EXAMINING THE CRITICAL FACTORS THAT INFLUENCE THE SUCCESS OF CONSTRUCTION AND DEMOLITION WASTE REVERSE LOGISTICS OPERATIONS

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ABSTRACT

The reverse logistics (RL) performance of construction and demolition waste (C&DW) differs significantly between countries. Although some countries are successfully circular, other countries are still far behind; with C&DW being largely directed to landfills or being illegally dumped. There is a lack of guidelines on the requirements for transitioning countries towards C&DW diversion, and little attention has been given to the factors that influence the success of C&DW RL and increased circularity. This study aims to develop a framework that helps in structuring and assessing the success of C&DW RL on a regional level and serves as a guide for transitioning developing countries towards implementing such operations. Since the framework should help evaluate where interventions are needed to enhance performance, the exact domains to be used and their priorities should be identified. A systematic literature review was conducted to identify the critical factors that affect the outcome of RL operations. After their identification, the interrelationships between the factors and the dependence and driving power of each are examined through interpretive structural modelling. This analysis provides valuable insights and thus, allows for the establishment of a hierarchy of factors that can serve as a guide for decision-makers. The developed framework can be utilized for enhancing the efficiency of current RL operations as well as for identifying the direction of action and efforts needed to shift developing countries towards the implementation of circular economy in the sector of C&DW.

Keywords: construction and demolition waste, illegal dumping, reverse logistics, interpretive structural modelling, circular economy, sustainability.

1 INTRODUCTION

Reverse logistics (RL) is an integral component in achieving a circular and sustainable world. RL operations aim to reduce the economic, environmental and social impacts associated with waste dumping and the extraction of raw aggregates. A noteworthy example of RL in construction is the utilization of recycled concrete aggregates (RA) as a substitute for natural aggregates (NA) in roadway engineering. Numerous research on the subject has demonstrated the feasibility and economic viability of using RA in road construction. This made the construction of roadway pavements one of the most worldwide accepted applications for RA and a promising market that should be encouraged and propagated.

Despite the fact that various studies have demonstrated the ease with which RL can be applied through using RA in road construction, its application is still limited, particularly in less developed regions [1]. Indeed, when comparing the construction and demolition waste (C&DW) management performance between different regions, a significant disparity can be noticed between developed and developing countries. While developed countries are making enormous strides in creating a circular economy, developing countries are still not able to take advantage of simple and convenient recycling applications for C&DW. Helping such regions achieve circularity requires examining the critical factors that influence the three

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main nodes of RL networks, i.e., waste generation nodes, waste treatment nodes and aggregate resale nodes.

This paper aims to investigate the critical factors that influence the success of C&DW RL operations and to offer a framework that would guide developing nations in their transition to adopting such operations. This framework would emphasize the specific domains and factors on which efforts should be concentrated, thus allowing for the benchmarking of any region to help in evaluating the time and efforts needed to shift towards circularity. Accordingly, it provides insights that are pivotal for the future decision-making, planning and strategy formulation required for enabling regional transitions.

This article begins by exploring the primary domains that will constitute the framework. For this purpose, a systematic literature review is conducted to synthesize the critical factors which influence C&DW management performance in regions taking into consideration all major nodes of RL. As the framework's outcomes should aid in determining where actions are required to improve performance, the priority of each of the domains and factors identified should be determined. This will be achieved through implementing interpretative structural modelling. The use of interpretive structural modelling (ISM) allows for the identification of interrelationships between factors as well as the dependence and driving power of each. Thus, it allows for the establishment of a hierarchy of factors that can serve as a guide for decision-makers. Finally, an example is provided that demonstrates how the framework can be used for the case of Lebanon, the partner country of RE-MED strategic project, funded by the ENI CBC MED program (https://www.enicbcmed.eu/projects/re-med).

2 FACTORS TO BE USED IN THE EVALUATION OF READINESS

Various regional factors play a significant role in either encouraging or hindering C&DW management performance. The assessment framework to be built in Section 4 will be based on the major factors pertaining to waste management in a region. This section aims to summarise the current understanding of factors affecting C&DW management and RL performance through a comprehensive and systematic review of relevant studies, which will be detailed below. The factors we aim to identify are those affecting the three nodes of RL mainly the transportation, disposal, treatment, and reselling of C&DW. However, because the goal is to develop regional solutions for the entire RL system's operations, this study will not focus on the variables impacting waste reduction or on-site generation and management.

The database engines used to conduct the review are Scopus and Web of Science. These databases include the bulk of C&DW management studies and are most preferred by researchers for conducting such reviews. The search strategy comprised of the following criteria: (TITLE ("construction", "waste" OR "demolition" , "waste") AND TITLE (factors OR barriers OR challenges OR performance) AND TITLE-ABS-KEY (recycl* OR manag* OR diver*) AND NOT TITLE-ABS-KEY (aggregates OR concrete)). This search criterion yielded 67 research or review articles. Conference papers and book chapters were not considered for this review.

The first screening phase comprised of examining the titles and abstracts of the initial set of articles, yielding the omission of 30 articles that were irrelevant for the review. The second screening phase comprised scanning the articles to assess their relevance and quality. This phase resulted in the omission of 12 articles that were also irrelevant (e.g. studied factors influencing waste generation on-site, factors affecting waste reduction on construction sites, or studies that did not discuss any factors). Finally, 22 articles were selected for the synthesis of factors influencing C&DW RL operations. Table 1 shows the critical factors that influence the success of RL operations and their respective domains.

Table 1: Comprehensive set of factors influencing regional C&DW management performance.

Social Factors		Explanation of Factors	Relevant Research Studies
1	Attitudes of stakeholders	Willingness and commitment of stakeholders to cooperate in waste management practices	[2-8]
2	Level of awareness	Knowledge and understanding of stakeholders regarding waste generation, management, and environmental impacts	[2, 7, 9-15]
3	Skills and Training	Presence of training and education for practitioners to guide towards successful implementation of waste management	[5, 6, 8-10, 13, 14, 16, 17]
Economic Factors			
4	Subsidies, Incentives, Taxes and Penalties	Presence of appropriate subsidies, incentives, taxes, and penalties that will drive toward the economic viability of C&DW management processes	[2, 3, 5, 7, 8, 14-16, 18-20]
5	Regulating Waste Dumping	Regulating landfilling activities through imposing charges that are carefully devised to encourage waste diversion	[3, 5, 10, 12, 18-21]
6	Economic Viability of Waste Management	Ability to prove the economic viability of waste management	[2, 3, 5, 6, 10]
7	Market for Recycled Aggregates	Presence of a market for recycled products and their competitiveness with virgin aggregates	[3, 5, 7, 8, 17, 20-22]
Political/Regulatory Factors			
8	Presence of Effective Regulations	Presence of comprehensive, detailed, clear, operational and rigid regulations, policies, and guidelines	[2, 3, 6, 10-12, 14-16, 20-22]
9	Supervision and Enforcement	Presence of monitoring systems and mechanisms that ensure that policies are enforced and violations are prevented	[3, 7, 9, 13-15, 20, 21]
Managerial/Operational Factors			
10	C&DW Management Plan	Implementation of construction and demolition site waste management plans on projects	[6, 7, 11, 21]
11	Communication and Coordination between Stakeholders	Presence of effective communication and coordination between the government, contractors, clients, and subcontractors	[3, 7, 8, 15, 19-21]
12	C&DW Data	Presence of data collection methods and systems that allow tracking waste from its generation to its disposal	[3, 19-21]

2.1 Social factors

The RL stakeholders include national governmental administrations, waste management companies, construction firms, developers, and waste outlets and markets. Each of these stakeholders has differing attitudes and behaviours. The main social determinants of C&DW performance in a region include the attitudes of stakeholders towards C&DW, the level of awareness of stakeholders and the level of skills they possess and training they receive.

2.1.1 Awareness

Stakeholders are not properly educated on the process of managing C&DW and are not fully aware of the potential of waste to be reused or recycled [7, 9, 10]. Furthermore, there is a lack of comprehension of the impact of C&DW on the environment and the remarkable benefits provided by waste management [9, 15, 23]. As environmental concerns are given utmost importance in developed countries, these concerns are not well grasped in other parts of the world where stakeholders are not cognizant of the environmental implications of haphazard waste management [3]. Suggested that the environmental implications of waste dumping should be highlighted to the public through research and mass media to raise their awareness on this issue. On the other end of the spectrum, even when C&DW is recycled, the circular economic model cannot be complete if these recycled products are not purchased and used in construction activities. However, practitioners are not concerned with the use of such aggregates and are not aware of the resource conservation prospects arising from using such recycled products in their construction activities [7, 12].

2.1.2 Attitudes

The attitudes of stakeholders, their commitment, and their willingness to change their current practices pertaining to C&DW management is another critical factor that affects the performance of C&DW management in a region [7]. It is almost impossible to build effective C&DW management in a region when the generators of construction waste are unwilling to cooperate [2]. Attitudes of construction practitioners towards waste recycling affect the development of recycling facilities. Recycling facilities are not likely to operate in regions where there will be no supply of C&DW. Therefore, it is important to ensure that all stakeholders in a region have a positive attitude and are willing to actively cooperate in managing C&DW [2, 8].

2.1.3 Training and skills

Training can directly change stakeholders' understanding and attitudes, and it is required for resolving the existing deficiencies in C&DW management. Construction professionals should be educated on the different processes of managing C&DW, as well as its significance and overall benefits [9, 10]. Furthermore, training should touch on the recycling potential for each of the waste materials [8], environmental impacts and sustainability, usage of RA in construction, as well as newer construction technologies . Furthermore, staff and workers can be educated on waste generating practices [12, 13], managing the generated waste, and the importance of waste recycling through meetings, workshops, seminars, or the dissemination of information [2].

2.2 Economic factors

Many academics stress the importance of proving economic viability to contractors to encourage the adoption of waste management strategies. The economic factors which play a role in the performance of C&DW management and recycling in a region are (1)

governmental-related financial factors such as subsidies, incentives, taxes and penalties, (2) waste dumping fees and penalties, (3) the feasibility of implementing waste management and (4) the existing market for recycled aggregates.

2.2.1 Subsidies, incentives, taxes and penalties

Governmental incentives and subsidies are considered successful measures for encouraging environmental awareness and increasing waste diversion. Examples of these include financial subsidies to recycling facilities for selling RA, incentives to construction contractors when applying on-site sorting, using RA in construction, or when recycling construction waste [20]. Moreover, subsidies can be provided to transportation companies in cases where recycling facilities are far from the sources of C&DW generation and high transportation costs are among the barriers to waste recycling [19]. Likewise, taxes and penalties are effective in reinforcing regulations pertaining to C&DW management [14].

The use of economic incentives for using C&DW management practices increases contractors' awareness of such processes and encourages their implementation [15]. For example, in certain cases, the operation of C&DW recycling facilities is not economically feasible without such subsidies, which hinders the continued operation of such facilities [19]. As governments provide subsidies for recycling facilities, the costs of recycling would decrease as well as the prices of the RA, making recycling a more reasonable alternative for construction contractors, and the use of recycled alternatives more attractive [7]. Steady financial support from the government is an important factor in enhancing regional waste diversion [21].

2.2.2 Regulating waste dumping

Imposing waste charges on waste dumping has been a fundamental measure applied in many regions for motivating waste diversion [12, 16]. Paying significant fees for landfilled waste makes diversion a more economically attractive option and motivates waste separation for recycling. The landfill charge could be progressive and more severe for recyclable waste materials [20]. Nonetheless, devising the right landfill charge needs careful consideration since a low charge might not be enough to encourage waste diversion, but a high charge might lead to illegal dumping [21]. Apart from landfill fees, Ma, Tam [19] suggested imposing a landfill ban on recyclables and limiting waste dumping to materials that cannot be recycled.

2.2.3 Economic viability of waste management

Since contractors place the highest priority on the project's profit, the considerable costs associated with C&DW management have long been an acknowledged impediment to its deployment [2]. Even if contractors are aware of the environmental benefits of waste reduction and diversion, they will still turn to the most profitable alternative. Therefore, it is important to ensure that C&DW management in a region is economically viable for contractors when developing the C&DW management infrastructure.

2.2.4 Market for recycled aggregates

For the existence and operation of recycling facilities, the financial security of these facilities must be guaranteed. As such, the presence of a market for the recycled products produced by the facilities is vital for their profitability and growth [7, 17, 21, 22]. Two factors influence the market and demand for RA: (1) their competitiveness with NA in terms of cost and quality, and (2) the existence of standards and specifications for RA to guarantee reliable quality.

2.3 Political and regulatory factors

The government plays a central role in leading the changes in C&DW management and directing a region towards sustainability. By developing clear regulations, policies and guidelines for waste management, the government could enhance the effectiveness of the waste management plans (WMPs) implemented on site and augment waste recovery [8]. Moreover, governments should maintain proper observation and regulation of the WM in a region [8].

2.3.1 Presence of effective regulations

Governmental regulations are fundamental for effective C&DW waste management [2, 8]. However, in order to achieve their desired effect, governmental regulations should be comprehensive, detailed, clear, operational and rigid [21]. It is also important to make sure that practitioners have a clear understanding of the requirements of the existing regulations [2]. Ill-conceived regulations hinder the success of waste management endeavours [21]. Moreover, the responsible personnel and departments for execution and monitoring should be appointed [21].

Apart from the policies and regulations, governments could also foster efficient C&DW management by developing clear guidelines for the processes required. Such requirements can be included in owners' specifications on a construction contract. These templates can serve as a guide for setting correct performance targets, limits for allowable waste generation, and guidelines for establishing the minimum required components to be included in the C&DW management plan [13].

2.3.2 Supervision and enforcement

Monitoring systems and supervision mechanisms are essential for ensuring that government policies are enforced and violations are prevented [7]. Supervision mechanisms can be accompanied by rewards and punishments [13]. For example, high penalties were advocated for the control of illegal dumping [21]. When no enforcement or supervision is present contractors are not concerned by the potential repercussions and are therefore unlikely to ensure that waste vehicles do not resort to illegal dumping to avoid landfill fees. A consequence of illegal dumping is the shortage in supply of C&DW to recycling facilities which hinders their operation and growth [21].

Governments should figure out methods to oversee waste management procedures on-site, and after being sent to treatment or disposal [9]. One of the tools suggested for monitoring waste disposal is tracing its paths by connecting GIS sensors on C&DW vehicles [21]. Yuan [21] proposed that a periodical assessment of supervision systems should be conducted with particular metrics that allow for measuring the efficiency of these systems.

2.4 Managerial and operational factors

The managerial and operational factors which act as drivers and barriers to effective C&DW management are the implementation of C&DW management plans on construction sites, the presence of effective communication and coordination between construction stakeholders, and the presence of mature waste data collection and tracking systems.

2.4.1 C&DW Management plan

The implementation of construction and demolition site WMPs is considered among the key practices for waste minimization and effective waste management. WMPs aim to ensure a

more proactive approach to waste management by outlining the strategies that the contractor will implement to reduce and manage C&DW before, during, and after construction activities. The preparation of such plans would provide better assurance that the contractor has a clear idea of the anticipated waste to be generated and has carefully composed a plan for effectively managing this waste [11].

2.4.2 Communication and coordination between stakeholders

Effective communication and coordination between stakeholders have been highlighted as a key factor for effective C&DW management by many studies [3]. At the regional level, the government is encouraged to coordinate with waste generators [7]. Steady communication channels created by the government can help enhance awareness of C&DW management [15]. On construction sites, effective communication should be present between contractors, clients and subcontractors. Well-developed communication channels help in achieving the intended diversion rates [8], spread awareness on the environmental benefits of waste management, as well as educate on the proper strategies for reducing and handling waste.

2.4.3 C&DW Data

A critical factor that can be considered overlooked in most regions is effective data collection pertaining to C&DW [21]. Acquiring such data is the first step towards understanding waste generation in a region and building effective systems for its management. It is essential to upgrade data collection methods and systems that allow tracking waste from its generation to its disposal. Thus, two main data collection systems should be developed. One that allows capturing the precise amounts of waste generated and its material composition [21] and another that allows tracing the waste after leaving the site [19].

3 ASSESSMENT FRAMEWORK

Understanding the interrelationship between the primary factors affecting C&DW RL operations is important for guiding reform efforts. This is particularly critical in areas where all the factors are severely lacking. Knowing and focusing efforts on the factors with high driving power can thus optimize this process instead of forming such strategies randomly. The ISM is an effective technique for interpreting complex interrelationships in a certain problem. This approach was first introduced by J. Warfield in 1973 in order to assist in understanding systems and finding solutions to complex problems [24]. Apart from the identification of factors implemented in Section 3, the ISM approach is comprised of four main steps as will be presented in the sections below:

3.1 Structural self-interaction matrix

The structural self-interaction matrix (SSIM) allows investigating the relationship between each of the factors in the context of the overall problem. Thus, this step aims to determine which of the factors influence the others. The following letters are used to represent the different relationships that can exist between two factors x and y [24]: ‘V’ signifies that factor x leads to attain factor y, ‘A’ signifies that factor y leads to attain factor x, ‘X’ signifies that factors x and y will assist each other, and ‘O’ signifies that factors x and y are unrelated. The SSIM is presented in Table 2.

Table 2: Structural Self-Interaction Matrix.

Factors	12	11	10	9	8	7	6	5	4	3	2	1
1. Attitudes of stakeholders	V	X	V	A	A	A	A	A	A	A	X	
2. Level of awareness	X	A	V	X	O	A	A	O	A	A		
3. Skills and Training	V	O	V	O	A	O	V	O	O			
4. Subsidies, Incentives, Taxes, and Penalties	V	O	V	A	A	V	V	O				
5. Regulating Waste Dumping	V	O	O	A	A	V	V					
6. Economic Viability of Waste Management	O	A	O	A	A	X						
7. Market for Recycled Aggregates	V	A	X	A	A							
8. Presence of Effective Regulations	V	O	V	O								
9. Supervision and Enforcement	V	O	V									
10. C&DW Management Plan	V	A										
11. Communication and Coordination	X											
12. C&DW Data												

3.2 Reachability matrix

The reachability matrix is a binary matrix resulting from the transformation of the letters in the SSIM into binary variables according to the following rules [24]: if Fx to Fy =V, then Fxy=1 and Fyx=0; if Fx to Fy =A, then Fxy=0 and Fyx=1; if Fx to Fy =X, then Fxy=1 and Fyx=1; and if Fx to Fy =O, then Fxy=0 and Fyx=0.

3.3 Level partition

The level partition establishes the reachability and antecedent variables for each factor. The reachability set contains all of the factors that are influenced by the respective factor, and the antecedent set contains the factors that affect the corresponding factor. The interaction set contains those shared by the reachability and antecedent sets. The level partition table enables iteratively determining the levels for each of the factors.

3.4 ISM model

The level partition allows drafting the ISM, which depicts the interaction of the different factors in the system as presented in Fig. 1.

The factors at the bottom of the ISM model have the highest driving power in driving the region towards efficient RL and those at the top have the highest dependence. It can be noticed that the regulatory factors possess the highest driving power. The second category

Table 3: Reachability Matrix.

Factors	1	2	3	4	5	6	7	8	9	10	11	12	Driving Power
1. Attitudes of stakeholders		1	0	0	0	0	0	0	0	1	1	1	4
2. Level of awareness	1		0	0	0	0	0	0	1	1	0	1	4
3. Skills and Training	1	1		0	0	1	0	0	0	1	0	1	5
4. Subsidies, Incentives, Taxes, and Penalties	1	1	0		0	1	1	0	0	1	0	1	6
5. Regulating Waste Dumping	1	0	0	0		1	1	0	0	0	0	1	4
6. Economic Viability of Waste Management	1	1	0	0	0		1	0	0	0	0	0	3
7. Market for Recycled Aggregates	1	1	0	0	0	1		0	0	1	0	1	5
8. Presence of Effective Regulations	1	0	1	1	1	1	1		0	1	0	1	8
9. Supervision and Enforcement	1	1	0	1	1	1	1	0		1	0	1	8
10. C&DW Management Plan	0	0	0	0	0	0	1	0	0		0	1	2
11. Communication and Coordination	1	1	0	0	0	1	1	0	0	1		1	6
12. C&DW Data	0	1	0	0	0	0	0	0	0	0	1		2
Dependence Power	9	8	1	2	2	7	7	0	1	8	2	10	

Table 4: Level Partition

Factors	Reachability set	Antecedent set	Interaction set	Level
1	1,2,10,11,12	1,2,3,4,5,6,7,8,9,11	1,2,11	3
2	1,2,9,10,12	1,2,3,4,6,7,9,11,12	1,2,9,12	3
3	1,2,3,6,10,12	3,8	3	5
4	1,2,4,6,7,10,12	4,8,9	4	5
5	1,5,6,7,12	5,8,9	5	5
6	1,2,6,7	3,4,5,6,7,8,9,11	6,7	4
7	1,2,6,7,10,12	4,5,6,7,8,9,10,11	6,7,10	4
8	1,3,4,5,6,7,8,10,12	8	8	6
9	1,2,4,5,6,7,9,10,12	2,9	2,9	6
10	7,10,12	1,2,3,4,7,8,9,10,11	7,10	2
11	1,2,6,7,10,11,12	1,11,12	1,11,12	5
12	2,11,12	1,2,3,4,5,7,8,9,10,11,12	2,11,12	1

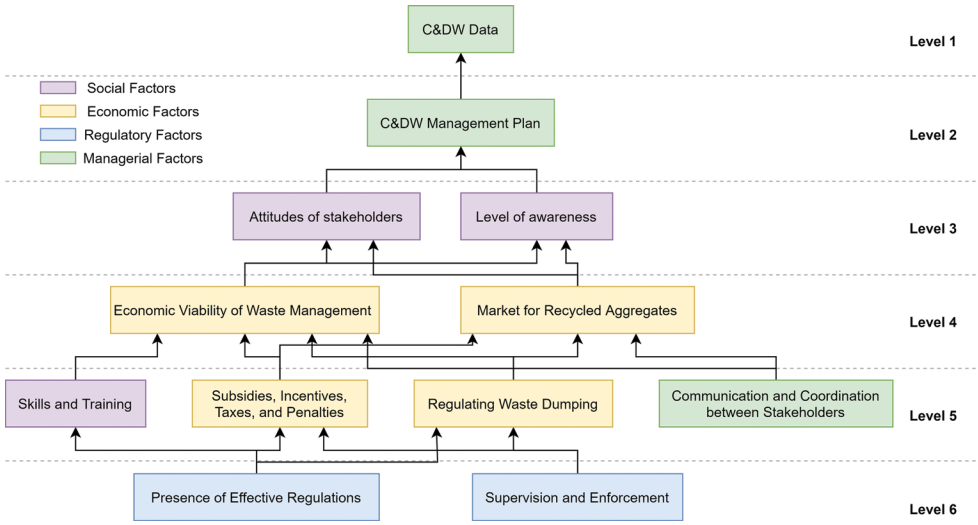

Figure 1: Interpretive Structural Model.

of factors with high driving power are the economic factors. On the other hand, social and managerial factors are mostly influenced by political and economic factors and play little role on their own in driving the region towards successful RL operations. Although all the factors are identified as critical in the literature review, the ISM analysis allowed pinpointing those with most impact on the whole system. Thus, it provides a map to guide efforts through focusing on factors with highest driving power.

4 EVALUATION OF READINESS – LEBANON

This section demonstrates how the results of the ISM may be used to assess Lebanon's readiness to implement efficient RL in C&DW management, one of the objectives of the RE-MED project. As such, the six factors covering the two bottom levels in the ISM diagram will be selected since they possess the highest priority. Because of their high driving power, these six factors play a critical role in influencing the rest of the factors, which is why their evaluation would provide a good indication of the status of the system. The assessment approach entails analysing each of the factors in the context of Lebanon. As a result, each factor will be scored on a scale of 1 to 5, with 1 indicating a major deficiency and 5 indicating complete competence. Figure 2 depicts the evaluation of the factors.

In Lebanon, there are no regulations specific to C&DW management. The existing regulations briefly mention some guidelines related to the disposal of C&DW and illegal dumping. However, they are not detailed nor specific enough, which is why this factor is given a rating of 2. Similarly, 'Subsidies, Incentives, Taxes, and Penalties' also received a rating of 2. These instruments are mentioned in the Lebanese laws and regulations concerning solid waste management, however, they are rarely executed.

The lowest rating was given to the three factors: 'Supervision and Enforcement', 'Skills and Training' and 'Regulating Waste Dumping', since they are all non-existent in Lebanon. Supervision and enforcement are not present for two main reasons: the lack of resources and the absence of legal treatment or disposal sites for C&DW. Similarly, there is a lack of training initiatives to educate contractors on correct on-site waste management techniques, the

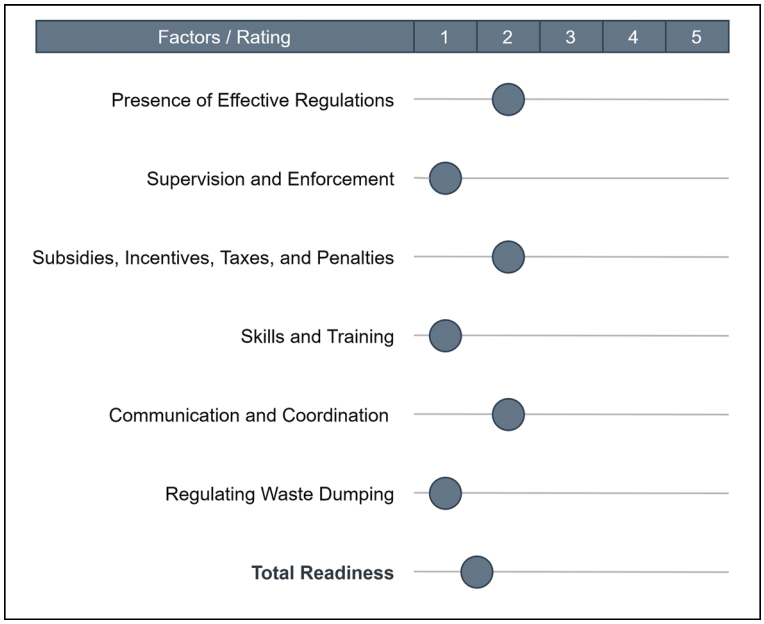

Figure 2: Rating of the different factors and the final readiness rate.

environmental advantages of waste diversion, or potential ways to reuse or recycle C&DW. Finally, waste dumping is not regulated by the government but rather each landfill is regulated through its respective owner. Finally, the 'Communication and Coordination between Stakeholders' was given a rating of 3, which signifies that communication and coordination channels already exist in Lebanon and are doing a satisfactory job in terms of connecting the different stakeholders. These channels include the Order of Engineers and Architects and the Lebanese Contractors Syndicate of Public Works and Buildings. The final readiness score was based on the average rating of the six evaluated factors and amounted to 1.7, which signifies that Lebanon is still a long way from being ready to properly deploy RL in construction.

5 CONCLUSION

This study aims to develop a framework that helps in structuring and assessing the success of C&DW RL on a regional level and serves as a guide for transitioning countries towards implementing such operations. For this purpose, the main factors that influence regional C&DW management were identified through a systematic and comprehensive literature review. Twelve factors of social, economic, regulatory and managerial nature were identified as critical for effective RL. After a broad understanding of the factors, the next step was to investigate the hierarchy of factors to identify those with the highest driving power. Interpretive structural modelling was used to identify the interrelationships between the factors and the dependence and driving power of each. Finally, the results from the ISM were used in assessing the readiness of Lebanon to shift towards circular practices.

The results of the ISM showed that the factors in the bottom level in the ISM, namely, 'Presence of Effective Regulations' and 'Supervision and Enforcement', should be given most priority when starting with the efforts for reform. After the weaknesses in these two factors have been properly remedied, the other four factors in Level 5 are given priority next.

Although all factors are important, those at the top are more dependent and hence have a smaller influence on the system. As a result, attempts to remedy the bottom factors will have a greater overall impact. Therefore, this model gives direction on which factors to focus in order to assess a region's readiness and make successful changes to improve the status quo.

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