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The organic waste management supply chain performance evaluation strategy uses an Interpretive Structural Modeling approach

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ABSTRACT
National Waste Management Information System shows that the amount of waste handled in Semarang City over the last three years has decreased with an average decline index of 1.06% per year. This is reinforced by the results of interviews with the Semarang City Environmental Service, that the handling of organic waste is still very limited because so far the handling has been more focused on an-organic waste. Therefore, it is necessary to evaluate supply chain performance to determine the constraints in organic waste management from upstream to downstream. Based on the research results using the Interpretive Structural Modeling (ISM) method through a focus group discussion process involving eight experts in the field of waste management, it is known that the supply chain performance for handling organic waste in Semarang City has 11 elements of constraints, which are divided into seven priority levels. The element with the highest priority is related to the availability of organic waste supplies, while the element with the lowest priority is technological innovation and the application of appropriate technology. Improving the performance of organic waste management supply chains should focus on elements according to priority.

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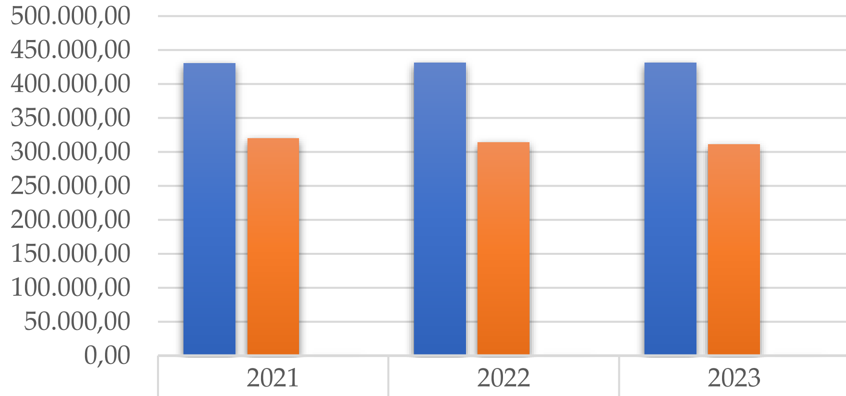
1. INTRODUCTION

Waste is a global problem in human life, even waste that was previously considered a local problem has now become a global threat that has an impact on several factors such as health, ecosystem sustainability and other aspects. Waste management is still a serious problem in Indonesia. Based on the official page of National Waste Management Information System (*Sistem Informasi Pengelolaan Sampah Nasional*, SIPSN), it is known that from the total 19.5 million tons waste generated in 2023, only 50.68% has been handled properly, or to be precise, around 9.9 tons. Based on its composition, the majority of waste is food waste, amounting to 40.5%. In addition, the biggest source of waste is from households, accounting for 39.5%.

Semarang City, which is the capital of Central Java Province, is one of the cities that represents the big cities on the island of Java. Official page of SIPSN shows data that waste generation in Semarang City has increased in the last three years as shown in Figure 1. It is also known that the amount of waste managed or handled in Semarang City in the last three years has decreased in performance from year to year. Based on interview results with the Semarang City Environmental Service, it was also found that waste management in Semarang City is still mostly focused on an-organic waste, while organic waste has not been resolved much and is still homework that must be completed immediately. This shows that the management and handling of organic waste in Semarang City needs to be a very serious concern for the Semarang City Government and all its citizens. From the amount of waste generated in the last three years shown in Figure 1, it is known that around 60.8% of the waste composition comes from organic and the rest is an-organic waste.



	2021	2022	2023
Waste Generated (ton)	430.749,75	431.085,22	431.534,65
Waste Managed (ton)	319.718,10	314.187,98	311.128,14
Waste Managed (%)	74,22	72,88	72,1

Figure 1. Semarang City waste management data in 2021 – 2023

This shows an urgency that waste management and handling should be more focused on organic waste. Many previous researchers have carried out research on waste management using several methods, because this is a very interesting and urgent problem to be studied in order to find the most appropriate solution [1-7]. Kaszycki et al. [1] and van der Velden et al. [6] discussed circular economic studies in closed loop-based organic waste management, while Melnyk et al. [2] discussed the prospects for implementing waste management in Ukraine. Rehman et al. [3] discussed a brief review of organic waste management using black soldier fly (BSF). While Shukor et al. [4] discussed organic waste management by utilizing composter technology. Dynamic and Life Cycle Assessment programs have also been used by Henault-Ethier et al. [5] and Rotthong et al. [7] to study organic waste management.

Waste management cannot be separated from the role of Supply Chain Management (SCM) [8, 9]. Supply chain management is a series of activities for product management from upstream to downstream (Forward Supply Chain) and from downstream to upstream (Reverse Supply Chain) [10-12]. The application of the SCM method to study waste management problems has been carried out by many previous researchers [9, 11, 13-20]. Several methods used in these studies to study SCM in waste management are Generalized Disjunctive Programming, Deterministic Snapshot Model, and Integrated Approach. In general, it can be concluded that the SCM approach in organic waste management has been proven successful in increasing effectiveness in waste management.

The approach used in this study is Interpretive Structural Modeling (ISM). The primary reason for using ISM in this study is its robust capability to unravel the intricate and interrelated obstacles in organic waste management. Previous studies have demonstrated the efficacy of ISM in systematically analyzing complex relationships among variables within a given system. For example, ISM has been effectively employed in various domains such as supply chain competitiveness, supply chain finance factors, supply chain sustainability, digitalization of supply chain, and block chain to identify hierarchical relationships between factors and to evaluate their interdependence [21-28]. Based on this, ISM is the appropriate method to use in this research which aims to identify and evaluate elements of obstacles in organic waste management. The results of this evaluation can then be used as a basis for decision making in the form of strategies to improve the performance of organic waste management in Semarang City.

2. MATERIALS AND METHODS

This research began by conducting a literature study related to Regional Government Regulations of Semarang City and also journals related to waste management. Then, the information from the literature study was deepened by conducting focus group discussions with research experts. This research involved eight experts who have expertise in waste management. Of the eight experts, six of them are practitioners and the other two are academics. The six experts are parties who have worked for a long time within the Semarang City Government, especially the Semarang City Environmental Service and Jatibarang TPA, with more than 15 years of experience. Then two academics are senior lecturers with more than 15 years of experience, who have expertise in supply chain management and are also consultants and operational managers in a maggot industry in Semarang City. The involvement of experts in research is divided into two main stages. The first is through online Focus Group Discussions (FGD) to identify factors or elements of obstacles and challenges in organic waste management in Semarang City, viewed from upstream to downstream, which is also based on references to several previous research literature. After obtaining eleven elements of organic waste management constraints, the initial stage of ISM was then carried out, namely identifying contextual relationships between elements through online FGD with experts, as a basis for preparing the Structural Self-Interaction Matrix (SSIM).

Data processing in this research uses the ISM method through several stages [29, 30]. Starting with identifying contextual relationships between elements, developing a Structural Self-Interaction Matrix, then designing a reachability matrix. After that, the results of the Reachability matrix are used for two things, namely to design the driver - dependency matrix and also to identify the level of separation of each element to identify the priority level of each element. The results of the level separation are then continued to design the Interpretive Structural Modelling model. The research stages can be seen in Figure 2.

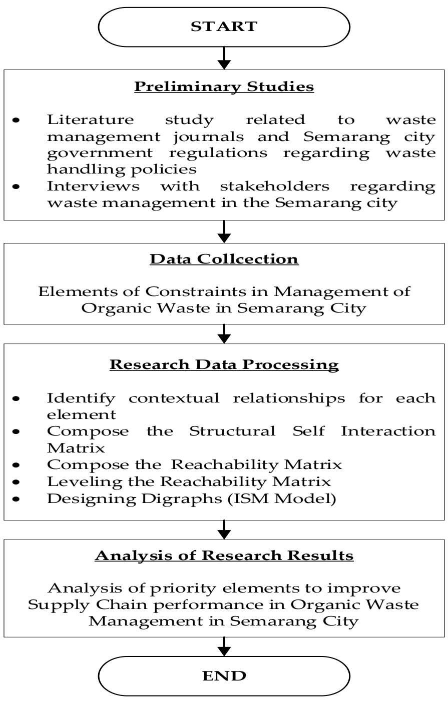


Figure 2. Research Flow Diagram

Contextual relationships between elements in ISM method are built by following existing rules, namely using four standard symbols as follows [31]:

- V= element i influences element j;
- A= element j influences element i;
- X= elements i and j influence each other;
- O= elements i and j do not influence each other.

These symbols are filled into the Structural Self - Interaction Matrix (SSIM) for becoming the basis for developing the reachability matrix.

The symbols in SSIM are converted into binary numbers (0 and 1), with the following rules [31]:

- If the relationship (i,j) is V, then the value of (i,j) is 1 and (j,i) is 0
- If the relationship (i,j) is A, the value of (i,j) is 0 and (j,i) is 1
- If the relationship (i,j) is X, the values of (i,j) and (j,i) are 1
- If the relationship (i,j) is O, the values of (i,j) and (j,i) are 0

After completing the reachability matrix stage, two further stages are carried out, namely describing the driver - dependence matrix and also carrying out levelling to find out the priority levels for each element. The driver dependency matrix is arranged by identifying the number of each row element to get the Driver Power value and adding each column element to get the Dependence Power value. Driver Power (D.P.) is the level of strength of an element to influence other elements, while Dependence Power (Dep.) is the level of dependence of an element to be influenced by other elements. Then in the driver dependence matrix, X axis represent the Driver Power value and Y axis represent the Dependence Power value.

Next, to carry out the Levelling stage, you must start by identifying the results of the binary numbers in the reachability matrix, the number 1 indicates there is a relationship between elements, while 0 means there is a relationship between elements. This basis is used to identify antecedent set, reachability sets, and intersection sets. The reachability set is an element (including the element itself) that influences other elements, while the antecedent set is an element that is influenced by other elements. Elements that intersect the reachability set and the antecedent set are called intersection sets, and this intersection set is the reference for determining the level of each element.

The information obtained from the Levelling results is used as a basis for designing the ISM model. ISM is a network consisting of nodes which represent elements and arrows which represents contextual relationship between elements. From the ISM results, it can be seen the priority order of each element of the organic waste management supply chain in Semarang City. The most basic element is a priority element as a basis for decision making to achieve better supply chain performance in organic waste management in Semarang City. Meanwhile, the elements above are further priorities that also need to be considered in accordance with the capabilities of the Semarang City Government.

3. RESULTS

3.1 Identify Constraint Elements

Based on the results of a literature study that was deepened through a Focus Group Discussion involving eight research experts, the results obtained were constraint elements of organic waste management in Semarang City as presented in Table 1.

Table 1. Elements of constraints in handling organic waste in Semarang city

Variables	Constraint Elements
A	Number of human resources involved
B	Capability of the human resources involved
C	Technological innovation that supports organic waste management
D	Ease of application of appropriate technology
E	Availability of capital (investment) for waste handling
F	Operational costs for waste management
G	Availability of organic waste raw materials
H	Availability of tools and materials for processing organic waste
I	Availability of adequate land
J	Support from the government and related institutions
K	Good cooperation between stakeholders from upstream to downstream

3.2 Structural Self – Interaction Matrix (SSIM) and Reachability Matrix

The preparation of the SSIM was carried out through FGD with eight experts, to agree on the contextual relationship between constraint elements of Organic Waste Management in Semarang City. Results of SSIM are presented in Table 2. It can be seen that the elements have a total contextual relationship with the following details:

- V with a total of 11 relationships
- A with a total of 16 relationships
- X with a total of 19 relationships
- O with a total of 9 relationships

Table 2. Structural Self-Interaction Matrix (SSIM)

FORMATION OF SSIM

(i,j)	K	J	I	H	G	F	E	D	C	B
A	X	V	V	X	A	V	V	O	O	X
B	X	V	X	X	A	V	O	V	X	
C	O	O	A	A	A	A	A	X		
D	A	A	A	A	A	A	A			
E	X	A	X	X	X	X				
F	O	O	V	V	A					
G	X	X	V	V						
H	O	X	X							
I	X	O								
J	X									
K										

The next step is to calculate the Reachability Matrix by changing the symbols on the SSIM into binary numbers (0 and 1). A recapitulation of the results of converting SSIM contextual relationships into binary numbers in the reachability matrix is presented in Table 3.

Table 3. Reachability Matrix

REACHABILITY MATRIX

(i,j)	A	B	C	D	E	F	G	H	I	J	K	D.P.	Rank
A	1	1	0	0	1	1	0	1	1	1	1	8	3
B	1	1	1	1	0	1	0	1	1	1	1	9	2
C	0	1	1	1	0	0	0	0	0	0	0	3	6
D	0	0	1	1	0	0	0	0	0	0	0	2	7
E	0	0	1	1	1	1	1	1	1	0	1	8	3
F	0	0	1	1	1	1	0	1	1	0	0	6	5
G	1	1	1	1	1	1	1	1	1	1	1	11	1
H	1	1	1	1	1	0	0	1	1	1	0	8	3
I	0	1	1	1	1	0	0	1	1	0	1	7	4
J	0	0	0	1	1	0	1	1	0	1	1	6	5
K	1	1	0	1	1	0	1	0	1	1	1	8	3
DEP.	5	7	8	10	8	5	4	8	8	6	7		
Rank	5	3	2	1	2	5	6	2	2	4	3		

After completing the conversion to binary numbers, then add the rows to get the Driver Power (D.P.) value and add the columns per column to get the Dependence Power (DEP.) value. Based on Table 3, it is also known that the element that has the largest Driver Power value is element G (Availability of organic waste raw materials), which means this element has the strongest influence compared to other elements. Meanwhile, the element that has the largest Dependence Power is element D (Ease of application of technology appropriate), meaning that the element is the element that is most influenced by other elements.

3.3 Driver – Dependency Matrix

Next, the Driver Power values and Dependence Power values become the X axis and Y axis in the Driver - Dependency matrix as shown in Figure 3. Based on the category, the driver – dependence power matrix is divided into four categories. Sector I means the element is in the Autonomous category, while Sector II means the element is in the Drivers category. For elements that are in Sector III, this means they are included in the Linkage category, and elements that are included in Sector IV means they are included in the Dependent category.

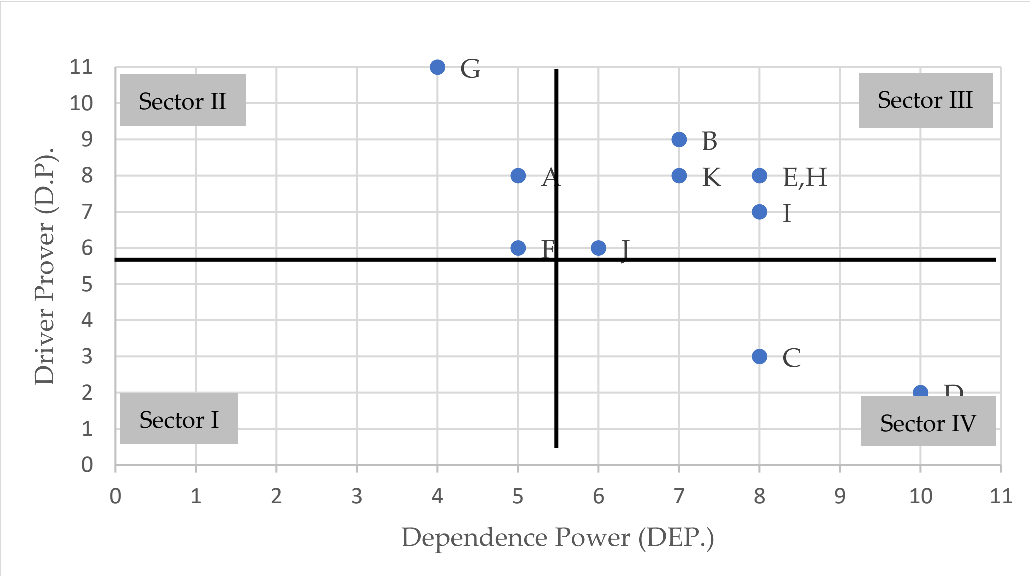


Figure 3. Driver - dependency matrix

Figure 3 shows that the 11 constraint elements of organic waste management supply chain are divided into three sectors, namely sectors II, III and IV. Elements A, G, and F are in sector II, which means that these elements have a very strong influence on other elements, and are not too influenced by other elements. Meanwhile, elements C and D are in Sector IV, which means that these two elements are very dependent on other elements, while the strength of their influence on other elements is relatively small. Sector III is occupied by the most elements, namely 6 elements. These elements are B, E, H, I, J, and K. The elements in Sector III mean that the driver power and dependence power are equally strong, or in other words the elements in this sector have the power of influence and great dependence on other elements.

3.4 Levelling

The next step is Levelling, namely separating the elements into several levels. To carry out Levelling, you must start by identifying the binary number results in the reachability matrix, the number 1 indicates there is a relationship between elements, while 0 means there is a relationship between elements. This basis is used to identify reachability sets, antecedent sets, and intersection sets.

From recapitulation of levelling results for the 11 elements which presented in Table 4, it is known that the levelling process is carried out until the seventh iteration, which means that the 11 elements of organic waste management supply chain are divided into 7 different levels. Level I is occupied by elements C and D. Level 2 is occupied by elements E and K. Level III is occupied by element J. Element IV is occupied by elements H and I. Level V is occupied by element F. Meanwhile level VI is occupied by elements A and B . Meanwhile, level VII is occupied by element G.

Based on the Levelling results, it can be concluded that element G is a priority element in improving supply chain performance in organic waste management in Semarang City, because element G is the most basic element that must be considered in decision making by stakeholders in Semarang City. Meanwhile, elements C and D are the last priority elements among the 11 elements of organic waste management. A.

Table 4. Recapitulation of organic waste management levelling results

Element	*Reachability set*	*Antecedent Set*	*Intersection Set*	Level
A	A,B,E,F,J,K	A,B,G,H,I,K	A,B,K	VI
B	A,B,C,D,F,H,I,J,K	A,B,C,G,H,I,K	A,B,C,H,I,K	VI
C	B,C,D	B,C,D,E,F,G,H,I	B,C,D	I
D	C,D	B,C,D,E,F,G,H,I,J,K	C,D	I
E	C,D,E,F,G,H,I,K	A,E,F,G,H,I,J,K	E,F,G,H,I,K	II
F	C,D,E,F,H,I	A,B,E,F,G,J	E,F	V
G	A,B,C,D,E,F,G,H,I,J,K	E,G,J,K	E,G,J,K	VII
H	A,B,C,D,E,H,I,J	A,B,E,F,G,H,I,J	A,B,E,H,I,J	IV
I	B,C,D,E,I,K	A,B,E,F,G,H,I,J,K	B,E,I,K	IV
J	D,E,G,H,J,K	A,B,G,H,J,K	G,H,J,K	III
K	A,B,D,E,G,I,J,K	A,B,E,G,I,J,K	A,B,E,G,I,J,K	II

3.5 ISM Model

The information obtained from the Levelling results presented in Table 4, then used as a basis for designing the ISM model. ISM is a network consisting of nodes and arrows. Dots represent elements and arrows represent contextual relationships between factors as presented in Table 2 regarding SSIM. The ISM organic waste management supply chain model in Semarang City is presented in Figure 4.

From the ISM results in Figure 4 you can see the priority order of the 11 elements of organic waste management supply chain in Semarang City. The most basic element is a priority element as a basis for decision making to achieve better supply chain performance in organic waste management in Semarang City. The elements above are further priorities that also need to be considered in accordance with the capabilities of the Semarang City Government. In other words, the availability of organic waste supply is the most priority consideration that must be studied to determine whether it is necessary to develop a more appropriate supply chain strategy to overcome problems in handling organic waste (organic waste management) in Semarang City, holistically using a supply chain perspective. The availability of organic waste supply means the amount of organic waste generation in the Semarang City area in the future, where the amount of generation will influence the strategy that must be determined for the elements that are in the next priority, related to the human resources involved and so on.

4. DISCUSSION

This research has succeeded in identifying constraints factors or constraint elements in organic waste management in Semarang City by involving experts in the field of waste management and supply chain. The research results, which were processed using the ISM method, succeeded in identifying constraint elements into seven priority levels. Of the seven priority levels, the most basic priority factor for improving organic waste management performance is related to the availability of organic waste raw materials, and the last priority factor is related to technological innovation in organic waste management. This is in accordance with several previous studies, that raw materials are the most important element for carrying out supply chain activities [32-35]. This research has development potential for further research, by widening the scope to downstream areas in particular. The downstream context is intended for products resulting from processed organic waste, which show additional value compared to when the organic waste has not been processed. With this expanded scope, it is hoped that the quality of supply chain research regarding organic waste management will be further improved and can be used to solve problems related to organic waste.

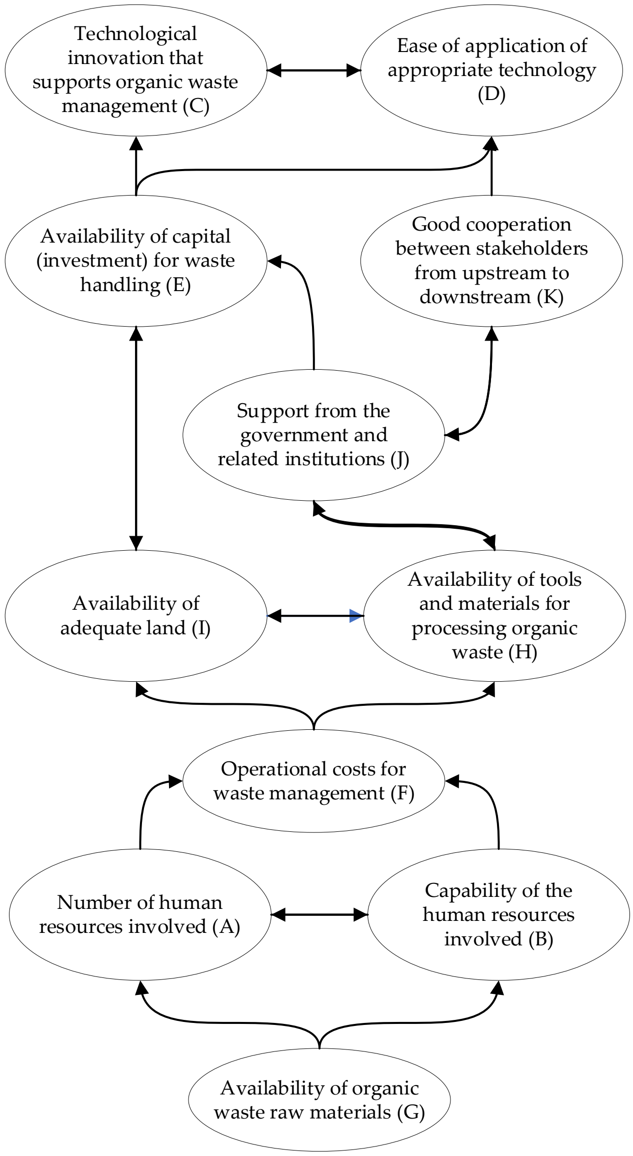


Figure 4. ISM model of organic waste management supply chain in Semarang City

5. CONCLUSION

Based on research data processing that has been completed using the ISM method involving eight experts in the field of waste management and supply chain, the results showed that there are 11 main constraint elements in organic waste management in Semarang City. The ISM results show that the 11 constraint elements are divided into seven priority levels. The most priority basic level is the availability of organic waste raw materials, while the last priority level is related to Technological innovation that supports organic waste management and Ease of application of appropriate technology. This is in line with the results shown in the driver dependency matrix, that the availability of raw materials is at the top in sector II, which means that this element has the highest level of influence among the other elements. Meanwhile, elements related to technological innovation are in sector IV, which means that these elements have the highest level of dependence among other elements. It can be concluded that the availability of organic waste supply is the most priority consideration that must be studied to determine whether it is necessary to develop a more appropriate supply chain strategy to overcome problems in organic waste management in Semarang City, holistically using a Supply Chain perspective.

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REFERENCES

[1] P. Kaszycki, M. Głodniok, and P. Petryszak, "Towards a bio-based circular economy in organic waste management and wastewater treatment – The Polish perspective," *N Biotechnol*, vol. 61, 2021, doi: 10.1016/j.nbt.2020.11.005.

[2] O. Melnyk, V. Scliar, S. Sabadash, and V. Butova, "EU municipal organic wastes management and its implementation prospects in Ukraine," *Environmental and Climate Technologies*, vol. 25, no. 1. 2021. doi: 10.2478/rtuect-2021-0014.

[3] K. ur Rehman *et al.*, "Black soldier fly, Hermetia illucens as a potential innovative and environmentally friendly tool for organic waste management: A mini-review," *Waste Management and Research*, vol. 41, no. 1. 2023. doi: 10.1177/0734242X221105441.

[4] J. A. Shukor, M. F. Omar, M. M. Kasim, M. H. Jamaludin, and M. A. Naim, "Assessment of composting technologies for organic waste management," *International Journal of Technology*, vol. 9, no. 8, 2018, doi: 10.14716/ijtech.v9i8.2754.

[5] L. Hénault-Ethier, J. P. Martin, and J. Housset, "A dynamic model for organic waste management in Quebec (D-MOWIQ) as a tool to review environmental, societal and economic perspectives of a waste management policy," *Waste Management*, vol. 66, 2017, doi: 10.1016/j.wasman.2017.04.021.

[6] R. van der Velden *et al.*, "Closed-loop organic waste management systems for family farmers in Brazil," *Environmental Technology (United Kingdom)*, vol. 43, no. 15, 2022, doi: 10.1080/09593330.2021.1871660.

[7] M. Rotthong, M. Takaoka, K. Oshita, P. Rachdawong, S. H. Gheewala, and T. Prapaspongsa, "Life Cycle Assessment of Integrated Municipal Organic Waste Management Systems in Thailand," *Sustainability (Switzerland)*, vol. 15, no. 1, 2023, doi: 10.3390/su15010090.

[8] P. Chintapalli and A. Vakharia, "The waste management supply chain: a decision framework," *SSRN Electronic Journal*, 2023, doi: 10.2139/ssrn.4348912.

[9] M. Mohammadi, E. Martín-Hernández, M. Martín, and I. Harjunkoski, "Modeling and analysis of organic waste management systems in centralized and decentralized supply chains using Generalized Disjunctive Programming," *Ind Eng Chem Res*, vol. 60, no. 4, 2021, doi: 10.1021/acs.iecr.0c04638.

[10] S. Chopra and P. Meindl, *Supply Chain Management. Strategy, Planning & Operation*. 2007. doi: 10.1007/978-3-8349-9320-5_22.

[11] O. Kwon and J. Han, "Organic-waste-derived butyric acid-to-biodiesel supply-chain network: Strategic planning design using a deterministic snapshot model," *J Environ Manage*, vol. 293, 2021, doi: 10.1016/j.jenvman.2021.112848.

[12] M. Hugos, *ESSENTIALS of Supply Chain Management Third Edition Michael*, no. November. 2008.

[13] A. Novra, F. Fatati, D. Devitriano, and S. Syarif, "Compost fertilizer business supply chain management strategy for stability of potential added value of waste raw materials in Jambi province, Indonesia," *African Journal of Food, Agriculture, Nutrition and Development*, vol. 23, no. 3, 2023, doi: 10.18697/ajfand.118.21625.

[14] C. Hussain and S. Hait, *Advanced Organic Waste Management: Sustainable Practices and Approaches*. 2022. doi: 10.1016/B978-0-323-85792-5.00060-5.

[15] C. Vlachokostas, "Closing the loop between energy production and waste management: A conceptual approach towards sustainable development," *Sustainability (Switzerland)*, vol. 12, no. 15, 2020, doi: 10.3390/su12155995.

[16] G. Haseli, A. E. Torkayesh, M. Hajiaghaei-Keshteli, and S. Venghaus, "Sustainable resilient recycling partner selection for urban waste management: Consolidating perspectives of decision-makers and experts," *Appl Soft Comput*, vol. 137, 2023, doi: 10.1016/j.asoc.2023.110120.

[17] S. Kharola *et al.*, "Barriers to organic waste management in a circular economy," *J Clean Prod*, vol. 362, 2022, doi: 10.1016/j.jclepro.2022.132282.

[18] M. H. Sabki, C. T. Lee, C. P. C. Bong, Z. Zhang, C. Li, and J. J. Klemeš, "Sustainable organic waste management framework: A case study in Minhang district, Shanghai, China," *Chem Eng Trans*, vol. 72, 2019, doi: 10.3303/CET1972002.

[19] H. R. Kopaei, M. Nooripoor, A. Karami, and M. Ertz, "Modeling consumer home composting intentions for sustainable municipal organic waste management in iran," *AIMS Environ Sci*, vol. 8, no. 1, 2021, doi: 10.3934/environsci.2021001.

[20] N. Abdullah *et al.*, "Integrated Approach to achieve a sustainable organic waste management system in Saudi Arabia," *Foods*, vol. 11, no. 9, 2022, doi: 10.3390/foods11091214.

[21] A. Verma and N. Singhal, "An integrated ISM-AHP computing framework for evaluating supply chain competitiveness," in *Lecture Notes in Mechanical Engineering*, 2022. doi: 10.1007/978-981-16-5281-3_6.

[22] P. Arsiwi and P. W. Adi, "Strategi peningkatan keunggulan kompetitif UKM Mina Indo Sejahtera dengan metode Interpretive Structural Modelling dan Analytic Network Process," *Jurnal Teknik Industri*, vol. 10, no. 3, 2020, doi: 10.25105/jti.v10i3.8407.

[23] S. Sorooshian, M. Tavana, and S. Ribeiro-Navarrete, "From classical interpretive structural modeling to total interpretive structural modeling and beyond: A half-century of business research," *J Bus Res*, vol. 157, 2023, doi: 10.1016/j.jbusres.2022.113642.

[24] Z. R. Marak and D. Pillai, "Supply chain finance factors: an Interpretive Structural Modeling approach," *Central European Management Journal*, vol. 29, no. 1. 2021. doi: 10.7206/cemj.2658-0845.42.

[25] D. L. Hughes, N. P. Rana, and Y. K. Dwivedi, "Elucidation of IS project success factors: an interpretive structural modelling approach," *Ann Oper Res*, vol. 285, no. 1–2, 2020, doi: 10.1007/s10479-019-03146-w.

[26] N. Shin and S. Park, "Evidence-based resilience management for supply chain sustainability: An interpretive structural modelling approach," *Sustainability (Switzerland)*, vol. 11, no. 2, 2019, doi: 10.3390/su11020484.

[27] P. Agrawal and R. Narain, "Analysis of enablers for the digitalization of supply chain using an interpretive structural modelling approach," *International Journal of Productivity and Performance Management*, vol. 72, no. 2, 2023, doi: 10.1108/IJPPM-09-2020-0481.

[28] N. P. Rana, Y. K. Dwivedi, and D. L. Hughes, "Analysis of challenges for blockchain adoption within the Indian public sector: an interpretive structural modelling approach," *Information Technology and People*, vol. 35, no. 2, 2022, doi: 10.1108/ITP-07-2020-0460.

[29] R. R. Menon and V. Ravi, "Analysis of barriers of sustainable supply chain management in electronics industry: An interpretive structural modelling approach," *Cleaner and Responsible Consumption*, vol. 3, 2021, doi: 10.1016/j.clrc.2021.100026.

[30] D. Mathivathanan, K. Mathiyazhagan, N. P. Rana, S. Khorana, and Y. K. Dwivedi, "Barriers to the adoption of blockchain technology in business supply chains: a total interpretive structural modelling (TISM) approach," *Int J Prod Res*, vol. 59, no. 11, 2021, doi: 10.1080/00207543.2020.1868597.

[31] D. Rukmayadi, Y. Saputra, R. Muhendra, and Z. F. Ikatrinasari, "Oasis pool corporate strategy planning using AHP-SWOT and ISM methods," *International Journal of Industrial Engineering and Production Research*, vol. 35, no. 1, Mar. 2024, doi: 10.22068/ijiepr.35.1.1961.

[32] R. Setyaningrum and P. N. Sari, "Organic waste management based on supply chain management using arena simulation and macro ergonomics approach," *Opsi*, vol. 16, no. 2, 2023, doi: 10.31315/opsi.v16i2.11325.

[33] P. Rathore, S. Chakraborty, M. Gupta, and S. P. Sarmah, "Towards a sustainable organic waste supply chain: A comparison of centralized and decentralized systems," *J Environ Manage*, vol. 315, 2022, doi: 10.1016/j.jenvman.2022.115141.

[34] Y. Hu, M. Scarborough, H. Aguirre-Villegas, R. A. Larson, D. R. Noguera, and V. M. Zavala, "A supply chain framework for the analysis of the recovery of biogas and fatty acids from organic waste," *ACS Sustain Chem Eng*, vol. 6, no. 5, 2018, doi: 10.1021/acssuschemeng.7b04932.

[35] O. Kwon, J. Kim, and J. Han, "Organic waste derived biodiesel supply chain network: deterministic multi-period planning model," *Appl Energy*, vol. 305, 2022, doi: 10.1016/j.apenergy.2021.117847.