BIO4HUMAN

D4.2. Gap Analysis Report
Annex 3. Summary of the literature review on evolvement on relevance of supply chain management in the humanitarian context (Task 4.2.2)

Disclaimer:

The content reflects the views of the authors only. The European Commission is not liable for any use that may be made of the information contained herein.

This document contains information, that is proprietary to the Bio4HUMAN consortium. Neither this document nor the information contained herein shall be used, duplicated, or communicated by any means to any third party, in whole or in parts, except with the prior written consent of the Bio4HUMAN consortium. This restriction legend shall not be altered or obliterated on or from this document. Neither the European Commission nor the Bio4HUMAN project consortium are liable for any use that may be made of the information that it contains.

Scope:

This is the report from investigation line in Task 4.2.2 of Work Package 4 dedicated to literature review. It is focused on solid waste management (SWM) within humanitarian actions. This literature review employs a systematic approach to synthesize knowledge on solid waste management in humanitarian actions, focusing on publications from the last 20 years. Key research questions address waste generation, management proceedings, handling practices, and the application of waste management approaches in humanitarian contexts. The review utilizes a comprehensive search strategy across Scopus, Elsevier, and Google Scholar, employing relevant keywords. Predefined inclusion and exclusion criteria ensure the selection of relevant, empirical, or theoretical studies published in English. A two-stage screening process (title/abstract and full-text review) and citation analysis refine the selection. Data extraction via a standardized form and thematic analysis are used to identify patterns, gaps, and insights. Limitations, including publication bias, language restrictions, and the exclusion of unpublished studies, are acknowledged. Despite these limitations, the structured methodology aims to provide a comprehensive and reliable overview of the existing literature on this specific topic.

Contents

Funded by the European Union

Funded by the European Union. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the European Research Executive Agency (REA). Neither the European Union nor the granting authority can be held responsible for them.

List of tables

List of figures

Abbreviations

CFRM	Community feedback and response mechanisms
DG ECHO	Directorate-General for European Civil Protection and Humanitarian Aid Operations
WASH	Water, Sanitation and Hygiene
WREC	Waste Management Measuring, Reverse Logistics, Environmentally Sustainable Procurement and Transport, and Circular Economy
HSC	Humanitarian Supply Chains
RL	Reverse Logistics
IWP	Informal Waste Pickers
HOs	Humanitarian Organizations
HA	Humanitarian Action
SWM	Solid Waste Management
WP	Work Package

Funded by the European Union

Funded by the European Union. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the European Research Executive Agency (REA). Neither the European Union nor the granting authority can be held responsible for them.

1. Introduction

Work Package 4 main objective is to better understand bio-based innovative technological solutions and bio-based systems may be applicable under different humanitarian contexts with best environmental and climate protection results. Implemented studies will aim on advancement and advantages over the traditional methods currently used by the humanitarian sector.

WP4-T4.2 is a continuation of consortium works elaborated in WP3 addressing "Mapping the key stakeholders" (T.3.1) and "Defining the needs of the humanitarian sector in SWM and the current status of how they are being addressed" (T.3.3). Very good base of information and knowledge is also settled by the report on "potential bio-based innovative technological solutions and bio-based systems" linked with the needs of the HA and implementing them by humanitarian organizations.

Task 4.2 is aiming on Identification of existing solutions and supply chain gaps will cover identification of the already existing technological solutions (or solutions being in the pre – production phase) which could respond to the needs of the sector (T4.2.1) identified in T3.3 and the identification of supply chain gaps in SWM system for humanitarian action consisting of analysis of the different links in the supply chain, the techniques used to manage the supply chains and the current techniques and technologies used to manage solid waste that is generated at each supply stage (T4.2.2).

Task 4.2.2 will focus on the literature review to manage solid waste generated in Humanitarian Actions for the identified supply stages. Several documentations will be assessed, and relevant insights will be extracted, analyzing the current state of the art and identifying potential applications for new bio-based solutions in this framework.

2. Methodology

The methodology for this literature review follows a systematic approach to ensure rigor and transparency. The review aims to synthesize existing knowledge on solid waste management in humanitarian actions, addressing research questions such as *How is waste generated? What are the proceedings to manage this waste? Is the waste handled in any form? Has been used a waste management approach in any humanitarian action?* Among other relevant questions. The scope was defined to include studies published in peer-reviewed journals, conference proceedings, and relevant literature, focusing on publications in English language from during the last 20 years.

Funded by the European Union

Funded by the European Union. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the European Research Executive Agency (REA). Neither the European Union nor the granting authority can be held responsible for them.

A comprehensive search strategy was employed, utilizing electronic databases such as Scopus, Elsevier and Google Scholar. Keywords relevant to the topic were applied, including “Waste Management”, “Supply Chain” or “Humanitarian Action” along with synonyms and related terms to maximize coverage.

To ensure relevance and focus, predefined inclusion and exclusion criteria guided the selection process. Inclusion criteria encompassed studies directly addressing the topic of interest, empirical or theoretical contributions, and publications within the specified timeframe. Conversely, studies that lacked relevance, had incomplete data or provided only theoretical results were excluded.

The screening process involved two stages. Initially, titles and abstracts were reviewed to exclude irrelevant studies. This was followed by a full-text review of the shortlisted articles to confirm their alignment with the review’s objectives. Lastly, a review of the provided citations was performed, making this an iterative process to enlarge the number of documents to analyse.

Data extraction was conducted using a standardized form to collect key information, including authors, publication year, study objectives, methodology, findings, and limitations. A thematic analysis was performed to identify recurring patterns, gaps, and insights across the literature.

Finally, the methodology acknowledges potential limitations, including publication bias, language restrictions, the exclusion of unpublished studies and the extremely specific topic to analyse. Despite these constraints, the structured approach ensures a comprehensive and reliable review of the literature, providing valuable insights into this topic.

3. Sources analysis

First, **Error! Reference source not found.** includes all the evaluated sources with relevant information about them is presented.

Table 1 Evaluated documents

1	Title	*Supply Chain Planning in the Humanitarian Sector: Landscape Analysis and Directions for the Future*
	Type	*Report*
	Authors	*The Center for Humanitarian Logistics and Regional Development (CHORD)*
	Country	*Germany*
2	Title	*Disaster waste management following the 2009 Victorian bushfires*
	Type	*Technical article*
	Authors	*Charlotte Brown, Prof. Mark Mikke, Dr. Erica Seville. University of Canterbury, New Zealand*
	Country	*New Zealand*
3	Title	*Green Logistics Guide*
	Type	*Report*
	Authors	*Samantha Brangeon, Richard Casagrande, Juan Galvez (IFRC)*
	Country	*Switzerland*

Funded by the European Union

Funded by the European Union. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the European Research Executive Agency (REA). Neither the European Union nor the granting authority can be held responsible for them.

4	Title	*To greener pastures: An action research study on the environmental sustainability of humanitarian supply chains*
	Type	*Research article*
	Authors	*Mohammad Hossein Zarei, Ruth Carrasco-Gallego, Stefano Ronchi. Politecnico di Milano, Universidad Politécnica de Madrid.*
	Country	*Italy, Spain.*
5	Title	*Guidance Note: Municipal Solid Waste Management in Crisis and Post-Crisis Settings*
	Type	*Guidelines and Notes*
	Authors	*Hilda van der Veen (UNDP)*
	Country	*Various*
6	Title	*Assessment of health-care waste management in a humanitarian crisis: A case study of the Gaza Strip*
	Type	*Research article*
	Authors	*Marco Caniato, Terry Louis Tudor, Mentore Vaccari. University of Brescia*
	Country	*Italy*
7	Title	*Humanitarian Logistics: Cross-Sector Cooperation in Disaster Relief Management*
	Type	*Book*
	Authors	*Alessandra Cozzolino (Sapieza Università di Roma)*
	Country	*Italy*
8	Title	*Innovation Opportunities in Solid Waste Disposal in Humanitarian Settings*
	Type	*Report*
	Authors	*Kimberly Worsham (FLUSH), Andrea Wong (Science Practice), Naji Makarem (UrbanEmerge), Mansoor Ali (UrbanEmerge) and Lamax Ogwal (UrbanEmerge)*
	Country	*United Kingdom*
9	Title	*Practical Guide to Solid Waste Management in Pacific Island Countries and Territories*
	Type	*Guide*
	Authors	*Several*
	Country	*Several*
10	Title	*Solid Waste Management (SWM) Guide*
	Type	*Guide*
	Authors	*Not Mentioned (Logistics Cluster – WREC)*
	Country	*Not Mentioned*
11	Title	*Red Goes Green: Barriers and enablers for effectively greening practices and strengthening environmental sustainability across the International Red Cross Crescent Movement*
	Type	*Research article*
	Authors	*Julia Hartelius (Swedish Red Cross)*
	Country	*Sweden*
12	Title	*Waste Management in Humanitarian Logistics*
	Type	*Bachelor's Thesis*
	Authors	*Laura Sophie Sprenger (Hämeen University of Applied Sciences)*
	Country	*Greece*

Funded by the European Union

Funded by the European Union. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the European Research Executive Agency (REA). Neither the European Union nor the granting authority can be held responsible for them.

Figure 1 Tag cloud

As mentioned in the Methodology Section, when searching in the databases, a tag cloud was generated. This tag cloud includes some keywords such as "Waste", "Logistics" or "Management". This tag cloud is presented in next **Error! Reference source not found.**.

Furthermore, in **Error! Reference source not found.**, a complete breakdown of the sources is presented. The information is divided by country, key topic and category. After that, statistics of the evaluated sources are also presented in **Error! Reference source not found.**, **Error! Reference source not found.** and **Error! Reference source not found.**.

Table 2 Breakdown of sources

Number of Documents	Country									
Key Topic	Germany	Greece	Italy	New Zealand	No data	Several	Sweden	Switzerland	United Kingdom	Total
Logistics			1					1		2
Management			1	1	1	2				5
Supply Chain	1		1							2
Sustainability							1			1
Waste		1							1	2
Total	**1**	**1**	**3**	**1**	**1**	**2**	**1**	**1**	**1**	**12**

Results show that Management was the most important key topic of the publications, being the rest quite similar among them. However, there was no clear trend in terms of countries. Two publications had an extremely large number of participants from different countries that was impossible to categorize.

Regarding the categories, three different kinds arise from the evaluation. These are the Research Articles, Reports and Guidelines, taking the 75% of the total evaluated documents.

Funded by the European Union

Funded by the European Union. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the European Research Executive Agency (REA). Neither the European Union nor the granting authority can be held responsible for them.

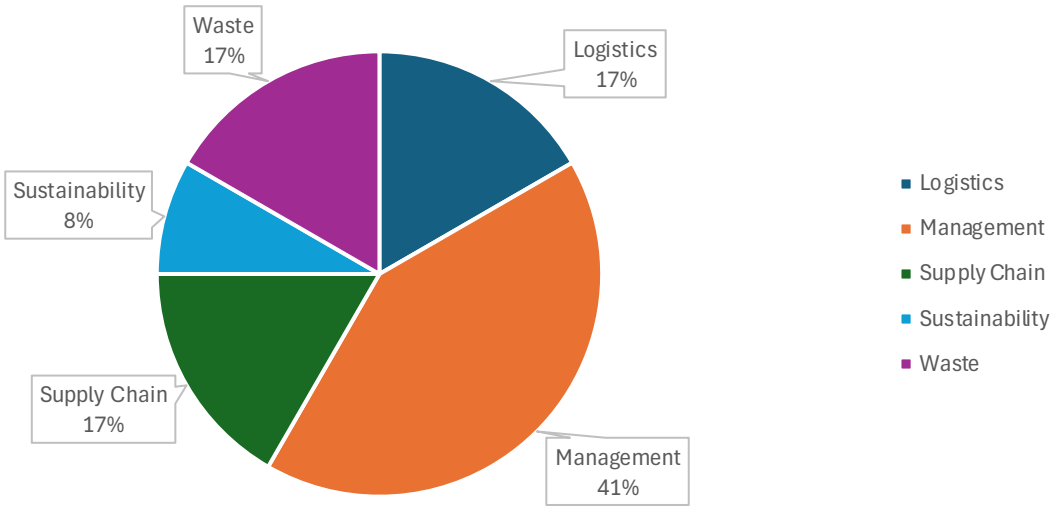

Figure 2 Percentage of publications by key topic

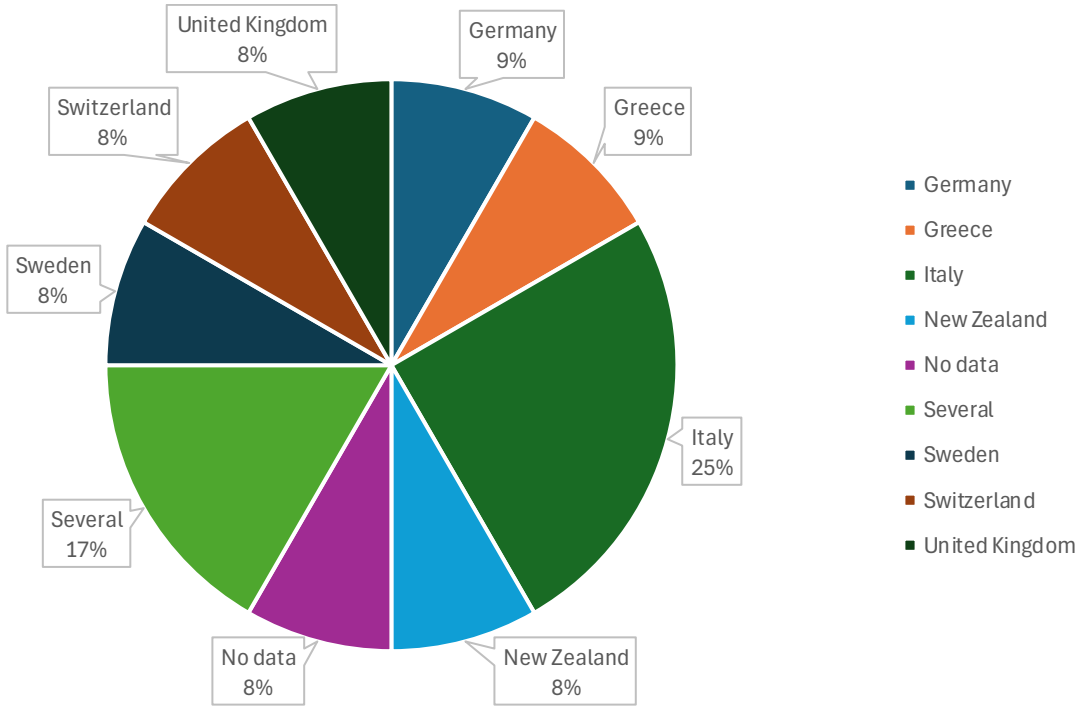

Figure 3 Percentage of publications by country

Funded by the European Union. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the European Research Executive Agency (REA). Neither the European Union nor the granting authority can be held responsible for them.

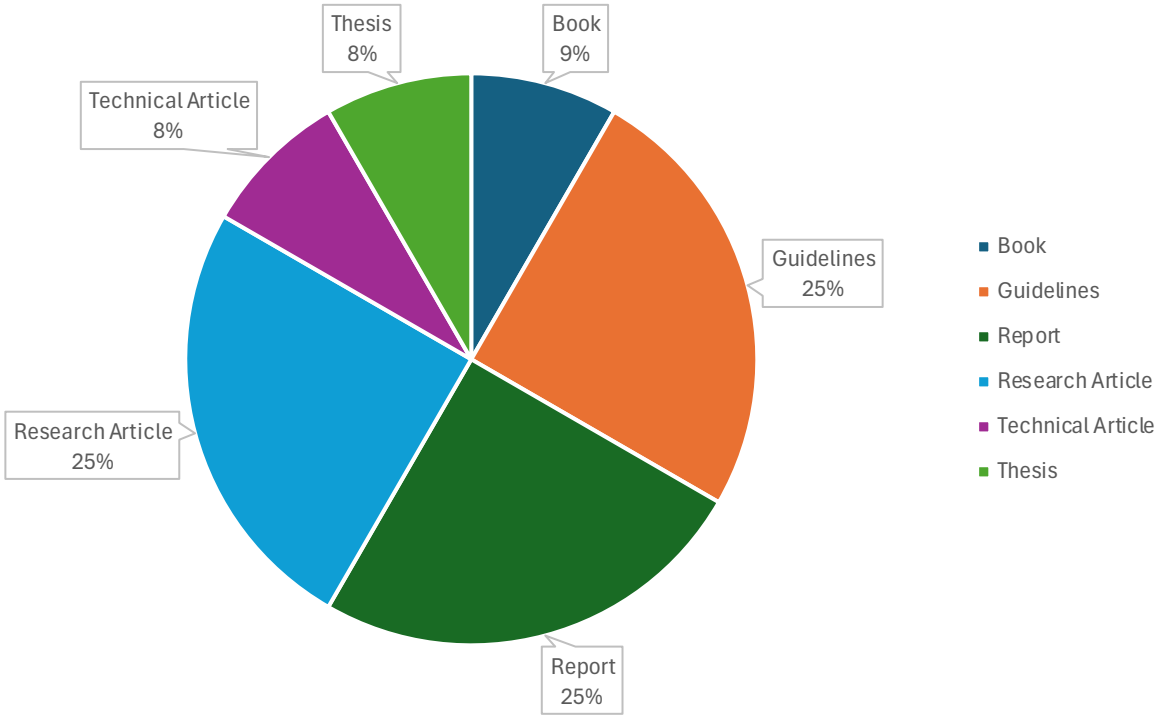

Figure 4 Percentage of publications by category

4. Main results

First step for performing the analysis of the literature review is to aggregate all the information into a unique structured table. In this way, **Error! Reference source not found.** shows the number of occurrences for each cell, depending on the supply chain stages and the evaluated aspects.

Funded by the European Union. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the European Research Executive Agency (REA). Neither the European Union nor the granting authority can be held responsible for them.

Table 3 Summary of results

Supply chain stages	Implementing entity	Key SWM supporting elements	Tools and technologies used in HAs	Waste generated	Logistical and organisational solutions used to manage SWM	Tools and technologies applied up to date	New bio-based technologies and solutions to improve SWM	Final products or services	TOTAL
Identification of needs	10	8	8	8	8	7	0	7	56
Conceptualization and planning	11	11	10	3	11	8	0	8	62
Procurement – sourcing/ purchasing of products and services	11	12	8	6	10	8	1	7	63
Goods in warehouses destination	4	6	6	6	5	4	0	2	33
Custom clearance	5	4	3	1	3	2	0	2	20
Transport to the destination country	5	5	4	5	5	4	2	2	32
Transport to the final destinations	8	9	9	8	8	6	1	4	53
Storage at the final destination	9	9	6	7	11	4	0	5	51
Operational logistic at final destination	10	10	10	9	10	8	5	7	69
TOTAL	73	74	64	53	71	51	9	44	439

Once the data has been aggregated, it is possible to obtain valuable insights and provide patterns, gaps or priorities in the Solid Waste Management in Humanitarian Action topic. So, three different approaches will be taken:

- Analysis by Columns
- Analysis by Rows
- Analysis by Clustering of Occurrences (0-3, 4-6, 7-10 & 11-12)

In the first analysis by columns, the data by columns reveals significant variability in focus and attention across SWM dimensions. The **"Implementing Entity"** column frequently mentions roles such as logistics officers and procurement staff, reflecting their central involvement in SWM activities, with an average of occurrences of 8.11 (16.6%). However, limited mentions of other roles, such as customs officials or field-level workers, suggest underrepresentation of stakeholders who play critical roles in specific supply chain stages, specially at the destination country. The **"Key SWM Supporting Elements"** column emphasizes foundational practices, such as regulatory frameworks and waste segregation, while

Funded by the European Union

Funded by the European Union. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the European Research Executive Agency (REA). Neither the European Union nor the granting authority can be held responsible for them.

elements like financial mechanisms or advanced monitoring systems appear infrequently. Similar values of average and percentage of occurrences are found for this column. Tools and technologies in the **"Tools and Technologies Used in HAs"** and **"Tools and Technologies Applied to Date"** columns predominantly reflect basic solutions, such as waste containers and segregation tools, while advanced technologies like anaerobic digestion systems or automated waste tracking remain scarcely mentioned. Most of the results in these two columns appeal for technologies and processes that are commonly used in the logistics sector, displacing the innovation to an insignificant aspect. However, there is a drop in the total occurrences of these two columns compared to the previous one, especially for the **Tools and Technologies Applied to Date"** column.

The **"Waste Generated"** column shows consistent reporting on common waste streams like packaging and organic waste, with hazardous or niche waste types like medical or electronic waste being less prominent. Similarly, the **"Logistical and Organizational Solutions"** column highlights conventional practices such as coordination with recyclers or basic transport systems, while innovative approaches like reverse logistics appear under-documented.

Finally, in the **"New Bio-Based Technologies"** column, the data underscores minimal mentions (9 occurrences in total) of sustainable technologies like biochar production, suggesting a gap in adopting bio-based innovations. This is clearly an aspect that must be addressed.

The row-wise analysis reveals significant variability in attention to SWM topics across the different stages of the supply chain. The **Identification of Needs** stage is well-represented with 56 total occurrences, emphasizing its foundational role in defining SWM practices. Frequent mentions of implementing entities and procurement processes highlight its strategic importance, though tools and technologies receive less attention, indicating room for improvement in detailing technical solutions at this stage. Similarly, **Conceptualization and Planning** emerges with 62 occurrences. Strong focus on "Key SWM supporting elements" and "Logistical and Organisational Solutions" underscores the prioritization of planning; however, there is a relative lack of mentions about waste generation, suggesting that evaluation of residues might be underexplored during this stage.

Procurement-related SWM, represented in the **Procurement - Sourcing/Purchasing of Products and Services** row, also has 63 mentions, reflecting robust attention to environmentally sustainable practices. The integration of SWM considerations into procurement is evident, particularly in roles and supporting elements, although advanced tools and bio-based technologies remain modestly referenced. Conversely, stages like **Goods in Warehouses Destination** (33 occurrences) and **Custom Clearance** (20 occurrences) are underrepresented, indicating potential gaps in explicitly addressing SWM challenges and innovations in these areas. These stages might require more detailed exploration.

Funded by the European Union

Funded by the European Union. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the European Research Executive Agency (REA). Neither the European Union nor the granting authority can be held responsible for them.

The **Transport to Final Destinations** (53 occurrences) and **Storage at Final Destination** (51 occurrences) stages receive moderate attention. They emphasize the operational complexities of waste management, particularly in logistical solutions and the roles of implementing entities. However, these stages lack sufficient mentions of bio-based technologies and innovative tools, highlighting an area where more focus could enhance SWM outcomes. Finally, **Operational Logistic at Final Destination** stands out with 69 mentions, the highest count, reflecting its importance as the culmination of SWM efforts. This stage showcases a stronger representation of supporting elements, tools, and organizational solutions, yet there remains a consistent gap in leveraging bio-based technologies and discussing final products across most rows.

Overall, the analysis underscores a disparity in focus, with early and final supply chain stages receiving more attention than intermediate phases like goods handling and transport. This suggests a potential misalignment between stages that demand SWM innovation and the stages most frequently discussed in the literature.

Finally, analysing the data through numerical clusters reveals distinct trends in how SWM aspects are addressed across supply chain stages. The **0–3 cluster** represents the least mentioned categories, which are notably scarce across the table, accounting for only 16 cells. Rows like **Custom Clearance** and **Goods in Warehouses Destination** dominate this cluster, with sparse mentions in dimensions such as **Bio-based Technologies**, **Waste Generated**, and **Final Products**. These low counts indicate potential gaps in attention or documentation in these specific stages and SWM areas. Their inclusion in this cluster highlights the need for broader exploration and innovation, as these aspects may play a crucial role in enhancing overall SWM effectiveness.

The **4–6 cluster** is slightly more prominent, capturing 21 cells across various rows and columns. This group represents moderate attention levels, often reflecting foundational efforts rather than advanced implementations. For instance, **Goods in Warehouses Destination** and **Transport to the Destination Country** stages frequently appear here, emphasizing their operational challenges but also revealing a lack of depth in the associated solutions. This cluster also includes several mentions of waste segregation and recycling practices, suggesting that while these areas are acknowledged, there is room for improvement in developing and documenting comprehensive approaches.

The **7–10 cluster** is the largest, encompassing 29 cells, reflecting robust attention to many SWM aspects. Rows like **Identification of Needs** and **Operational Logistic at Final Destination** dominate this range, demonstrating a consistent focus on key SWM supporting elements, implementing entities, and waste management processes. The frequent presence of this cluster signifies an established foundation of SWM practices across these stages, though the variability in emphasis suggests potential opportunities for enhancing consistency and depth in areas like **bio-based technologies**, which is a consistent result among the analysis.

Funded by the European Union

Funded by the European Union. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the European Research Executive Agency (REA). Neither the European Union nor the granting authority can be held responsible for them.

The **11–12 cluster** is the smallest but significant, containing only 6 mentions, primarily in the **Conceptualization and Planning** and **Procurement** stages. This reflects a strong emphasis on these foundational stages, particularly in supporting elements and implementing entities, which are critical for establishing effective SWM frameworks. However, the limited distribution of this cluster underscores that very few areas of SWM are comprehensively addressed across the literature, pointing to an imbalance in attention that may hinder holistic improvements in SWM practices across the supply chain. This clustered analysis reveals both strengths in foundational stages and notable gaps in intermediate and advanced SWM solutions.

5. Conclusions & recommendations

The analysis of the structured data on solid waste management (SWM) across supply chain stages reveals key trends and gaps in current practices. From a **column perspective**, the focus on "Implementing Entity", "Key SWM Supporting Elements" and “Logistical and Organisational Solutions” highlights a well-documented understanding of roles and baseline elements for SWM. However, advanced dimensions such as "New Bio-Based Technologies" and "Final Products and Services" are underrepresented, suggesting limited documentation or adoption of innovative approaches. This uneven distribution underscores the need for a balanced and comprehensive SWM strategy.

From a **row analysis**, stages like "Conceptualization and Planning", "Procurement and Sourcing" and “Operational Logistics at Final Destination” receive considerable attention, reflecting their critical roles in SWM. Conversely, intermediate stages like "Custom Clearance" and "Goods in Warehouses Destination" are consistently under-documented. This may reflect either a lack of attention in practice or insufficient recording in existing literature, which can create inefficiencies and missed opportunities for optimization in these areas.

The **clustering analysis** highlights distinct patterns in how SWM is addressed. Most mentions fall within the 7–10 cluster, showing a focus on standard practices and foundational efforts across the supply chain. However, the presence of 0–3 clusters in critical areas such as bio-based technologies and logistical solutions signals persistent gaps that could hinder advancements in SWM. The sparse representation in the 11–12 cluster indicates a lack of comprehensive or universal best practices across all stages, pointing to variability in the maturity of SWM strategies.

Some recommendations based on the results of this literature review:

- **Expand Focus on Intermediate Stages**: Attention must shift toward underrepresented stages such as "Custom Clearance" and "Goods in Warehouses Destination." Strengthening SWM in these areas could provide continuity and reduce bottlenecks across the supply chain. These two stages arise as critical aspects of the supply chain, especially “Custom Clearance”, which may stop the complete procurement of the humanitarian aid.

Funded by the European Union

Funded by the European Union. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the European Research Executive Agency (REA). Neither the European Union nor the granting authority can be held responsible for them.

- **Enhance Adoption of Advanced Technologies**: Significant efforts should be made to document and implement cutting-edge tools and bio-based technologies. Pilot projects and case studies could be developed to explore their feasibility and benefits in humanitarian logistics.

- **Improve Consistency Across SWM Dimensions**: Greater standardization is needed in addressing SWM dimensions across supply chain stages. Establishing guidelines or frameworks could help ensure all aspects of SWM are considered and integrated consistently.

- **Address Gaps in Documentation and Practice**: Encouraging systematic data collection and reporting across all stages can provide a clearer picture of existing gaps and successes. Initiatives like centralized data repositories or collaborative research projects can support this objective.

- **Foster Collaboration for Best Practices**: Organizations should focus on knowledge-sharing initiatives to spread successful SWM practices from high-performing stages to underrepresented ones. Training programs, inter-agency partnerships, and workshops can help disseminate valuable insights.

6. Summary

6.1. Identified Gaps

- **Underrepresentation of intermediate stages (custom clearance and goods in warehouses destination):** Limited attention and documentation exist for stages such as Custom Clearance and Goods in Warehouses Destination. These gaps could create inefficiencies and missed opportunities for optimization.
  Custom Clearance and Goods in Warehouses Destination.

- **Limited adoption of advanced technologies:** There is a significant gap in the documentation and implementation of advanced tools and bio-based technologies, such as anaerobic digestion systems and automated waste tracking.
  Relates to multiple supply chain stages (cross-cutting issue).

- **Inconsistent documentation across SWM dimensions:** Disparities in reporting on key elements, tools, and innovative approaches across supply chain stages create gaps in understanding and optimizing SWM.
  Relates to multiple supply chain stages (cross-cutting issue).

- **Neglected focus on waste generation in planning:** Insufficient attention to evaluating and planning for waste generation during the Conceptualization and Planning stage.
  Conceptualization and Planning.

Funded by the European Union

Funded by the European Union. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the European Research Executive Agency (REA). Neither the European Union nor the granting authority can be held responsible for them.

6.2. Best Practices

- **Integration of SWM considerations into procurement:** Procurement practices that incorporate SWM considerations, such as environmentally sustainable purchasing and logistics coordination with recyclers, are well-documented. *Literature review on Procurement - Sourcing/Purchasing of Products and Services.*
- **Focus on operational logistics at final destination:** Strong representation of supporting elements, tools, and organizational solutions for SWM at the final operational stage. *Operational Logistics at Final Destination. Analysis of SWM dimensions.*
- **Regulatory frameworks and waste segregation:** Foundational practices, such as establishing regulatory frameworks and implementing waste segregation systems, are consistently highlighted as effective SWM measures. *Relates to multiple supply chain stages (cross-cutting issue). Key SWM Supporting Elements column.*

6.3. Missing Information

- **Lack of information regarding custom clearance related to advanced technologies:** There is insufficient documentation on the use of advanced technologies in the Custom Clearance stage. *Example: Lack of advanced tools like automated waste tracking systems.*
- **Lack of information regarding goods in warehouses destination related to bio-based technologies:** Minimal mentions of bio-based technologies, such as biochar production, in the context of Goods in Warehouses Destination, or any other supply chain stage. *Example: Lack of innovation-focused approaches in warehouse management.*
- **Lack of information regarding conceptualization and planning related to waste generated:** Limited evaluation of waste types and quantities during the planning stages hinders effective SWM strategies. *Example: Missing data on medical or electronic waste generation during planning.*
- **Lack of information regarding transport to final destinations related to tools and technologies:** There is a shortage of documentation on innovative tools used in the Transport to Final Destinations stage. *Example: Absence of advanced routing systems for optimized waste transport.*

Funded by the European Union

Funded by the European Union. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the European Research Executive Agency (REA). Neither the European Union nor the granting authority can be held responsible for them.