the criteria confirmed the accuracy of the segmentation. Additionally, when comparing the outcomes per area with overall Sustainable Development Goals (SDGs) scores, the results align with global sustainability performance trends (Sachs, Lafortune, Fuller, & Drumm, 2023). The correlations between the capabilities and willingness criteria, as well as within these categories, were moderate and significant, consistent with expectations and the literature. The logical

correlation between capabilities and willingness and the frequent underrepresentation of the Type II and Type III segments further underscores the interconnected nature of these criteria, as supported by existing literature (Akhavan et al., 2018; Bai et al., 2017; Rezaei & Lajimi, 2019; Rezaei & Ortt, 2012, 2013b; Rezaei et al., 2015).

Sensitivity plays a significant role in determining the weights of the criteria using the BWM, as the subjective opinions of experts influence these weights. Different experts may have varying perspectives on the importance of the criteria, leading to potential variations in the final weights and, therefore, segmentation. To assess the impact of this subjectivity, a sensitivity analysis was conducted, focusing on the highest possible difference in weights. Given the scale used (ranging from 1 to 5), scores could easily fluctuate by +1 or -1 due to the inherent subjectivity in expert judgment.

The sensitivity analysis identified outstations that lie close to the segmentation boundaries, indicating that these outstations should be handled with particular care. Figure 6 highlights these outstations with a red cross. The analysis reveals that 50 of the 168 outstations (approximately 29.8%) fall within this sensitive area. As these outstations are near the thresholds that determine their segment classification, they require more careful consideration when applying the specified components of strategies. The strategies may not be as effective or applicable to these outstations compared to those further from the segmentation boundaries. Conversely, the remaining outstations, unaffected by the sensitivity analysis, can be considered accurately placed within their corresponding segments, even when the sensitivity is considered.

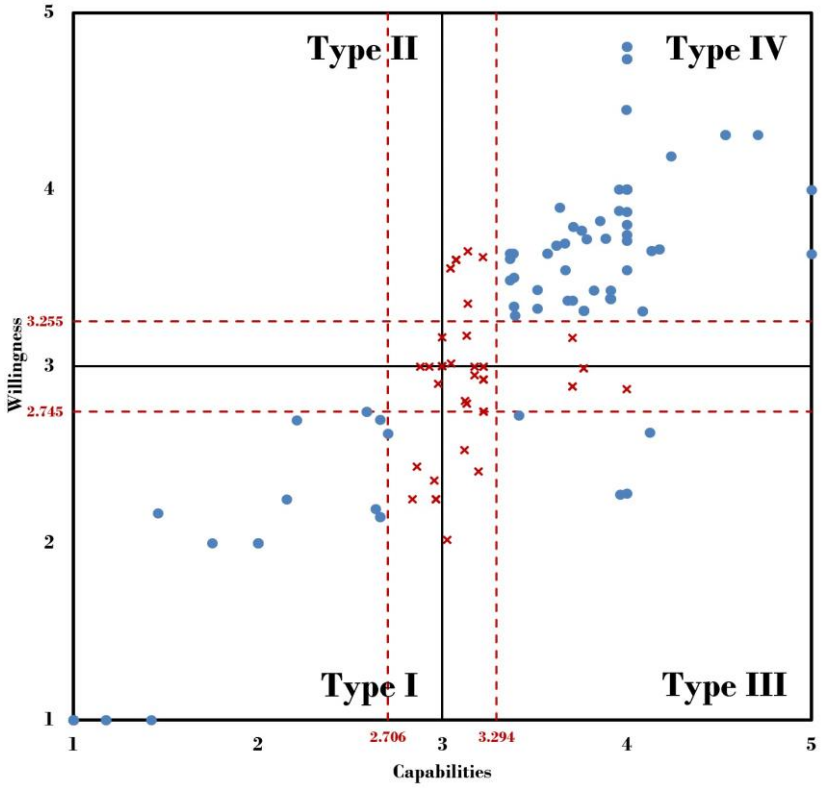

Figure 6. The segmented outstations with the sensitivity range

The checklist's reliability is questionable since it is filled out by the partners themselves, potentially leading to biased responses. Without a mechanism to verify the accuracy of the information provided, partners may overstate their implemented sustainability practices. Verifying the checklist to ensure the integrity of the data used in the DSS is essential, but time-consuming.

Bias may also arise from AODs scoring the partners, as they manage the sustainability strategies and may feel their performance is being judged by the partners' outcomes. Their intrinsic motivation to achieve sustainability goals could affect their objectivity, especially since they also specify the strategies for each segment. This could compromise the reliability of the results.

Additionally, the absence of Type II partners (low capabilities, high willingness) questions the reliability of strategies developed for this group. Since no real examples exist, the proposed strategies may not be as applicable or generalisable.

Finally, the step-by-step strategy assumes all outstations are equally important, potentially overemphasising small outstations with minimal impact. The focus on Type IV partners for quick wins is sensible but could be impractical under time constraints. The more challenging partners, which need the most attention, are addressed later in the process, potentially delaying progress toward sustainability goals.

7. Conclusion and future research

This study has demonstrated the effectiveness of a Decision Support System (DSS) in providing a structured framework for guiding Partner Relationship Management (PRM) toward achieving sustainability goals within cargo airlines. The successful application of the DSS to a cargo airline highlighted its ability to outline the necessary steps to address sustainability objectives systematically. Central to this process is the step-by-step strategy, which not only organises the actions needed but also ensures that sustainability goals are systematically pursued.

The checklist is crucial to the DSS. While segmenting partners based on their capabilities and willingness is crucial, the checklist provides an essential tool for assessing their actual sustainability performance. This dual focus on potential and actual performance ensures that the DSS is not only theoretical but also practical in enhancing sustainability outcomes.

This study also demonstrates that segmenting existing partners based solely on their sustainability capabilities and willingness is an effective approach. The results indicate that this method allows for a more nuanced and targeted strategy, enabling the company to focus its resources where they can have the most impact. By categorising partners according to these specific dimensions, the DSS facilitates more precise and actionable strategies tailored to each partner's potential and commitment to sustainability.

The DSS and the associated step-by-step strategy have shown potential for broader applicability beyond the cargo airline industry. The structured approach to categorising partners, whether by area, Ground Handling Agent (GHA), or other relevant options, enables a systematic and targeted implementation of sustainability strategies. This method could be adapted for use in other industries or for different types of sustainability initiatives.

While the DSS and step-by-step strategy have proven effective in this study, further research is needed to validate and refine these tools in other contexts. Further research should focus on the validation and broader application of the step-by-step strategy. The step-by-step strategy proposed in this study should be validated through application. This would help determine the extent to which the strategy can be generalised and identify any necessary adjustments for different contexts.

Furthermore, evaluating the DSS's applicability beyond cargo airlines to other industries would provide insights into its adaptability. This could involve testing the DSS in industries with similar sustainability challenges or in entirely different sectors where partner management is critical to achieving sustainability goals.

This research addresses notable gaps in the existing literature, particularly in the area of specific sustainability criteria. By developing a list of capabilities and willingness criteria, this study provides a general framework for assessing sustainability in companies. This contribution offers a detailed set of criteria that can be utilised not only in the aviation industry but also across various sectors where sustainability assessment is essential.

Furthermore, it has been observed that current partner selection processes often do not prioritise sustainability. The criteria developed in this research can be integrated with traditional selection criteria such as price and quality. This integration can enhance the evaluation process, ensuring sustainability becomes a core consideration in partner selection. By doing so, the research encourages a shift in how partners are evaluated, promoting sustainability as a critical factor in decision-making processes.

In addition, the strategies found in the literature based on the 2x2 segmentation model were initially identified as components of strategies rather than clear, explicit strategies. This research has supplemented these initial components of strategies, providing a more detailed overview. The specified components of strategies developed in this study can be applied in a broader context, offering guidance for various industries aiming to implement components of strategies based on segmentation.

Based on Rezaei and Ortt (2013b), market segmentation can be divided into three sub-topics:

(1) Consumer segmentation
(2) Industrial customer segmentation or demand-side business-to-business segmentation
(3) Supplier segmentation or supply-side business-to-business segmentation

This research proposes an extension to this framework by introducing a fourth category:
(4) Partner segmentation

This addition addresses a broad range of partners with whom a company collaborates to achieve a common goal, such as sustainability goals.

The most significant contribution of this research is the development of a generalised DSS. This system was designed in detail to guide PRM for the operations of existing partners of cargo airlines, specifically to achieve sustainability goals. The DSS integrates specific partners and sustainability goals as inputs, employing MCDM and particularly BWM methodology to process these inputs. The result is a step-by-step strategy tailored to enhance the sustainability performance of these partners.

Also, the step-by-step strategy can be used in a broader context. Even though the research focused on generalising the results for cargo airlines in general, it seems that it can be generalised to different actors as well. Organisations that want to achieve certain sustainability goals and are working with many partners can use the segmentation based on the DSS and the generalised strategies, including the step-by-step strategy, which shows which partners to focus on first and how.

Future research should explore various methods of categorising partners beyond the traditional 2x2 matrix. Understanding which segmentation techniques are most effective in different contexts will enable more tailored and impactful strategies. Developing clear guidelines for selecting segmentation methods will enhance the strategic use of the DSS.

Finally, applying segmentation methods suggested by Rezaei and Lajimi (2019), which categorises items into non-critical, leverage, bottleneck, and strategic items, could provide new insights. Incorporating segmentation based on the size and impact of the partners, such as critical versus non-critical partners or low-impact versus high-impact partners, could address the current limitation of not considering the size of partners. This approach could enhance the strategic planning and execution of sustainability initiatives by ensuring that partners with the most significant potential impact are prioritised effectively.

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Use of AI: AI has not been used.

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Appendix A. Explanation of the criteria

A.1. Capabilities

- **Collaborative capability**

Collaborative capability is a partner's ability to adopt initiatives for sustainability with partners within the own network or outside the own network. It includes the ability of the partner to cooperate with sustainability practices, which can not be achieved by a single partner.

- **Financial position**

The financial position of the partner, including the partner's credit rating, relative to the financial position of other partners within the network.

- **Geographical location capability**

The influence of the geographical location of the partner. This is purely about the geographical location, so it is not about the influence of the government or the public in that area.

- **Innovation management capability**

The capability of the partner to ease innovation processes while generating new ideas and creating new business opportunities to enhance sustainability.

- **Knowledge management capability**

The capability of the partner to acquire new knowledge and to evaluate current knowledge about sustainability practices. This is also called 'industry knowledge', with industry referring to the knowledge of sustainability practices.

- **Management and organisation**

The management and organisation of the partner in relation to the acceptance of sustainability practices.

- **Measurement capability**

The extent to which the partner can measure their performance based on sustainability. Knowing to what extent certain practices are sustainable contributes to actually enhancing sustainability practices.

- **Position in industry**

The partner's position in the industry in comparison with other competitors in the same industry, including the reputation of this partner.

- **Technological capability**

The capability of the partner to implement technologies to enhance sustainability.

A.2. Willingness

- **Attitude**

The attitude of the partner towards sustainability.

- **Commitment to continuous improvement in process**

The level of commitment of the partner to continuously improve the current processes.

- **Dependency**

The level of dependency of the partner on the organisation which is looked at.

- **Economic opportunities**

The level at which sustainable practices could lead to economic opportunities for the partner. The return of a sustainability investment could be higher for one partner in comparison with another partner.

- **Environmental concerns**

The level of environmental concerns (which can also be seen as public concerns and public pressure) of the public in the area where the partner operates. These concerns are purely focused on the opinion of the public.

- **Ethical standards**

The level of adoption of ethical standards by the partner.

- **Government grants**

The level of opportunities in which the government supports sustainable practices with grants or other tax rebates, which could motivate the partner to implement these sustainable practices.

- **Honest and frequent communications**

The frequency and the honesty of the communication with the partner.

- **Long-term relationship**

The length of the existing relationship with the partner.

- **Market pressure**

The level of pressure by the market to implement sustainable practices. This is purely focused on the market, which means that other companies can, for example, put pressure on the partner to implement sustainable practices.

- **Mutual respect and honesty**

The level of mutual respect and honesty with the partner.

- **Regulatory pressure**

The level of pressure by regulations to implement sustainable practices. This is purely focused on the pressure put by the government with regulations on the partner.

- **Relationship closeness**

The closeness of the relationship with the partner.

- **Strict contract terms and conditions**

The strictness of the contract's terms and conditions with the partner regarding implementing sustainability practices. This means that the higher the strictness, the higher the willingness for sustainability since implementing these sustainability practices is forced by the contract's terms and conditions.

- **Willingness to co-design and participate in new sustainability practices**

The partner's willingness to co-design and participate in new sustainability practices.

- **Willingness to invest in specific equipment**

The willingness of the partner to invest in specific equipment for sustainable practices.

- **Willingness to share information, ideas, and technology**

The willingness of the partner to share information, ideas, and technology to enhance sustainability.

Appendix B. Scoring of the outstations

This Appendix contains the scores of the 168 outstations on the capabilities and the willingness criteria. The outstations are scored by the AOD of each area. Table B1 shows the scores for Asia, B2 for Africa, Table B3 for America, and Table B4 for Europe.

Table B1. Scoring of the outstations in Asia

Area	Outstation	C_1^C	C_2^C	C_3^C	C_4^C	C_5^C	C_6^C	C_1^W	C_2^W	C_3^W	C_4^W	C_5^W	C_6^W	C_7^W	C_8^W
Asia	1	5	4	4	4	3	4	4	4	4	4	2	4	2	4
	2	5	4	4	4	3	4	4	4	4	4	2	4	2	4
	3	5	3	4	4	3	4	4	4	4	4	2	4	3	4
	4	5	3	4	4	3	4	4	4	4	4	2	4	3	4
	5	5	4	5	5	4	5	5	4	5	5	2	3	2	5
	6	4	4	5	5	4	5	5	4	5	5	2	3	2	5
	7	4	4	5	5	4	5	5	4	5	5	2	3	2	5
	8	5	5	4	4	3	3	5	3	3	3	1	2	2	4
	9	2	5	3	3	3	2	2	2	2	3	1	1	1	3
	10	4	4	4	4	4	4	4	4	5	4	1	1	1	4
	11	5	4	4	4	4	4	5	5	4	4	1	1	1	4
	12	5	4	4	4	4	4	5	5	4	4	1	1	1	4
	13	4	4	4	4	4	3	4	4	3	3	1	1	1	3
	14	4	4	4	4	4	3	4	4	3	3	1	1	1	3
	15	2	4	2	2	1	1	2	4	3	3	1	1	1	2
	16	5	5	4	4	3	3	5	3	3	3	1	2	2	4
	17	4	4	4	4	4	3	4	4	3	3	2	2	1	4
	18	4	5	3	3	3	4	3	2	2	3	1	1	1	3
	19	5	4	3	3	2	1	4	1	1	3	1	1	1	3
	20	5	4	3	3	2	1	4	1	1	3	1	1	1	3
	21	4	3	3	3	2	2	4	1	1	3	1	1	1	3
	22	5	4	3	3	2	1	4	1	1	3	1	1	1	3

Table B2. Scoring of the outstations in Africa

Area	Outstation	C_1^C	C_2^C	C_3^C	C_4^C	C_5^C	C_6^C	C_1^W	C_2^W	C_3^W	C_4^W	C_5^W	C_6^W	C_7^W	C_8^W
Africa	23	4	4	5	4	2	3	4	3	2	3	1	2	4	4
	24	3	3	3	3	2	2	3	2	2	3	1	1	1	2
	25	4	4	5	4	2	3	4	3	3	4	1	2	4	4
	26	4	4	5	4	2	3	4	3	2	3	1	2	4	4
	27	2	1	2	2	2	2	2	2	2	2	2	2	2	2
	28	3	3	3	3	2	2	3	2	2	3	1	1	1	2
	29	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	30	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	31	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	32	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	33	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	34	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	35	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	36	2	2	2	2	2	2	2	2	2	2	2	2	2	2
	37	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	38	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	39	2	2	2	2	2	2	2	2	2	2	2	2	2	2
	40	5	5	5	5	5	5	5	3	3	3	3	3	3	4
	41	2	2	2	2	2	2	2	2	2	2	2	2	2	2
	42	2	2	2	2	2	2	2	2	2	2	2	2	2	2
	43	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	44	4	2	4	4	2	3	4	3	3	3	1	2	2	2
	45	4	4	5	4	2	3	4	3	3	4	1	2	4	4
	46	4	4	5	4	2	3	4	3	3	4	1	2	4	4
	47	3	3	4	4	2	3	4	2	2	3	1	1	1	2
	48	4	4	5	4	2	3	4	3	3	4	1	2	4	4
	49	4	4	5	4	2	3	4	3	3	4	1	2	4	4
	50	4	4	5	4	2	3	4	3	3	4	1	2	4	4
	51	4	4	5	4	2	3	4	3	3	4	1	2	4	4
	52	2	1	1	1	1	1	1	1	1	1	1	1	1	1
	53	4	1	3	3	2	3	4	2	1	3	1	1	1	2
	54	2	2	4	4	4	3	2	2	3	2	3	3	3	2
	55	4	4	4	4	4	4	4	3	2	3	3	2	3	2
	56	4	4	4	4	4	4	4	2	2	2	1	2	2	1

Table B3. Scoring of the outstations in America

Area	Outstation	C_1^C	C_2^C	C_3^C	C_4^C	C_5^C	C_6^C	C_1^W	C_2^W	C_3^W	C_4^W	C_5^W	C_6^W	C_7^W	C_8^W
	57	3	2	3	3	3	4	4	3	4	3	1	2	2	2
	58	3	3	3	3	3	3	4	3	3	4	1	3	3	3
	59	3	3	3	3	2	3	2	3	3	2	2	2	3	2
	60	4	3	4	4	3	3	3	3	3	3	2	2	3	2
	61	3	3	3	3	3	2	3	3	3	3	1	2	3	2
	62	4	3	4	4	3	2	3	2	3	3	2	2	3	1
	63	4	2	4	3	3	3	4	3	4	4	3	2	4	3
	64	4	3	3	3	3	3	3	3	3	4	3	2	2	3
	65	4	2	4	3	3	3	4	3	4	4	3	2	4	3
	66	4	2	3	3	3	3	3	3	3	4	3	2	2	3
	67	4	2	4	3	3	3	4	3	4	4	3	2	4	3
	68	4	3	4	3	4	3	3	4	5	4	3	2	2	3
	69	4	3	3	3	3	2	3	3	3	4	3	2	2	3
	70	4	2	4	3	3	3	4	3	4	4	3	2	4	3
	71	3	1	3	3	3	2	3	2	3	4	2	2	2	2
	72	4	3	3	3	3	3	3	3	3	4	3	1	2	3
	73	4	2	4	3	3	3	4	3	4	4	3	2	4	3
	74	2	1	2	2	2	1	2	2	2	3	3	1	2	2
	75	4	2	4	3	3	3	4	3	4	4	3	2	4	3
	76	4	2	4	3	3	3	4	3	4	4	3	2	4	3
	77	4	3	4	3	3	4	4	3	4	4	4	3	3	3
	78	5	3	3	5	3	5	3	4	2	3	3	1	1	3
	79	4	3	4	3	3	4	4	3	4	4	4	3	3	3
	80	3	3	3	3	3	3	3	3	3	3	3	3	3	3
America	81	3	3	3	3	3	3	3	3	3	3	3	3	3	3
	82	3	3	3	3	3	3	3	3	3	3	3	3	3	3
	83	2	1	1	1	1	1	1	1	1	1	1	1	1	1
	84	2	2	1	1	1	1	1	1	1	1	1	1	1	1
	85	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	86	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	87	4	3	4	4	4	4	4	4	4	5	3	3	3	3
	88	4	4	5	5	4	4	4	5	4	5	4	4	4	4
	89	4	3	4	4	4	4	4	4	4	5	3	3	3	3
	90	4	3	3	4	2	3	4	2	3	4	1	1	2	3
	91	4	3	3	4	2	3	4	2	3	4	1	1	2	3
	92	4	3	3	4	2	3	4	2	3	4	1	1	2	3
	93	4	3	3	4	2	3	4	2	3	4	1	1	2	3
	94	4	3	3	3	2	3	4	3	3	4	2	1	3	3
	95	3	3	3	3	2	2	3	2	3	3	1	4	2	3
	96	4	3	3	4	2	3	4	3	3	4	1	1	2	3
	97	4	3	3	4	2	3	4	3	3	4	1	1	2	3
	98	4	2	3	4	2	3	4	2	3	4	2	1	2	2
	99	4	4	4	4	4	4	5	4	5	5	5	4	3	5
	100	4	4	4	4	4	4	5	4	5	5	5	4	3	5
	101	5	5	5	5	5	5	5	4	4	5	3	4	2	3
	102	4	4	4	4	4	4	5	4	5	5	5	4	4	5
	103	4	4	4	4	4	4	5	4	5	5	5	4	4	5
	104	4	4	4	4	4	3	4	4	3	4	3	3	2	3
	105	4	5	4	4	5	3	4	5	5	5	5	3	4	4

Table B4. Scoring of the outstations in Europe

Area	Outstation	C_1^C	C_2^C	C_3^C	C_4^C	C_5^C	C_6^C	C_1^W	C_2^W	C_3^W	C_4^W	C_5^W	C_6^W	C_7^W	C_8^W
	106	4	4	4	4	4	4	4	4	4	4	4	4	4	4
	107	4	3	3	3	2	3	3	3	2	3	3	3	3	3
	108	4	4	4	4	2	4	4	3	3	3	3	3	3	4
	109	4	4	4	4	4	4	4	4	4	4	4	4	4	4
	110	4	4	4	4	4	4	4	4	4	4	4	4	4	4
	111	4	4	4	4	4	4	4	4	4	4	4	4	4	4
	112	4	4	4	4	4	4	4	4	4	4	4	4	4	4
	113	4	4	4	4	4	4	4	4	4	4	4	4	4	4
	114	4	4	4	4	4	4	4	4	4	4	4	4	4	4
	115	4	4	4	4	4	4	4	4	4	4	4	4	4	4
	116	4	4	4	4	4	4	4	4	4	4	4	4	4	4
	117	4	3	3	4	2	3	3	3	2	3	3	2	3	3
	118	4	2	3	3	2	2	3	3	2	3	3	2	3	3
	119	4	4	4	3	3	3	4	3	4	3	4	3	4	3
	120	4	4	4	4	4	4	4	4	4	4	4	4	4	4
	121	3	3	3	3	4	3	4	3	3	3	4	3	4	4
	122	4	4	4	4	3	4	4	4	4	4	4	4	4	4
	123	4	4	4	4	4	4	3	4	4	4	4	4	4	4
	124	4	4	4	4	3	4	4	3	4	4	4	3	4	4
	125	3	4	4	4	3	4	4	4	3	4	4	4	3	4
	126	4	4	4	4	3	3	3	4	4	4	4	3	4	4
	127	3	4	3	4	3	4	4	4	4	4	3	4	4	4
	128	4	3	4	4	3	4	4	4	3	4	4	4	4	4
	129	4	4	4	4	2	4	4	3	3	3	3	3	3	4
	130	4	3	4	4	2	4	4	3	3	4	3	4	3	4
	131	4	3	3	3	2	3	3	3	2	3	3	3	3	3
	132	4	4	4	4	2	4	4	3	3	3	3	3	3	4
	133	4	4	4	4	4	4	4	4	4	4	4	4	4	4
	134	4	4	3	4	4	4	4	3	4	4	3	4	4	4
	135	4	4	4	4	4	4	4	4	4	4	4	4	4	4
	136	4	4	4	3	4	4	3	3	4	3	4	3	4	3
Europe	137	4	4	4	4	4	4	4	4	4	4	4	4	4	4
	138	4	4	4	4	4	4	4	4	4	4	4	4	4	4
	139	4	4	4	4	4	4	4	4	4	4	4	4	4	4
	140	4	4	4	4	4	4	4	4	4	4	4	4	4	4
	141	4	4	4	4	4	4	4	4	4	4	4	4	4	4
	142	4	4	4	4	4	4	4	4	4	4	4	4	4	4
	143	4	3	3	4	2	3	3	3	2	3	3	2	3	3
	144	4	3	3	4	2	3	3	3	2	3	3	2	3	3
	145	3	4	4	3	3	3	3	3	3	4	3	4	3	4
	146	4	2	3	3	2	2	3	3	2	3	3	2	3	3
	147	4	4	4	3	3	3	4	3	4	3	4	3	4	3
	148	4	4	4	4	4	4	4	4	4	4	4	4	4	4
	149	3	3	3	3	4	3	4	3	3	3	4	3	4	4
	150	4	3	4	3	4	3	4	4	4	3	3	3	4	3
	151	4	4	4	4	4	4	4	4	4	3	4	3	4	3
	152	4	4	4	4	4	4	4	4	4	4	4	4	3	3
	153	4	3	4	3	4	3	4	3	4	3	4	3	4	3
	154	3	4	3	4	4	3	4	3	4	3	4	3	4	3
	155	3	4	3	4	4	4	3	3	4	4	3	4	3	3
	156	4	4	4	4	4	4	4	4	4	4	4	4	4	3
	157	4	3	3	3	4	3	4	4	3	4	3	4	3	4
	158	3	3	3	4	3	4	4	4	3	3	4	3	4	3
	159	4	4	4	4	4	4	4	4	4	4	4	4	4	4
	160	4	4	4	4	4	4	4	4	4	4	4	4	4	4
	161	4	4	3	4	3	3	3	4	4	3	4	4	3	3
	162	4	4	4	4	4	4	4	4	4	4	4	4	4	4
	163	4	4	4	4	2	4	4	3	3	3	3	4	3	4
	164	3	3	3	4	4	3	4	3	4	4	3	3	4	3
	165	4	3	3	3	4	4	3	3	4	3	3	4	4	3
	166	3	3	3	4	4	3	3	4	4	3	3	3	4	3
	167	4	4	4	3	2	4	4	3	3	3	3	4	3	4
	168	3	3	3	4	3	4	3	4	3	4	4	4	3	3

Appendix C. Aggregated scores

Table C1. Aggregated scores for the outstations capabilities and willingness

Area	No.	$S_{j,cap}$	$S_{j,wil}$	Area	No.	$S_{j,cap}$	$S_{j,wil}$	Area	No.	$S_{j,cap}$	$S_{j,wil}$	Area	No.	$S_{j,cap}$	$S_{j,wil}$
Asia	1	4.131	3.652	Africa	23	3.765	2.989	America	57	3.047	3.015	Europe	106	4.000	4.000
	2	4.131	3.652		24	2.662	2.149		58	3.000	3.165		107	3.131	2.790
	3	3.884	3.723		25	3.765	3.314		59	2.956	2.354		108	3.913	3.381
	4	3.884	3.723		26	3.765	2.989		60	3.415	2.724		109	4.000	4.000
	5	4.709	4.311		27	1.753	2.000		61	2.706	2.621		110	4.000	4.000
	6	4.534	4.311		28	2.662	2.149		62	3.120	2.525		111	4.000	4.000
	7	4.534	4.311		29	1.000	1.000		63	3.074	3.603		112	4.000	4.000
	8	4.084	3.312		30	1.000	1.000		64	3.175	2.996		113	4.000	4.000
	9	3.025	2.020		31	1.000	1.000		65	3.074	3.603		114	4.000	4.000
	10	4.000	3.546		32	1.000	1.000		66	2.928	2.996		115	4.000	4.000
	11	4.175	3.664		33	1.000	1.000		67	3.074	3.603		116	4.000	4.000
	12	4.175	3.664		34	1.000	1.000		68	3.365	3.489		117	3.224	2.743
	13	3.706	2.885		35	1.000	1.000		69	2.880	2.996		118	2.590	2.743
	14	3.706	2.885		36	2.000	2.000		70	3.074	3.603		119	3.569	3.639
	15	2.157	2.249		37	1.000	1.000		71	2.211	2.695		120	4.000	4.000
	16	4.084	3.312		38	1.000	1.000		72	3.175	2.949		121	3.044	3.555
	17	3.706	3.162		39	2.000	2.000		73	3.074	3.603		122	3.956	4.000
	18	3.964	2.275		40	5.000	3.636		74	1.458	2.170		123	4.000	3.745
	19	2.965	2.247		41	2.000	2.000		75	3.074	3.603		124	3.956	3.880
	20	2.965	2.247		42	2.000	2.000		76	3.074	3.603		125	3.781	3.719
	21	2.837	2.247		43	1.000	1.000		77	3.616	3.683		126	3.662	3.697
	22	2.965	2.247		44	3.124	2.805		78	4.124	2.626		127	3.635	3.897
					45	3.765	3.314		79	3.616	3.683		128	3.709	3.790
					46	3.765	3.314		80	3.000	3.000		129	3.913	3.381
					47	3.196	2.404		81	3.000	3.000		130	3.665	3.544
					48	3.765	3.314		82	3.000	3.000		131	3.131	2.790
					49	3.765	3.314		83	1.175	1.000		132	3.913	3.381
					50	3.765	3.314		84	1.422	1.000		133	4.000	4.000
					51	3.765	3.314		85	1.000	1.000		134	3.853	3.824
					52	1.175	1.000		86	1.000	1.000		135	4.000	4.000
					53	2.637	2.194		87	3.753	3.768		136	3.907	3.384
					54	2.861	2.431		88	4.240	4.188		137	4.000	4.000
					55	4.000	2.872		89	3.753	3.768		138	4.000	4.000
					56	4.000	2.282		90	3.224	2.926		139	4.000	4.000
									91	3.224	2.926		140	4.000	4.000
									92	3.224	2.926		141	4.000	4.000
									93	3.224	2.926		142	4.000	4.000
									94	3.131	3.172		143	3.224	2.743
									95	2.662	2.698		144	3.224	2.743
									96	3.224	2.998		145	3.394	3.288
									97	3.224	2.998		146	2.590	2.743
									98	2.977	2.903		147	3.569	3.639
									99	4.000	4.738		148	4.000	4.000
									100	4.000	4.738		149	3.044	3.555
									101	5.000	4.000		150	3.365	3.609
									102	4.000	4.809		151	4.000	3.712
									103	4.000	4.809		152	4.000	3.803
									104	3.706	3.372		153	3.365	3.639
									105	3.997	4.453		154	3.384	3.639
													155	3.678	3.372
													156	4.000	3.874
													157	3.219	3.616
													158	3.387	3.502
													159	4.000	4.000
													160	4.000	4.000
													161	3.515	3.433
													162	4.000	4.000
													163	3.913	3.429
													164	3.137	3.651
													165	3.513	3.328
													166	3.137	3.354
													167	3.820	3.429
													168	3.387	3.338
Average		**3.742**	**3.166**	**Average**		**2.499**	**2.150**	**Average**		**3.112**	**3.143**	**Average**		**3.689**	**3.640**
Average of all outstations														**3.287**	**3.131**