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List of Acronyms

| | |
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| CDW | Construction and Demolition Waste |
| CE | Circular Economy |
| CEAP | Circular Economy Action Plan |
| CEC | Circular Economy Committee |
| CO2e | Carbon dioxide Equivalent |
| DE | Domestic Extraction |
| DMC | Domestic Material Consumption |
| DMI | Domestic Material Input |
| DPO | Domestic Processed Output |
| EC | European Commission |
| EPD | Environmental Product Declaration |
| EPR | Extended Producer Responsibility |
| EU | European Union |
| GDP | Gross Domestic Product |
| GPP | Green Public Procurement |
| GVA | Gross Value Added |
| ISO | International Organization for Standardization |
| LGU | Local Government Units |
| MFA | Material Flow Analysis |
| MoESD | Ministry of Economy and Sustainable Development |
| NGO | Non-governmental Organization |
| NWMP | National Waste Management Plan |
| PCF | Product Carbon Footprint |
| PM | Processed Materials |
| RAS | Reimbursable Advisory Service |
| RME | Raw Material Equivalent |
| VAT | Value-added Tax |
| WMC | Waste Management Center |

Disclaimer

This Report was prepared by a World Bank team. The findings, interpretations and conclusions expressed do not necessarily reflect the views of the Executive Directors of the World Bank or the respective Governments they represent. The report was produced to provide advisory support to the Ministry of Economy and Sustainable Development (MoESD) and does not necessarily represent the views of the Government of the Republic of Croatia.

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Executive Summary

This report provides a summary of a diagnostic analysis undertaken for circular economy approaches in solid waste management in Croatia. The analysis was conducted by the World Bank in 2021 as part of a Reimbursable Advisory Service (RAS) for the Government of Croatia on Circular Economy (CE) Approaches in Solid Waste Management. Key tasks included a review of the current policy landscape, a material flow analysis, the identification of focus sectors and the selection of a priority sector for further deliberations, a stakeholder engagement process, and the documentation of relevant international good practice examples.

Croatia has been lagging the other European Union member states in transitioning towards a Circular Economy. In 2019, Croatia's material consumption footprint, which captures the total amount of raw materials required to produce the goods used by the economy, totaled 54.1 million tonnes, corresponding to 12.9 tonnes per capita per year. Non-metallic minerals dominate the footprint's composition with 43 percent, followed by biomass with 34.5 percent, fossil fuels with 18.6 percent and finally metal ores with 3.4 percent. Housing contributes 40 percent to Croatia's material footprint, primarily using non-metallic minerals, followed by nutrition, which contributes 23 percent - mostly biomass. The remaining societal needs make up a smaller fraction of the total material footprint, with services amounting to 15 percent, manufactured goods to 10 percent, healthcare to 7 percent and mobility to 5 percent. The Croatian economy is only 2.7 percent circular compared to an EU average of 12.8 percent¹. The Croatian government acknowledges the country's needs to transition toward circularity and is trying to apply CE approaches in waste management policies and strategies. However, the current National Waste Management Plan 2017-2022 (NWMP) has not been implemented as planned, which poses the risk of Croatia not meeting EU targets, as well as losing funding under the current EU operational programme 2021-2027.

The current policy landscape for circular economy approaches in waste management needs to be better oriented towards the application of CE approaches. The strategic approach to waste management is set in Croatia's 2005 Waste Management Strategy, which also sets the framework for the current National Waste Management Plan (NWMP) 2017-2022. As regards the implementation of the NWMP, significant progress has been achieved regarding the construction of recycling yards and procurement of equipment, vehicles, and vessels for separate collection. Implementing infrastructural measures and activities important for the transition to a CE and the achievement of EU waste targets have been delayed. The new NWMP for the next 5-year period (2023-2028) is currently under development, and will need to be in line with current EU policies on CE in waste management. The current cycle of drafting strategic documents provides a good opportunity to include CE policies at the national strategic level.

The construction and demolition waste (CDW) sector was selected as the priority sector for developing a circular economy action plan. Following a quantitative and qualitative prioritization exercise, four sectors were proposed for priority action, including food, construction, plastics (including plastics packaging), and textile. From this list, the Ministry of Economy and Sustainable Development (MoESD) chose construction and demolition waste as the priority sector of the development of a Circular Economy Action Plan primarily due to its large material footprint (consumption and waste generation), carbon footprint, and economic value. This decision was influenced by two devastating earthquakes in 2020 and the large amounts of construction debris. In addition, CDW plays a dominant role in terms of resource use and waste generation and thus has the best potential to be the priority sector for the development of a Circular Economy Action Plan. The existing institutional and legislative framework also facilitates action and the achievement of visible and feasible results in the CDW sector within a reasonable period.

A national Circular Economy Committee has been established in October 2021 at the inter-ministerial and cross-institutional level, as a result of stakeholder mapping exercise. The mapping of all key stakeholders was undertaken at the start of the stakeholder engagement process. This supported the creation of a multi-stakeholder Circular Economy Committee (CEC), which is intended to monitor, evaluate, and guide possible circular economy measures and actions. It would also be instrumental in the circular transition through the inter-and intra-ministerial collaboration, including in the construction sector.

Stakeholder consultations undertaken in the context of this analysis revealed several barriers to more circularity in Croatia which can be grouped into four categories of incentives, institutions, information, and finance. Incentives for circularity remain low, particularly because recycling CDW can be more expensive than other waste management practices, such as landfilling, resulting in higher prices for secondary materials than for virgin materials. In terms of institutions, stakeholders are concerned about the complexity of the current legislation on CDW, which is difficult to follow for market players. As regards information, stakeholders expressed the need for more knowledge sharing and capacity building to gain a better understanding of the CE and to demystify the concept. Appropriate waste management practices and the different roles of stakeholders should also be more articulated. One of key questions raised was who will finance increasing recycling activities. Most funding requirements are expected to be covered by the EU, with the private sector as the main beneficiary. Investments are to be used for the production of recyclable products, including research and innovation, product design, and prototyping and testing.

A national case study has been prepared for Slovenia - a CE frontrunner in the region - which may serve as an inspiration for improving circularity in Croatia. Over only few years, Slovenia has managed to make the transition from a nearly all-landfilling to a predominantly recycling economy. Several success factors stand out, including a clear strategic framework, advanced waste management policies, fiscal incentives, mandatory Green Public Procurement, and the involvement of a broad range of stakeholders. The key lesson learned from Slovenia, however, is to position CE as a government strategic priority in the context of a “whole of government approach” - including the Prime Minister’s office and all line Ministries.

In addition to the national case study, the analysis also took a sectoral approach for identifying international good practices along different stages of the lifecycle in the CDW sector. In the *material production phase*, voluntary agreements (environmental product declarations, product carbon footprints and material passports) can be reinforced by obligatory measures (mandatory environmental performance assessments, eco-design requirements) and supported by economic instruments (tax on raw materials). *Circular design* criteria can be integrated in construction permits. The focus of circularity measures in the *construction phase* is mainly on recording information related to the efficient use or recycling of construction materials and buildings’ components in the form of Building Passports and Building Information Modeling. In addition, Green Public Procurement has significant potential to encourage the introduction of a circular economy in the construction sector. *Use phase practices* focus on extending the lifetime of existing structures through repair, maintenance, and alternative ways of using buildings. As regards the *end-of-life phase*, the focus is on ensuring sufficient quantities of recycled materials through material recovery targets while guaranteeing a quality of recycled materials at least equal to products made from virgin materials through end-of-waste criteria.

Chapter 1: Introduction

1. This report provides a summary of a Diagnostic Analysis for a Circular Economy in Croatia. The analysis was conducted by the World Bank in 2021 as part of a Reimbursable Advisory Service (RAS) for the Government of Croatia on Circular Economy Approaches in Solid Waste Management. This RAS is financed from the European Union's Cohesion Fund. It started in September 2020 and is scheduled to last until the end of November 2022.

2. Croatia is lagging behind other EU member states in transitioning towards a circular economy. At the core of the circular economy (CE) concept is the decoupling of economic growth from natural resource use. This can be achieved by designing-out waste and pollution, keeping products and materials in use, and regenerating natural systems. Croatia's economy is only 2.7 percent circular, compared to the global average of 8.6 percent, while the EU is 12.8 percent². This means that more than 97 percent of all materials consumed each year never make it back into the economy as raw materials. Even though the Croatian Government has acknowledged the need to move towards a CE, and national and local authorities have made efforts focusing on waste management and green public procurement, this only partially covers the actions needed to reach the circular economy goals defined by EU legislation.

3. The European Commission's Early Warning Report (2018) points out that Croatia has one of the EU's highest landfilling rates of municipal waste³, which puts the country at risk of missing EU targets. The warning highlights that, the separate collection of recyclables, including bio-waste, is not yet carried out effectively; economic incentives for citizens and municipalities are yet to be implemented; the extended producer responsibility schemes in Croatia do not fully cover the costs of separate collection; and that more investment is needed in projects higher up the waste hierarchy which go beyond the treatment of residual waste. The implementation of the current National Waste Management Plan (NWMP) 2017-2022 is lagging, which not only puts Croatia at risk of missing EU targets and facing infringement procedures, but also of losing funding under the current EU operational programme 2021-2027. Considerable efforts will be needed to achieve the EU target of limiting the share of municipal waste landfilled to 10 percent by 2035.

4. By improving waste management, Croatia can reduce health and environmental impacts, save space, reduce greenhouse gas emissions, and unlock energy and material efficiency gains. Benefits would be felt on many levels: regionally by developing economies of scale in the waste management sector, and locally through better environmental conditions, e.g., reduced littering and landscape deterioration due to landfilling, and less water and air pollution. Croatia can improve the management of its waste, accelerate recycling, limit the use of landfilling, and create incentives to change consumer behavior. The goal is to achieve the EU targets: at least 65 percent of municipal waste by weight should be recovered by recycling and preparing for re-use, while the amount of municipal waste landfilling should be reduced to 10 percent by weight by 2035, respectively.

5. The Government of Croatia has acknowledged the need to move towards a circular economy, minimizing waste generation, separating at source, directing waste streams to various ways of utilization, and treating waste as a resource. Therefore, the country is looking to speed up meeting EU Circular Economy targets and incorporating circular economy approaches into the current National Waste Management Plan (NWMP) 2017-2022 as well as into the future (post-2022) NWMP. In this context, the Ministry of Economy and Sustainable Development (MoESD) requested World Bank support, with the aim

of improving waste management practices in Croatia and supporting the country in transitioning towards a circular economy.

6. The main aim of this RAS is to support the MoESD in the preparation of the new post-2022 NWMP, integrating the Circular Economy aspects in waste management, in line with the European Green Deal and its Circular Economy Action Plan. Diagnostic work has been undertaken and recommendations are made on how to speed up the transition towards CE. The overarching methodology of this diagnostic analysis is based on a “general-to-specific” approach, starting with general analyses of the circularity of the Croatian economy and the circular economy policy landscape, followed by a prioritization of sectors for further policy development and the subsequent selection of one priority sector for the development of a circular economy action plan. Each activity undertaken in the context of the diagnostic analysis has a tailored methodology, which is described in the relevant chapters as well as in more detail in the accompanying appendices. The structure of the report follows the key tasks of the diagnostic analysis, which included a review of the current policy landscape of existing CE related policies and institutional arrangements (chapter 2), a material flow analysis (chapter 3), the identification of focus sectors and the selection of a priority sector for further deliberations (chapter 4), stakeholder engagement activities (chapter 5), and the identification of international good practice examples (chapter 6). Activities also include strengthening of coordination among various stakeholders, promotion of joint ownership of the new waste management agenda, and capacity building. The accompanying appendix presents the consultant reports with detailed data, results and recommendations on which each of key chapters of this report are based.

Chapter 2: Assessment of Croatia's Circular Economy policy landscape

7. The National Development Strategy 2030 encourages the development of CE as one of the priorities in the implementation of public policies that will contribute to the development of a globally competitive, green, and digital industry. The strategy states that production sectors that follow the postulates of a circular and decarbonized economy will be the basis for sustainable and competitive development. The defined priorities for the implementation of the policy in the field of sustainable environment are to increase the efficiency of municipal waste management and to prepare for the transition to a CE and the development of circular management of space and buildings. Financial support will be provided to the development of clean technology-based and CE-oriented industries, especially those that contribute to the implementation of the waste management priority (waste prevention, preparation for re-use, recycling, recovery, and re-use).

8. The Waste Management Strategy of the Republic of Croatia provides the framework within which Croatia will have to reduce the amount of waste it produces and manage the waste generated sustainably. The strategy adopted in 2005 (with objectives and measures defined until 2025) includes the assessment of the current situation, main waste-management objectives and measures, hazardous-waste management measures and guidelines for the recovery and disposal of waste. The Strategy also provides guidelines for the construction and demolition waste management system improvement. Moreover, the Waste Management Strategy introduces measures to reduce and prevent waste in production, managing waste without increasing risk to human health and the environment, (re)using valuable properties of waste as part of a CE, and setting economic instruments to promote more reuse and recycling of waste. The responsible ministry is the Ministry of Economy and Sustainable Development (MoESD) for the preparation of waste management legislation, national waste management strategy and waste management plan, as well as coordination and cooperation among all involved institutions in waste management in Croatia.

9. The National Waste Management Plan of the Republic of Croatia sets objectives and measures for establishing waste management aligned with some of the CE criteria. The National Waste Management Plan (NWMP) 2017-2022 includes plans for waste management at all levels, from the national to the local level. It has a strong emphasis on waste prevention, with a focus on municipal waste, biowaste with special emphasis on food waste, construction waste, wastepaper and cardboard, and the generation of electrical and electronic waste. The NWMP (2017-2022) reinforces the focus on prevention by adopting the waste prevention plan as an integral part of the plan. However, waste prevention concepts and measures need to be updated in the next National Waste Management Plan (2023-2028) under preparation, in line with the newest waste prevention measures from the new EU CE Plan of 2020 and the latest version of the EU Waste Framework Directive.

10. The key infrastructure component of the NWMP consists of recycling yards and recycling centers with sorting and composting capabilities where waste can be prepared for recycling. The capacities and facilities of these waste management centers (WMCs) will be designed to meet the goals of the plan, thus promoting innovative waste management practices for the achievement of reduced waste quantities. The Plan also focuses on reducing the total quantity of mixed municipal waste by applying measures such as establishing re-use centers, home composting, development of quality and categorizing criteria for compost and digestants, enhancing separate collection of waste, financial incentives for separate waste collection,

introducing a fee for landfilling, enhancing recycling, strengthening the market for waste intended for recycling, and planning energy recovery.

11. The implementation status of NWMP shows that the best implementation progress has been made on waste prevention measures. Significant progress has been achieved regarding the construction of recycling yards and procurement of equipment, vehicles, and vessels for separate collection. The group of measures aimed at improving the waste management information system and administrative procedures in waste management also showed satisfactory progress. Delays are found in the implementation of infrastructure measures and activities which are decisive for the transition to a CE and the achievement of EU waste targets, like development of re-use and repair networks and establishment of re-use centers, construction of sorting plants for dry recyclables, constructing of new recycling facilities and/or capacity increase of existing recycling plants for dry recyclables, facilities for bio-waste treatment, projects preparation and construction of WMCs, etc. Activities for ensuring additional recycling capacities, creating recycling market, introduction of waste policy that will enhance the shift from landfilling to re-use and recycling (e.g. introduction of landfill tax) have not started yet.

12. The new NWMP (2023-2028) needs to be in line with the current EU policies related to CE approaches in waste management. The new NWMP will bring more advanced waste prevention measures, and detailed policy measures on sustainable products by requiring more sustainable product design, and circularity in production processes. Industrial and innovation strategies will need to be included to stimulate more eco-innovations in research and development by the private sector and academics. To provide more economic incentives to the private sector, the market for secondary raw materials needs to expand both in terms of supply and demand for the well-functioning market. In order to do that, the introduction of requirements for recycled content in products, developing further end-of-waste criteria for certain waste streams, and use of the restrictions on substances of very high concern such as POPs and other toxic substances are essential.

13. Croatia also has a National Action Plan for Green Public Procurement, however its incorporation in public procurement is limited. The National Action Plan for Green Public Procurement (GPP) 2015-2017 is missing advanced circularity procurement measures such as measures supporting product durability, reparability, and recycled material content in products. Furthermore, GPP remains voluntary except for some state authorities, which are required to procure according to GPP criteria. It is not often being used by the public administration as there is a lack of awareness and knowledge of the procurement department. The number of products currently covered by GPP is also too small to make a circular impact. The same situation is observed in the national Eco-labelling system which does not cover durability, reparability, and recyclability criteria.

14. Further Consumer engagement in waste prevention and implementing waste hierarchy can drive circularity. It is commendable that there are certain measures and campaigns addressing consumers related to waste prevention, such as mandatory charging of plastic bags, the Waste Prevention Portal, as well as campaigns related to separate waste collection. However, such measures are not supported by dedicated instruments empowering consumers and public buyers to enhance their participation in the CE initiatives, e.g., local area/neighborhood initiatives, web-based tools and platforms support repair and reuse, etc.

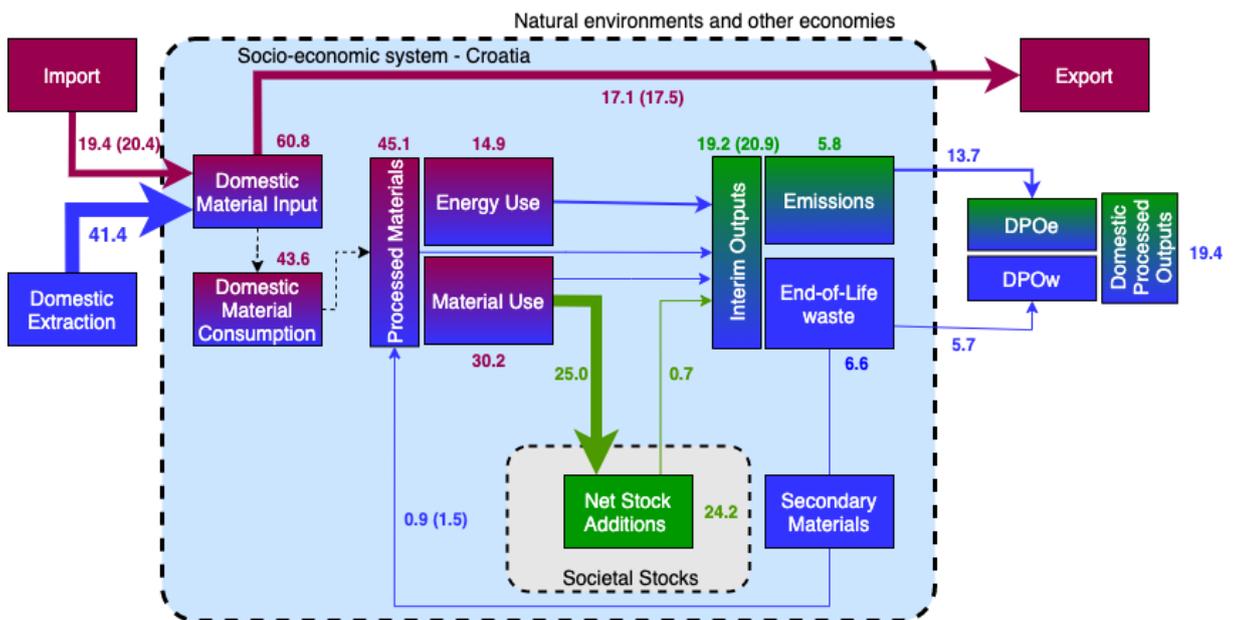
15. Given the current cycle of drafting strategic documents there is an opportunity to strengthen the policy landscape for circularity. As Croatia entered the EU in 2013, it adopted its main strategic documents, however, circular economy has become a main policy topic in the EU only later when the EU adopted the first CE Action Plan in 2015. Given the current EU policy programming cycle, the government can drive the

momentum towards increasing the understanding on CE among stakeholders and to develop measures that promote CE practices at different levels and sectors. By design, CE has a cross-cutting nature that is also linked to climate change, product policy, eco-innovation, green public procurement, etc. Hence policy coherence is necessary to ensure that the CE agenda is addressed through a “whole of government” approach. This would also support the implementation of circular economy measures that have lagged.

Chapter 3: Material flow analysis for circular economy in Croatia

16. Material flow analysis shows that Croatia is largely a linear economy (Figure 1). In 2019, domestic extraction (DE) in Croatia amounted to 41.4 million tonnes of natural resources, the equivalent of about 9.9 tonnes of resources per capita per year. Imports amounted to 19.4 million tonnes of direct physical products (excluding secondary materials). Croatia's Domestic Material Input (DMI), calculated as the sum of DE plus physical imports, thus amounted to 60.8 million tonnes. Subtracting 17.1 million tonnes of direct physical exported products (excluding secondary materials), Croatia's Domestic Material Consumption (DMC) amounted to 43.6 million tonnes. It is estimated that secondary materials consumed in Croatia amounted to about 1.5 million tonnes. The resulting total 45.1 million tonnes of direct physical processed materials (PM), splits into 14.9 million tonnes for energy use and 30.2 million tonnes for material use. Among these 30.2 million tonnes, the majority (25 million tonnes) is added to stock materials with a lifespan of more than a year). Meanwhile, 0.7 million tonnes come out of the stock by demolition. Finally, the total amount of Domestic Processed Output (DPO), representing all the outflows from the economy to the environment, stands at 19.4 million tonnes.

Figure 1 – Material flow analysis of Croatia's economy (direct flows in million tonnes)⁴



17. Croatia is a net importer of resources, requiring more resources than it can extract domestically. When accounting direct physical imports and exports in terms of raw material equivalent (RME)⁵, direct physical import increases by roughly 50 percent to 30.1 million tonnes and the direct physical exports increases slightly to 17.4 million tonnes. Bringing all this together⁶, Croatia's material consumption footprint, which captures the total amount of raw materials required to produce the goods used by the economy, totals 54.1 million tonnes, corresponding to 12.9 tonnes per capita per year. The consumption-based carbon footprint of Croatia amounts to 22 million tonnes of carbon dioxide equivalents (CO₂e) whereas the production-based carbon, i.e., the direct emission from Croatia industries, amounts 18.2 million tonnes of CO₂e. With a consumption footprint higher than the domestic extraction, Croatia is an

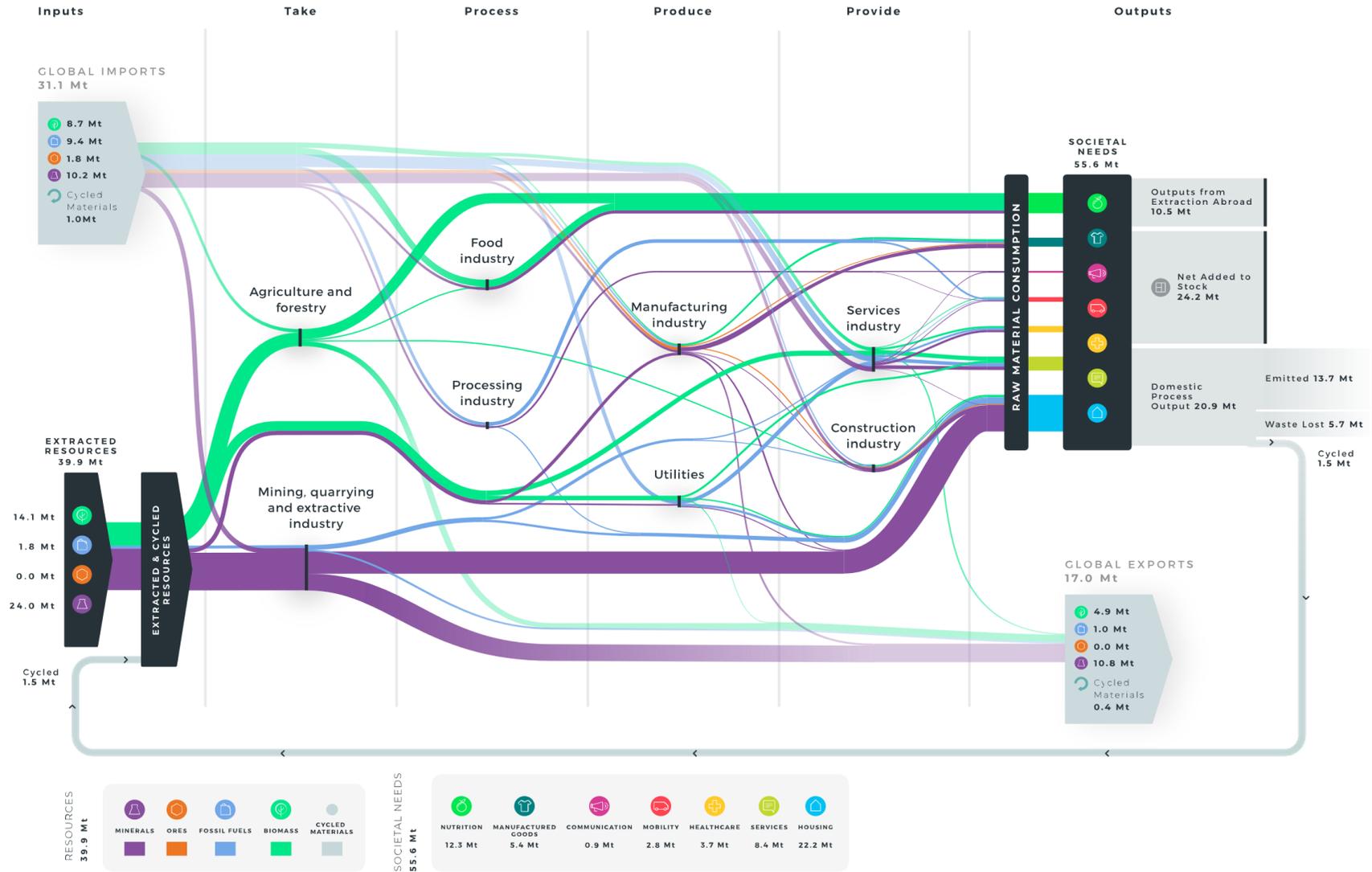
importer of impacts: more resources are needed than are extracted. This extraction – and its related impacts – are accruing abroad to satisfy Croatia’s final demand.

18. Non-metallic minerals dominate the footprint’s composition with 43 percent, followed by biomass with 34.5 percent, fossil fuels with 18.6 percent and finally metal ores with 3.4 percent. Regarding the region of origin, 45 percent (24.5 million tonnes) of the total consumption is satisfied by Croatian resources while the remaining 55 percent relies on foreign economies with the rest of Europe, the United States and China ranking on top. Interestingly, most of the metal ores are imported from the East European region, most of the fossil fuels from the United States (as well as Romania) while most of the non-metallic minerals come from China. Table 1 summarizes domestic extraction and raw material consumption (material footprint) by raw material category.

Table 1 Summary of absolute footprint results by raw material category

| Raw material category | Domestic Extraction (million tonnes) | Imports (RME) (million tonnes) | Exports (RME) (million tonnes) | Raw material consumption (million tonnes) |
|-----------------------|--------------------------------------|--------------------------------|--------------------------------|---|
| Biomass | 15.6 | 8.7 | 5.5 | 18.8 |
| Metal Ores | 0.0 | 1.9 | 0.0 | 1.9 |
| Non-metallic Minerals | 24.2 | 10.2 | 11.0 | 23.4 |
| Fossil Fuels | 1.6 | 9.4 | 0.9 | 10.1 |
| Total | 41.5 | 30.1 | 17.4 | 54.1 |

Figure 2 Sankey diagram visualizing the material footprint behind satisfying Croatia's societal needs and link with the four key resource groups



SOURCE - Circle Economy Analysis, Exiobase v3.8 + HR resource extraction data 2016-

19. In terms of societal needs, housing dominates the material footprint at 40 percent, primarily using non-metallic minerals as shown in the Sankey diagram (Figure 2). Nutrition is the second largest end use for domestic material flows in Croatia, making up 23 percent of the total material footprint, consisting mostly of biomass materials. Services rank third, with 15 percent of the total share and approximately half of the materials consisting of biomass and the remainder almost equally consisting of non-metallic minerals and fossil fuels. The remaining societal needs make up a smaller fraction of the total material footprint, with manufactured goods amounting to 10 percent, healthcare to 7 percent and mobility to 5 percent through the different sectors of the economy.

20. Overall, Croatia is 2.7 percent circular⁷—leaving a circularity gap of 97.3 percent and making it less circular compared to the global average. Ecological cycling—or the share of renewable primary biomass, from food crops and agricultural residues to wood—comes in at an estimated 23.2 percent of direct physical processed materials (PM), which is the sum of raw material consumption and secondary material consumption. Non-circular inputs—the gasoline, diesel and natural gas burned for energy, which are inherently non-circular—make up 10.7 percent, while non-renewable inputs—non-fossil and non-biomass materials, like metals or plastics that are not cycled, account for just 1.1 percent. The largest portion—43.6 percent—of Croatia's dashboard of indicators is claimed by additions to reserves and stocks, like new buildings and infrastructure. Net extraction abroad – the net share of resources that are consumed in Croatia but were originally extracted abroad, is 18.9 percent. The global Circularity Metric in 2020 was 8.6 percent, well above the Croatian circularity metric of 2.7 percent. In comparison, Norway's circularity rate stands at 2.4 percent, Austria's at 9.7 percent and The Netherlands at 24.5 percent.

Chapter 4: Focus Sector Identification

21. Based on the assessment of the current state of the circular economy in Croatia, a sector analysis was undertaken aimed at identifying sectors which should be prioritized for circular economy initiatives. While the circular economy will require a system wide transition across all economic sectors, the approach of focusing on priority sectors allows for strategic action based on potentials and impacts. The selection of sectors to be analyzed was based on the sectors included in the EU Circular Economy Action Plan of 2020 and includes electronics, batteries, vehicles, packaging, plastics, textiles, construction, and food. The ranking of these sectors was done using two different approaches: a quantitative analysis based on a set of nine selected indicators, and a qualitative analysis based on literature and expert interviews. The final choice of the priority sector to take forward in the context of this RAS for the development of a Circular Economy Action Plan was taken by the Ministry of Economy and Sustainable Development.

22. The quantitative analysis revealed packaging, food, plastics, and construction as the four sectors to be prioritized on the circularity agenda. The quantitative analysis is based on nine quantifiable indicators which can be grouped in three categories: (i) significance of the sector in the Croatian economy (four indicators), (ii) contribution to waste streams (one indicator), and (iii) circularity potential (four indicators). To prioritize circularity and environmental effects, indicators on waste streams and circularity potential were weighted twice as high as economic indicators. However, the quantitative assessment of the materials used in individual sectors in the Croatian economy proved to be a challenging task, as statistics are collected mainly in financial terms and not in tonnes of raw materials purchased. Nonetheless, Table 2 summarizes the results of the quantitative analysis.

23. The qualitative assessment revealed the highest potential for circularity in the food, plastics, textile, and construction sectors. Given challenges with data that affected the confidence in the quantifiable indicators, further prioritization based on non-quantifiable criteria was undertaken. This qualitative assessment was based on a literature review and expert interviews and looks at general framework conditions necessary to move toward the circular economy, including national priorities and existing barriers and enabling conditions. However, this was a subjective exercise with less granularity in assessing the differences across sectors than the quantitative analysis. Table 3 summarizes the circularity potential based on these qualitative factors.

24. Following the quantitative and qualitative prioritization exercise, four sectors were proposed for priority action, including food, construction, plastics (including plastics packaging⁸), and textile. These four priority sectors were analyzed in more detail below through the lens of material flow analysis (MFA), carbon footprint, and economic values – attributes considered most important by the government.

25. The food sector's footprint—amounting to 5.65 million tonnes—represents approximately one-tenth of the country's material consumption. It also acts as a significant source of waste, producing 0.11 million tonnes (most of which is landfilled) and emissions, releasing 1.65 million tonnes of CO₂e. The

sector was highlighted as a key lever for impact due to its ties with other core economic sectors—such as tourism—and its growing relevance in policymaking and social spheres. Strategies range from prioritizing the products of fresh, local goods and making use of surplus food, to improving separate organic waste collection and processing and valorizing such waste by scaling up biofuel production.

26. Construction takes the lead in material footprint and waste for the sectors explored, with consumption topping 11.5 million tonnes—equal to roughly one-fifth of the nation's economy. It accounts for one-third of Croatia's waste stream, producing 1.77 million tonnes, and about 13 percent of emissions, producing 3.64 million tonnes of CO₂e. The sector is also characterized by high energy and water use, making it an especially potent hotspot. Strategies are based on closing flows by reusing building materials, designing for disassembly, adaptability and reduced energy consumption, and maximizing the use and lifetime of current stocks.

27. While the plastic sector's material and carbon footprints are low—just 0.21 million tonnes, responsible for an equal weight of emissions—its ubiquitous impact on marine life and biodiversity has brought it into the public and political spotlight The sector, and the pollution it generates, also pose a significant threat to tourism, one of the main engines of Croatia's economy, resulting in a recently enacted ban on single-use plastics. Strategies for the sector are based on maximizing the recyclability and reusability of plastics through eco-design alternatives, implementing take-back schemes and developing improved recycling infrastructure.

28. The textile sector's material footprint is also relatively low, coming in at 1.6 million tonnes, and it emits about 0.80 million tonnes of CO₂—less than 3 percent of Croatia's total emissions. However, the textile sector has garnered attention across the globe in recent years for its resource-intensive, polluting nature—momentum that is reflected in policy action. Strategies in this sector revolve around bolstering eco-design, increasing separate collection rates, developing improved infrastructure for cycling and stimulating the uptake of repair services and second-hand offerings.

29. From the top four sectors identified by the quantitative and qualitative approaches, the Ministry of Economy and Sustainable Development chose construction and demolition waste (CDW) as the priority sector for the development of a Circular Economy Action Plan. The decision of the ministry was based on economic, environmental, institutional and practical considerations. Most significantly, this decision was influenced by the urgency for action in the wake of two earthquakes in 2020 and the related surge in CDW, which raised public interest in CDW management activities, and showed that CDW management infrastructure needs urgent development and new investments.

30. The construction and demolition waste sector plays a dominant role in terms of resource use and waste generation and thus has the best potential to be the priority sector for the development of a Circular Economy Action Plan. As shown in the MFA of the Croatian economy, the construction sector is not only the largest contributor to Croatian GVA among the top four sectors, it also has the highest resource consumption, makes the highest contribution to overall waste, and has the highest carbon

footprint. Although the recovery rate for CDW is quite high at 67 percent (2019), significant amounts still end up in landfills. Since construction and demolition waste streams are large in mass and volume, such landfills occupy significant space with negative effects on communities and the environment. Also, there is a need to improve recovery/recycling processes as current practices often lead to “downcycling” (aggregates for roads, backfilling), while the circular economy calls for high-quality recycling. Additionally, official data on CDW are underestimated which indicates that the recycling rate is probably lower and that certain quantities of waste end up improperly discarded in the environment.



Figure 1: CDW sector and its footprint in Croatia

31. In addition, the existing institutional and legislative framework facilitates action and the achievement of visible and feasible results in the CDW sector within a reasonable period of time. Institutional setup and capacities are key enabling and success factors for circular economy actions. Unlike in other sectors, the institutional framework for the CDW sector is set up in a way that roles and responsibilities are not scattered between many stakeholders, and relations between relevant line ministries are in place, which makes it easier to take action to integrate circularity. In particular, waste management competencies are all under the Ministry of Economy and Sustainable Development, while cooperation with the Ministry of Construction, Physical Planning and State Assets is required for issues regarding the circularity of building design. The latter already has experience and is active in developing and implementing sustainable buildings design projects.

Table 2: Ranking of sectors based on quantitative indicators with higher priority to indicators measuring environmental protection and circularity potential

| 1.1. GDP contribution | | | 1.2. Growth potential | | | 1.3. Employment | | | 1.4. Competitiveness | | | 2.1. % of total waste | | |
|--------------------------------------|--------------|---------|------------------------|--------------|--------|---------------------------------|--------------|--------|----------------------------------|--------------|--------|-----------------------|--------------|-------|
| 8 | Food | 10,7% | 8 | Food | 13,0% | 8 | Food | 14,4% | 8 | Electronics | 10,8% | 16 | Construction | 11,5% |
| 7 | Electronics | 8,6% | 7 | Textiles | 12,4% | 7 | Packaging | 12,8% | 7 | Textiles | 9,1% | 14 | Packaging | 5,0% |
| 6 | Packaging | 7,9% | 6 | Vehicles | 9,2% | 6 | Plastics | 9,6% | 6 | Food | 9,0% | 12 | Plastics | 1,3% |
| 5 | Plastics | 6,0% | 5 | Packaging | 6,6% | 5 | Electronics | 7,7% | 5 | Vehicles | 4,6% | 10 | Vehicles | 1,2% |
| 4 | Construction | 4,3% | 4 | Plastics | 5,7% | 4 | Construction | 6,5% | 4 | Plastics | 2,6% | 8 | Food | 1,0% |
| 3 | Vehicles | 3,0% | 3 | Electronics | 5,6% | 3 | Textiles | 3,0% | 3 | Packaging | 2,0% | 6 | Electronics | 0,9% |
| 2 | Textiles | 1,6% | 2 | Batteries | 4,4% | 2 | Vehicles | 2,9% | 2 | Construction | 0,7% | 4 | Batteries | 0,2% |
| 1 | Batteries | 0,6% | 1 | Construction | -4,6% | 1 | Batteries | 0,7% | 1 | Batteries | 0,1% | 2 | Textiles | 0,2% |
| 3.1. Recycling vs recyclable portion | | | 3.2. Avoidable volumes | | | 3.3. Circular Material Use Rate | | | 3.4. Generation of waste per DMC | | | TOTAL SCORE | | |
| 16 | Textiles | 40,86% | 16 | Packaging | 40 878 | 16 | Textiles | 0,13% | 16 | Packaging | 100,0% | Packaging | | 87 |
| 14 | Packaging | 73,00% | 14 | Plastics | 31 535 | 14 | Food | 0,80% | 14 | Batteries | 99,2% | Food | | 78 |
| 12 | Construction | 82,89% | 12 | Food | 26 648 | 12 | Construction | 1,82% | 12 | Electronics | 83,4% | Plastics | | 69 |
| 10 | Food | 85,46% | 10 | Vehicles | 10 352 | 10 | Vehicles | 12,45% | 10 | Vehicles | 33,0% | Construction | | 63 |
| 8 | Plastics | 106,37% | 8 | Electronics | 9 200 | 8 | Plastics | 12,58% | 8 | Plastics | 24,6% | Vehicles | | 62 |
| 6 | Vehicles | 114,60% | 6 | Construction | 8 936 | 6 | Packaging | 36,87% | 6 | Construction | 5,6% | Textiles | | 57 |
| 4 | Batteries | 122,35% | 4 | Batteries | 659 | 4 | Electronics | 38,18% | 4 | Food | 0,9% | Electronics | | 55 |
| 2 | Electronics | 122,40% | 2 | Textiles | 362 | 2 | Batteries | 41,66% | 2 | Textiles | 0,6% | Batteries | | 33 |

Note: Green colours represent higher potentials for circularity, while red colours represent lower potentials for circularity.

Table 3: Summary of the level of circularity in the sectors according to the non-quantifiable prioritization criteria

| | electronics and ICT | batteries | vehicles | packaging | plastics | textiles | construction and building | food |
|---|---------------------|-----------|----------|-----------|----------|----------|---------------------------|------|
| Priority materials | | | | | | | | |
| potential for raw materials saving | * | * | * | ** | *** | ** | ** | *** |
| scarcity and dependence | *** | *** | *** | ** | ** | * | ** | *** |
| environmental impact | *** | *** | *** | *** | *** | ** | ** | *** |
| Barriers and enabling conditions | | | | | | | | |
| legal framework | * | ** | ** | ** | *** | *** | ** | *** |
| pricing of WM costs | * | * | * | * | ** | *** | ** | *** |
| consumer and business acceptance | ** | ** | ** | ** | *** | ** | ** | *** |
| treatment and collection infrastructure | * | * | * | ** | *** | ** | *** | *** |
| economic incentives | * | * | * | ** | *** | *** | ** | *** |
| investment and innovation | * | * | * | ** | *** | *** | *** | *** |
| replacement with alternative materials | * | * | * | *** | *** | *** | ** | *** |

* Low potential for circularity

** Medium potential for circularity

*** High potential for circularity

Chapter 5: Stakeholder engagement activities and identification of capacity building needs

5.1 Stakeholder mapping

32. The stakeholders for circular economy in CDW include a range of actors from national, through local to businesses and of civil society who could contribute to policy development related to all stages of the material and building life cycle in the construction sector. The stakeholders relevant for CDW in Croatia were identified through a stakeholder mapping activity⁹ which involved analysis of spectrum of stakeholders – individuals, groups, and organizations – organized along key criteria describing their fields and area of intervention, the geographical area in which they operate and produced a comprehensive stakeholder map. Those include public institutions at the national level¹⁰, private business represented through trade associations¹¹, regional and municipal level actors¹², public and private companies¹³, Academia¹⁴ and NGOs¹⁵. Stakeholder mapping was undertaken through in-person and virtual consultations to gather their input on proposed policies, current situation in Croatia, as well as barriers and opportunities to circular economy development.

33. Stakeholder mapping also contributed to the creation of a national Circular Economy Committee (CEC), which is intended to guide the circularity agenda and serve as a platform for coordination, innovation, knowledge management, and communication. The CEC was established in October 2021 at the inter-ministerial and cross-institutional level. The CEC is intended to guide, evaluate and consult on possible circular economy measures and actions. While the remit of the committee is broader than CDW, it could provide support and guidance related to the circular transition, coordinate and incentivize the inter- and intra-ministerial collaboration, and accordingly promote CE approaches in the construction and demolition waste sector.

5.2 Stakeholder engagement

34. Stakeholder engagement revealed the collection of opinions on both downstream and upstream of CDW policies. Prior to the consultation meetings, guiding questions were provided for discussing the following topics: i) Construction sector in the context of the EU Circular Economy Action plan, ii) Circular Economy approaches regarding CDW, and iii) The role of the Green Public Procurement (GPP), which were also covered through focused presentations. According to group of stakeholders consulted during consultation meetings, selective deconstruction and pre-demolition auditing and landfill tax were highlighted as possibly ensuring a high level of reuse, recycling and other recovery of CDW, while resource efficiency criteria in GPP and tax on raw material were proposed for ensuring better resource efficiency in the production of construction products and during the design, construction and operation of buildings.

35. Low economic viability of recycled material and its availability, costs of recycling, and financing sources were among key barriers and challenges, alongside policy options to stimulate the private market and the role of local institutions. Economic viability of CDW in Croatia was found to be low as recycling of CDW can be more expensive than other waste management practices, e.g., landfills. Although

most stakeholders agreed that the separation rate among citizens/consumers would increase if 'landfill tax' is to be introduced, local governments are cautious on the introduction of landfill tax considering that it could increase illegal dumping of waste. CDW in Croatia is critical as waste is difficult to procure (although there is a digital waste exchange marketplace developed by the Croatian Chamber of Commerce¹⁶) and measures to boost waste market are needed. One of key questions raised was regarding the source for financing recycling. As per majority of the private sector respondents, most of the investment needs are expected to be funded by EU sources, and financing is planned to be funneled into the private sector to be used to accelerate the transition to CE. According to the same group of respondents, investments are to be used for production of recyclable products, including - developing scientific and technical activities, conducting research and innovation, designing innovative products, and construction of prototypes and testing.

36. Investors and construction companies need to make broader use of recycled material using different instruments which can broadly be categorized under incentives, institutions, financing, and information. Stakeholders highlighted several important factors, including: (i) Requirements for recycling to be included in tender requirements, including GPP tenders; (ii) Recycling to be co-financed from public-private sources; (iii) The evaluation of the economic viability of deconstruction and selective demolition over full demolition to be mandatory ; (iv) the introduction of voluntary agreements and establishing rules in collaboration with the companies; (v) the need for mapping, identification and availability of CDW for recycling in the country, such as mapping of the recycling facilities, mapping of the activities that can use recyclables from CDW (e.g., production sector) and identification of the players on the market or mapping of abandoned buildings; (vi) Increasing the amount of available CDW waste for recycling – includes earthquakes disaster waste; and, (vii) Local capacity to be strengthened also in terms of controlling/inspectorate.

37. The role of Local Government Units (LGU) is important in steering of the process towards higher circularity of CDW. It was highlighted that LGUs should have a role in controlling and raising the costs of landfilling to make recycling competitive. Also, LGU should seek opportunities for, and strengthen their collaboration with local companies for managing CDW.

5.3 Stakeholder Survey on CE

38. CDW was also evaluated as amongst the worst managed waste streams in Croatia as part of a broader stakeholder survey on the introduction of circular economy in Croatia. The survey, as part of the stakeholder engagement process, included representatives of national, regional, and local public sector, private companies, academia, NGO's and consumer's representatives. The survey indicated respondent's opinion on introducing circular economy in Croatia, on the role of different stakeholders and their opinion on, barriers and initiatives needed to increase the level of circularity in Croatian economy. Respondents expressed their training and capacity buildings needs related to circular economy. It was also felt that the management of CDW streams related to the construction sector had the greatest potential for development and application of circular economy approaches. Capacity building needs and expectation of stakeholders in construction sector are also identified based on the survey results.

39. Stakeholders felt that coordination, understanding, and complementing activities between the public and private sectors are key to achieving circularity rather than single stakeholder actions. Stakeholder survey emphasized the importance of different stakeholder's role in circular economy transition. Among the top three relevant key-rated institutions were (i) private sector (industry and trade), (ii) waste management companies and (iii) local governments. Waste management companies (utility companies, recyclers, WMCs) and state institutions were considered the most important stakeholders in Croatia, with the Ministry of Economy and Sustainable Development as the institution in charge of the process of establishing a CE in cooperation with local (regional) governments.

40. The private sector is acquainted with the concept of circular economy and willing to engage in circular economy practices but it faces several barriers. While private sector representatives expressed willingness to making investments in technology to increase the circularity of their products and production processes, they identified barriers to circular economy transition including: (i) Lack of education and information and need for capacity building and training, (ii) Lack of sufficient clarity of the status of industries involved in circular economy that could create an industrial symbiosis, (iii) Insufficient quantity and quality of incentives, (iv) insufficient or unclear instruction for the industry, (v) Implementation and enforcement failures: limited, disparate or no enforcement in practice, leading to the regulations being diluted or altered

5.4 Priorities for capacity building

41. One of the top priorities identified by stakeholders was the need for additional knowledge / trainings on CE approaches in the Croatian context. It was also felt that since approaches to the circular economy differ across countries, institutional capacity development needs to take Croatia-specific requirements into account. For example, key policy options identified during stakeholder consultations include landfill tax, and raw material tax, pre-demolition audit, and GPP, all of which need capacity building and training to implement them in the Croatian context.

42. While the regulatory framework for pre-demolition audits exists, the challenge is with choosing the most appropriate way to implement them. This can be achieved by introducing certain types of pre-demolition investigation depending on the complexity of the sites (respectively the level of qualification of the investigator) to acquire the information referred in *Article 8 of the Ordinance on construction waste and waste containing asbestos*. Other areas of assistance in decision making could be the selection of the most appropriate approach for stricter implementation of the building demolition project (required by *Article 76 of the Construction Act*) through introducing a demolition recovery concept and confirmation of dismantling. As the competent authorities and demolition control procedures have already been regulated, specific training measures may be recommended related to the requirements and documentation of pre-demolition investigation, requirements for selective deconstruction, obligations for separation (per material, per subsequent treatment), control and enforcement practices, documenting and reporting of the demolition.

43. The implementation of landfill tax has been a pending issue for some time and needs awareness, training, and capacity building for implementation support. Possible approaches include explaining the

advantages of different types of landfill tax structure (based on waste types, waste properties, types of landfill technologies), possible tax exemptions, the factors for determination of the optimal rate of the tax, as well as the choice of measures to overcome the negative consequences of landfill tax (waste "export", illegal dumping). More specific recommendations for training of potential competent authorities on the implementation of landfill tax were identified, such as exchange of experience in organizing taxable quantity reporting, including measures so that reporting reflects the structure of the tax, cooperation and exchange of information between waste management authorities and tax administration, control and verification of the accuracy of the declared data, implementation of criteria and procedures for funding waste management projects including tendering, evaluation and approval of projects for activities, which will be financed by the landfill tax revenues, sharing experience in involving private financial institutions in evaluating projects and monitoring to ensure that approved measures are implemented.

44. The concept of the green public procurement has already been introduced into Croatian law but practical use of GPP needs to be scaled-up. Capacity building efforts may be focused on more specific training measures for using GPP procurement to reduce environmental impacts from construction works, implementing needs assessment to ensure that a "true" demands exist, acquiring deeper knowledge about construction works procuring process and existing GPP criteria suitable for the construction sector, the possibilities for preliminary check for market availability of products that meet the GPP criteria, verification for compliance with GPP criteria during the contract execution phase, and etc.

45. There is interest in exploring the idea of a raw material tax on the lines of similar experience in the mining and minerals sector. Raw material tax is not introduced in Croatia, but there are experiences in applying similar instrument - concessions on renewable and non-renewable minerals. Support may include, e.g., selection of taxable raw materials (including those not covered by existing concession legislation), determination of entities liable for paying the tax (other than the extractive industry), possible exceptions, exchange of experience on the factors on which the optimal amount of the tax depends, way of identification by the tax administration of the taxable component, way of calculation of the taxable amount and its declaration, procedures for verification, revenue collection options, revenue use, etc.

46. Capacity-building and training plan summarizes recommended capacity building measures, identifies implementors and recipients as well as identifies training topics. Based on the results from the previous tasks and stakeholder consultations a capacity building program on circular economy was developed for supporting decision making process, institutional set-up as well as awareness raising and training of multiple stakeholders including national, regional, and local levels of government authorities, private sector and other relevant stakeholders. Suggested training topics and educational needs per different type of stakeholders and include: (i) Knowledge of the concept of circular economy: myths and misconceptions related to technologies in waste management; (ii) Actors in waste management and their role in proper and adequate waste management in Croatia; (iii) Stakeholder network and coordination mechanisms; (iv) Raising public awareness about CE practices in waste management; (v) Identification of problems and ways of making decisions about CE; (vi) Knowledge of legal aspects and legal obligations related to CE procedures in waste management; and (vii) Consequences of a linear economy on health and the environment.

Chapter 6: International Good Practices and Lessons for Croatia

47. This chapter presents international good practices in accelerating the transition to a circular economy. The first section takes a national perspective focusing on Slovenia, considered as a regional front-runner on the circularity agenda. Section two takes a sectoral approach, presenting different examples of good practice in Europe and beyond with a focus on the construction and demolition waste (CDW) sector. Both approaches allow to draw lessons which may be useful for Croatia to support the circular transition across the whole economy and specifically in the CDW sector.

6.1 Slovenia as a regional front-runner

48. Slovenia has been in the EU 10 years longer than Croatia and has developed an advanced circular economy policy framework that is helping it achieve good results. Circular Economy is one of Slovenia's strategic development priorities. The Slovenian government has produced several key strategic documents related to CE of cross-cutting nature and has been implementing the concrete initiatives and projects that are having an impact and are achieving most of the CE targets set by EU well before the targeted years, such as recycling rate of bio-waste, paper and glass.

49. The 2018 “Roadmap towards Circular Economy in Slovenia”¹⁷ sets the pathway for Slovenia to become one of the region’s leaders in the CE. The process of preparing the document was under the patronage of the Partnership for the Green Economy of Slovenia. The consortium of document authors was led by the Circular Change NGO platform. The roadmap represents a process of identification and collection of a wide array of circular practices and initiatives, allowing to map out activities that should be directed by the Government and carried out by the stakeholders. It describes in each of four priority areas why it is an area of priority, and illustrates good practices in the country, main challenges, and promising prospects to achieve the CE. Croatia lacks such a strategic document that guides the government and stakeholders in what practices are necessary for the transition to the CE.

50. While CE in Croatia is mainly understood as a task of the Ministry of Economy and Sustainable Development, in Slovenia it is understood as a “whole of government” task including the Prime Minister’s office and all line Ministries. This is a substantial difference in governance and the government commitment toward CE. Hence in Slovenia initiatives have been taken which are backed up by all Ministries, such as mandatory Green Public Procurement. Furthermore, in Slovenia, CE is already reflected in several government strategic documents, such as the Industrial Development Strategy, while in Croatia many strategic documents currently in force do not reflect the principles of CE yet as noted in the earlier chapter.

51. Slovenian government has taken initiative in creating a multi-stakeholder's platform to lead and support the CE agenda as development priorities. The first initiative was to set up an interdepartmental group was set up and is led by the Prime Minister office, and it includes members from the Ministry of the Environment and Spatial Planning, the Ministry of Finance, the Ministry of Education, Science and Sport, the Ministry of Public Administration, the Ministry of Infrastructure, the Ministry of Agriculture, Forestry and Food, the Ministry of Labour, Family, Social Affairs and Equal Opportunities and Government Office for Development and European Cohesion Policy. Hence, there is very broad inclusion of Ministries and

public institutions. The inter-departmental group was later expanded to the Partnership for the Green Economy of Slovenia in 2015 which leads and supports the process of transition to a CE within the country and promotes CE internationally. In this partnership, the tasks of the Government are to connect policies, improve the legislative framework, to provide guidelines and support to the implementation of policies toward green and circular economy, and provide financial resources. The tasks of the other partners are the transfer of experience and knowledge, providing examples of good practice and successful implementation of CE principles. The CE Roadmap is seen as a "living system", which is upgraded, updated, and adapted over time.

52. The involvement of multiple stakeholders with the goal of facilitating the transition from a linear to a circular economy has been ongoing since 2016. It started with the Partnership for Slovenia's Green Economy project, taking place under the patronage of the Prime Minister uniting over 3,000 partners. Regional consultations and meetings with stakeholders have helped to collect the core information for the creation of the CE Roadmap. During the first stage, twelve regional consultations were conducted. Consultations took a bottom-up approach to identify and evaluate the potentials of each of the regions, both within the framework of natural resources and economic activities, knowledge and good practices, in order to identify four priority areas of Slovenia's circular transition. As a result of the consultations, the selected four priority areas are food systems; forest-based value chains; manufacturing; and mobility.

53. Slovenia is one of the few EU Member States that have mandatory Green Public Procurement (GPP). For example, in the city of Ljubljana, the city's green purchases represent more than 70 percent of all the city's investment. A wide range of products are covered by Slovenian GPP legislation: electricity, food, beverages, agricultural products for food and catering, office paper and hygienic paper products, electronic office equipment, audio, video equipment, refrigerators, freezers and their combinations, washing machines, dishwashers, air conditioners, buildings, furniture, cleaners, cleaning services and laundry services, passenger and transport vehicles and bus and coach services and tires. While in Croatia, GPP remains a voluntary requirement and it is often not implemented by public administration.

54. Good results in waste management have been achieved due to changes in waste management policies that enabled Slovenia to move from a nearly all-landfilling to a dominantly recycling society. Slovenia has established an efficient municipal waste separate collection system, with 71 percent separately collected in 2018. Separate collection systems operate across Slovenia. They entail: (i) a door-to-door collection system to collect bio-waste (covering more than 90 percent of the country) and residual waste; and (ii) a drop-off system for dry recyclables. Croatia has an insufficient system of waste separation, with only 37 percent of municipal waste being separately collected in 2019. It should enhance "door to door" and "drop-off" systems for separate collection. As stated in the EC's early warning report for Croatia in 2018, the goal should be: "development of a more prescriptive collection service standard for implementation by local governments to ensure a high level of recycling, emphasizing door-to-door separate collection, and ensuring a more rapid spread of door-to-door service throughout Croatia."¹⁸ As a result of an effective waste separation and collection system in Slovenia, bio-waste management is quite advanced with more than 84 percent of bio-waste being recycled in 2019; while in Croatia in 2019, the share of bio-waste sent for recovery was 14 percent. Thus, more advanced measures and a more efficient

system of separate collection and recycling of bio-waste is needed in Croatia. This is addressed in the Croatian Waste Prevention Plan 2019-2022, which is accompanied by a detailed Program for its implementation.

55. Slovenia now landfills only 5 percent of its municipal waste; the backbone of Slovenia's success is its use of fiscal instruments; Slovenia is a forerunner in improving separate collection and increasing recycling rates in a relatively short time, by putting in place economic instruments such as a landfill tax, reduced VAT (9.5 percent)¹⁹ on minor repairs of bicycles, clothes and household linen, shoes and leather goods as well as awareness-raising campaigns and advanced separate collection system. The landfill tax in Slovenia introduced in 2001 as part of the Decree on environmental tax for environmental pollution helped reducing landfilling and increasing recycling and re-use. All operators of landfills for hazardous, non-hazardous and inert waste are obliged to pay tax for the disposal of waste. the country has one of the highest environmental tax revenues as a share of GDP across the EU. Slovenia also introduced a network of reuse and waste prevention centers and an expanding set of recycling/composting plants in order to divert waste from landfills. Croatia still landfills most of its municipal waste (59 percent in 2019). Thus, more advanced waste diversion measures are needed as well as more measures to promote recycling and recovery, including the introduction of a landfill tax.

56. Slovenian cities and municipalities, as well as the non-governmental sector, are increasingly important drivers for the transition to the CE. They increasingly promote a more sustainable lifestyle, as well as circular and eco-innovative development. Ljubljana, with separate collection and recycling rates of municipal waste at 69.5 percent is the European capital with the largest share of separately collected waste²⁰. The City of Ljubljana introduced measures that encourage citizens to sort waste such as door-to-door collection and a pay-as-you-throw system. Separate collections measures also include higher frequency for separated streams as compared to mixed waste. The door-to-door collection, especially of biowaste, has led to a rapid increase in recycling rates.

57. Ljubljana's Regional Waste Management Center²¹ is the most modern facility for waste treatment in Europe, processing waste from more than a third of Slovenia. The main part of the regional center consists of three facilities for mechanical-biological waste treatment, where two types of waste are processed: separately collected biowaste and residual mixed municipal waste. Bulky waste is also accepted and assorted. Coupled with the setting up of efficient separate municipal waste collection, the regional center performs waste recycling and recovery by extracting raw materials in a way that the greatest possible amount of usable material is extracted and reduces the quantity of disposed waste.

58. The key lesson-learnt from Slovenia's efforts and initiatives is, above all, to position CE as a government strategic priority and not only one ministry's mandate. Coherence and complementarity exist in the multiple strategic documents of the national and local level and effectively allocated the government budget to the CE-driven initiatives and the programs. In addition, the effective use of environmental fiscal instruments, such as a landfill tax, has been a key driver in shifting consumer and business behavior.

6.2 Good practices in the construction and demolition waste sector

59. Several EU Member States lead the way in the implementation of circular economy actions in the CDW sector. These good practices can be categorized according to the different stages of the life cycle they address: i) material production phase; ii) design phase; iii) construction phase; iv) use phase; and v) end-of-life phase.

Material production phase

60. Practices targeting the material production phase aim to ensure that construction products are designed and manufactured so that they remain in circulation for as long as possible and when they reach the end of their useful lives, can be easily reclaimed to produce new products. Currently, circularity considerations during design and manufacturing of construction products are not legally binding on EU level. In the majority of EU countries, however, many factors support the production and marketing of sustainable construction products, such as advances in production techniques, better know-how and the tendency among consumers to buy green products and buildings. There are also economic advantages such as reduced waste management costs associated with green products as well as potentially higher sale prices.

61. Voluntary agreements are usually the first initiative that Governments and the construction business take. The manufacturers make a voluntary commitment to produce green materials and products. The Environmental product declaration (EPD) or product carbon footprints (PCF) are the applied voluntary mechanisms to verify and prove such claims. Similarly, material passports contain information about the reusability and recyclability of the product. Good practices of voluntary agreements can also help builders meet other requirements for circular buildings such as renewability and non-hazardousness. Some of these practices are applied to a limited extent in Croatia.

62. The voluntary initiatives can be further reinforced by obligatory measures and supported by economic instruments. Some member states make assessment or verification mandatory in places, e.g., mandatory assessment of environmental performance of buildings for an environmental permit in the Netherlands. There is also a strong intention for the adoption of mandatory policies on EU level. Under the REACH Regulation, provision of information on the content of hazardous substances in construction products is mandatory for manufacturers. Other EU legal documents with the potential for making the environmental performance of construction products more obligatory are the Eco-design Regulations that will contain limit values (e.g. minimum recycled content) or prescriptions on how to achieve reusability, recyclability or other properties. Apart from the legal obligations, the tax on raw materials that has been applied in Denmark since 1990 is an example of an economic instrument aimed at making recycled materials more competitive with virgin materials. This is a tax that will artificially increase the price of the virgin materials so that they become more expensive than recycled materials. However, sufficient data is required to establish a reliable and consistent tax base, something which is currently unavailable in Croatia.

Design Phase

63. Measures targeting the design of buildings aim at reducing material requirements of construction, while making buildings adaptable, modular, and detachable. Examples of circular design required by legislation or otherwise encouraged by the public authorities are rare. Building codes, whether European or national, currently do not include obligatory requirements for circular design. Currently, in most countries including Croatia, mandatory instruments for circular design of construction works are not applied - with exception of circular design as part of the certification, which is however limited mainly to large trade or office buildings. However, there are several voluntary certification systems that measure and certify the concept of sustainable development and a voluntary ISO standard for design for disassembly and adaptability, which is a precondition for making the circular design obligatory in the future.

64. Circular design criteria can be integrated in construction permits. An example of an indirect link between circular design and regulatory requirements is the building permit in the Netherlands. It is required in the application for construction permits that a full environmental performance assessment of the building is performed – for all construction materials used in the building and for the building in general. In the legislation, a threshold for environmental performance is set – and if the total score of the environmental performance is below this limit the building receives a construction permit.

Construction phase

65. Circularity measures addressing the construction phase of buildings are focused on recording information related to the efficient reuse or recycling of construction materials and buildings' components. Such information includes, amongst others, the materials and components used in the building during construction, their location, way of installation and deconstruction, their recyclability and reusability, so that instead of extracting virgin raw materials the end-of-life buildings could be used as a storage for materials for construction of new buildings. Examples include *Building Passports* and *Building Information Modeling* to facilitates the exchange of information, design for sustainability and certification management.

66. Building Passports and Building Information Modeling are already used in Croatia as part of the certification process, but more widespread use should be facilitated. The Environmentally Friendly Labeling Program of Croatia is implemented including a procedure for label awarding and independent verification by a third party in line with the procedure of the EU's environmental label - the EU Ecolabel. But there are no national Eco-label criteria related to construction. Currently, GPP in Croatia is a voluntary mechanism, except for the central state bodies for which it is mandatory. Croatian national green public procurement criteria do not include criteria related to the construction sector.

67. There are a range of economic instruments and mandatory measures that can strengthen circular approaches during the construction phase. Green Public Procurement (GPP) has significant potential to encourage the introduction of a circular economy in the construction sector. There is a strong trend to

introduce circularity criteria in the development of criteria for GPP and eco-label at European level. The practice in Malta of lower tax for restoration of old buildings compared to demolition is an example of another economic instrument. Furthermore, the Directive 2012/27/EU on energy efficiency and the Energy Performance of Buildings Directive introduce obligations and objectives for building renovation.

Use phase

68. Use phase practices focus on extending the lifetime of existing structures through repair, maintenance, and alternative ways of using buildings. The circularity potential during the usage of the buildings could be enhanced through repair works with the purpose of extending the active life of buildings, as well as updating building passports and building information modeling software. The Performance-based contract is an innovative mechanism for ensuring that the maintenance of buildings during their use is optimal by extending the obligations of the GPP contracts to the operational phase buildings.

69. The Extended Producer Responsibility concept is suitable for construction products with shorter lifetimes, such as carpets, but these may not be appropriate for products that remain in situ over a building's lifetime. The EPR and the take-back schemes for construction products are not widely applied worldwide but in accordance with Croatian legislation²², producers of construction products are obliged to provide to the buyers and/or users of their product the possibility of returning such used products, free of charge. Performance-based contracts are a new concept, but it is readily applicable as the Energy Performance Contracts are regularly used in Croatia.

End-of-life phase

70. Policy options for the end-of-life phase aim to ensure quality and quantity of recycled waste that are returned into the economy. To make recycled materials usable, they are required to be at least of equal quality to the products made from virgin materials. Green materials made from recycled waste are often given credits in voluntary environmental rating systems, but some countries have obligatory national end-of-waste criteria that set out conditions that have to be met to be no longer classified as a waste, thus becoming a product. To have a sufficient quantity of recycled materials, there are many practices to introduce material recovery targets beyond EU requirements and mandatory selective deconstruction, pre-demolition auditing, deconstruction reporting, and construction permits with binding recycling targets. Economic and voluntary instruments can be used to boost market supply and demand of recycled materials, including through a landfill tax, minimum content of recycled materials in GPP.

71. Additionally, there are international experiences Croatia could consider in dealing with waste management problems caused by earthquakes. The available practices and policies include both downstream measures (recycling) and upstream measures on the management of CDW deriving from the collapsing of buildings and infrastructure following earthquakes. A disaster waste management plan, pre-disaster waste estimation, pre-arranged contracts and rates with contract, temporary staging sites for storing, sorting, and processing could facilitate disaster waste management process and increase

effectiveness of recycling CDW. Other legal and financial framework exist to support disaster waste management processes, including emergency legal waiver on solid waste regulation, having a special law in place to allow the movement of mixed earthquake waste, as well as a reconstruction fund. The focus is not only on recycling but also on waste prevention and land reclamation after disasters.

72. In the short-term, mandatory separation for selected materials is recommended in Croatia. It is recommended that mandatory separation is applied to hazardous waste soil, stones, and asphalt for which readily available realization in road construction is available. Plaster and mortar should be separated from the mineral waste mix consisting of concrete, bricks, and tiles by applying simple technologies of crushing and sieving of demolition waste to be used in low-grade recycling options mainly in road construction. The main recommended instruments to achieve these initial objectives are obligatory separation of mixed mineral fraction, enforcement of hazardous waste related requirements, landfill restrictions (tax, which is currently under consideration, and bans), stricter requirements for backfilling, adoption of national end-of-waste criteria, voluntary agreements for minimum recycled content, and enforcement of the take-back obligations.

73. In the mid-term, selective deconstruction and source separation should be made obligatory for most of the construction and demolition waste. Most of the construction and demolition waste fractions should be source separated, especially, for concrete, bricks and tiles that will be utilized for reuse or as high-grade recycled materials used in new construction products. Thus, measures for increasing the supply of high-quality construction and demolition waste materials should be introduced, including mandatory site waste management plans, a tax on raw materials and reduced criteria for the use of waste in specific construction applications (definition of quality classes, following the example of Austria). To increase demand for recycled waste, a national database of environmental product declaration (EPD) has to be created proving environmental claims (following the example of Belgium) and GPP criteria shall become mandatory requiring building passports, BIM, eco-labels and minimum recycled content.

74. Given all possible measures to be implemented during the short and midterm, only additional measures to create a market for recycled products shall remain for the long-term. The main long-term measures would be in the form of requiring Environmental Performance Assessment in "CE" marking and "C" marking (e.g. through Environmental Product Declarations), mandatory assessment of Environmental Performance in construction permitting, design for disassembly and adaptability to be required by the building code and implementation of Performance based contracts in GPP.

Chapter 7: Conclusions

75. The results of this diagnostic analysis are intended to help the Croatian Government to better understand the circular economy challenges and opportunities in its approach to solid waste management. The analysis confirmed that Croatia’s economy is only marginally circular – also when compared to its EU peers, and that more effective measures are necessary to support waste prevention, consumer behavioral change, and green/circular public procurement. In addition, the analysis provides the way forward by identifying priority sectors for government action, including food, construction, plastics (including packaging), and textiles.

76. The government will need to strengthen collective, systematic, and comprehensive action to support the circular transition. A key conclusion and recommendation of the analysis is that the government needs to take a collective (all-of-government and multi-stakeholder), systematic (economy-wide), and comprehensive (multiple-stakeholder) approach aimed at mainstreaming circular economy into domestic policies. International good practice shows that several success factors stand out, including a clear strategic framework, advanced waste management policies, mandatory Green Public Procurement, and the involvement of a broad range of stakeholders. Fiscal instruments play a particularly important role in incentivizing circular practices, including landfill taxes and reduced VAT on circular actions like reuse and repair. However, such measures need to be designed in a way that avoids illegal practices (such as littering and illegal dumping), which is likely in the absence of adequate monitoring and enforcement. The key lesson learned from Slovenia, however, is to position CE as a government strategic priority in the context of a “whole of government approach” - including the Prime Minister’s office and all line Ministries.

77. With the construction and demolition waste sector identified by the government as the priority sector, the next step is to develop a Circular Economy Action Plan (CEAP) for the sector. Based on the result of this analysis, a comprehensive CEAP will be developed for the construction and demolition waste sector, including specific short and mid-term measures for its implementation, as well as benchmarks for its enforcement. In addition, follow up activities identified will include engagement with relevant stakeholders to strengthen coordination and generate joint ownership, as well as capacity building on circular economy approaches in municipal solid waste management. The multi-stakeholder Circular Economy Committee (CEC) will play a key role in implementing these activities.

Endnotes

- ¹ The figures for Croatia and EU are not directly comparable because of the use of different methodologies.
- ² The EU figure for EU is from Eurostat as compared to the figure for Croatia and World which are calculated by Circle Economy. Hence, they are not strictly comparable.
- ³ 77 percent landfilling in Croatia in 2016 compared to 24 percent in the EU in 2018
- ⁴ For the material flow accounting of Croatia's economy, different data sources and baseline years are used as no single baseline year can be identified. Thus, the decision was made to use the most recent year available for each dataset/database. The baseline year of each data set is as follows: i) macroeconomic monetary data for the Input-Output Table (year 2016), ii) domestic extraction data for all regions (year 2019); iii) waste generation and treatment data (year 2018); iv) air emission data by NACE sectors (year 2018).
- ⁵ Raw material equivalents (RME) is a virtual unit that measures how much material was extracted from the environment, domestic or abroad, to produce the product for final use. Especially for finished and semi-finished products, imports and exports in RME are much higher than their corresponding physical weight. For example, traded goods are converted into their RME to obtain a more comprehensive picture on the 'material footprints'; the amounts of raw materials required to provide the respective traded goods.
- ⁶ Material footprint is calculated as domestic extraction (DE) plus raw material equivalent of imports minus raw material equivalents of exports.
- ⁷ This circularity gap is measured by circularity metric, which is an economic-wide indicator of the state of circularity of an economy with the following characteristics: i) input-side indicator, measuring the share of secondary material consumption of the total material consumption, ii) consumption-based, ii) based on raw material consumption (RMC) rather than the domestic material consumption (DMC)
- ⁸ Plastics and packaging were merged since the regulatory and institutional framework for them is similar.
- ⁹ The stakeholder mapping was done under a separate project activity.
- ¹⁰ E.g., Ministry of Economy and Sustainable Development-MoESD, Ministry of Physical Planning, Construction and State Assets, Ministry of Health, State Inspectorate-SI, Environmental Protection and Energy Efficiency Fund-EPEEF
- ¹¹ E.g., Croatian Chamber of Economy, Croatian Chamber of Trades and Crafts, Croatian Chamber of Architects, Croatian Chamber of Civil Engineers, Croatian Employers' Association
- ¹² Including Counties and local government authorities, Association of Counties, Cities and Municipalities
- ¹³ CDW management companies, construction sector companies
- ¹⁴ E.g., Civil Engineering Faculty, Faculty of Mining, Geology and Petroleum Engineering, Faculty of Architecture
- ¹⁵ E.g., Zelena akcija, the strongest environmental umbrella NGO
- ¹⁶ Waste Exchange (Burza otpada): <https://digitalnakomora.hr/e-gospodarske-informacije/burza-otpada/centar-informacija/o-burzi-otpada>
- ¹⁷ https://circulareconomy.europa.eu/platform/sites/default/files/roadmap_towards_the_circular_economy_in_slovenia.pdf
- ¹⁸ <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A52018SC0414>
- ¹⁹ <https://www.avalara.com/vatlive/en/country-guides/europe/slovenia/slovenian-vat-rates.html>
- ²⁰ <https://www.vokasnaga.si/en/separating%20waste>
- ²¹ <https://www.vokasnaga.si/en/Regional%20Waste%20Management%20Centre>
- ²² Ordinance on construction waste and waste containing asbestos (2016)