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CIRCULARITY OF BULKY WASTE: A CASE STUDY OF KRŠKO IN SLOVENIA

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Towards a SUSTAINABLE BLUE ECONOMY

20 - 22 March, 2022
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Introduction

- ✓ Since the early 1970s onwards, science has been warning policymakers and the rest of the public in lack of fresh raw materials and the need to use alternatives
- ✓ Meanwhile policymakers adopted many directives to accelerate the use of alternative resources and the transition from linear to circular economic flow which embodies strategy for slow, narrow and close resource loops:
  - ✓ Innovating for sustainable growth: A bioeconomy for Europe
  - ✓ Directive (EU) 2018/851 of the European Parliament and of the Council of 30 May 2018 amending Directive 2008/98/EC on waste
  - ✓ Guidance on cascading use of biomass with selected good practice examples on woody biomass
  - ✓ A new Circular Economy Action Plan – For a cleaner and more competitive Europe

kostak

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Circular economy

- ✓ Circular economy aims to rationalize the use of raw materials and energy resources, limit the formation of waste and to ensure the best appropriate waste recovery, with respect to five-step waste hierarchy and waste quality.

Pont, A., Robles, A. Gil, J.A. (2019). e-WASTE: everything an ICT scientist and developer should know. IEEE Access, Vol. 7.

Linear economy

- ✓ Despite the good results in theory, we are today in practice still witnessing a number of economic systems using material and energy flows linearly and destroying biogeochemical processes in the ecosystem.
- ✓ In this context, we can also include the management of bulky waste.

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Bulky waste

- ✓ Bulky waste is a technical term taken from waste management to describe waste types that are too large to be accepted by the regular waste collection.
- ✓ It represents a variety of discarded items, e.g. furniture, sporting and children's goods, sanitary elements, mattresses, waste electric and electronic equipment (WEEE) etc., made from different long–lasting materials, e.g. polymers, ceramics, wood, metals etc., that leave the use process at the consumer after a functional or desirability life.

Collection and sorting

- ✓ The quantities of bulky waste in Slovenia are rising rapidly and have in the year 2019 reached 55,000 tons.
- ✓ The collection and sorting of bulky waste usually remains unchanged in Slovenia or in the other countries of the European Union (EU).
- ✓ Bulky waste is generally being collected from the streets or pavements of the area once or twice annually free of charge and sorted in two groups, e.g. hazardous and non hazardous.
- ✓ In practice bulky waste sorting according to quality is usually still neglected.
- ✓ Large quantities are still being deposited in landfills, illegal dumpings in nature, burned in domestic fireplaces or incinerated without energy production.
- ✓ This causes loss of valuable material and environmental concerns.

Suitable model

- ✓ Due to the fact that the existing methods of bulky waste management do not provide grounds for the circular economy, it is necessary to prepare a suitable model and its environmentally evaluation.
- ✓ The objective is to present Circular Process Model (CPM) of bulky waste:
  - ✓ Display waste management processes of bulky waste,
  - ✓ Investigate material quality, quantity and composition using Material Flow Analysis (MFA),
  - ✓ Implement environmental assessment employing Life Cycle Assessment (LCA),
  - ✓ Perform case study of Krško in Slovenia.

Methods

- ✓ The CPM considered:
- ✓ (1) collection orders and appropriateness for reuse,
- ✓ (2) collection and transportation,
- ✓ (3) sorting based on resource quality into different classes,
  - ✓ excellent -> preparing for reuse for the same purpose (PRSP),
  - ✓ good -> preparing for reuse for another purpose (PRAP),
  - ✓ average -> recycling (REC),
  - ✓ poor -> energy generation (ENG).
- ✓ (4) recovery based on resource quality and customer preferences,
- ✓ (5) marketing and sales.

Benefits

- ✓ There are significant benefits if circular models are also proper evaluated, e.g. using MFA and /or LCA.
- ✓ MFA is an analytical method to quantify flows and stocks of materials or substances in a well-defined system. It is an important tool to study the circular economy and to devise material flow management. In this research:
  - ✓ Bulky waste quantity recording using the MFA method, which represents the material flow through entire waste management. Mileage of vehicles was also recorded.
  - ✓ The LCA for evaluating CPM considered was applied.
  - ✓ The selected environmental impact was Global Warming Potential (GWP).
  - ✓ Modelling was performed in Microsoft Office Excel ® using Ashby (2021) database.
- ✓ The basis for proper calculation of environmental impacts was performed by the MFA. The combining LCA and MFA allows for both, planning bulky waste management flow and assessing environmental impacts of CPM.
- ✓ Sorting time or costs were out of the scope.
- ✓ Besides, collection orders, marketing and sales processes were not environmentally evaluated.

Case study

- ✓ Case study was performed in Krško, Slovenia
  - ✓ European Week for Waste Reduction (EWWR 2021) - 22 and 26 November 2021 (5 days).
- ✓ The Kostak Company carries out the public service of municipal waste collection in municipalities Krško and Kostanjevica na Krki, at 345 km2, supplying 11,000 households and collecting about 11,500 tons of waste annually.

(a) Slovenia

(b) Municipalities Krško and Kostanjevica na Krki

(c) Waste recycling centre Krško

Knof

- ✓ The Kostak Company very well cooperate with Knof social company (so.c.) which is responsible for the realisation of the circular economy in the Posavje and Dolenjska regions with its four Reuse Boutiques.
  - ✓ Between 10 and 15 tons of materials, mostly furniture, textiles and electronic equipment, are collected, sold or donated to needy families annually by Knof and Kostak.

Results

- ✓ The total amount of collected bulky waste during EWWR 2021 was 71 m3 or 6,101.5 kg.
  - ✓ PRSP=301,5 kg,
  - ✓ PRAP=100 kg,
  - ✓ REC=3,600 kg,
  - ✓ ENG=2,100 kg.

Preparing for reuse for the same purpose - Preparation of materials

Renovated kitchen chairs

Materials reused for another purpose

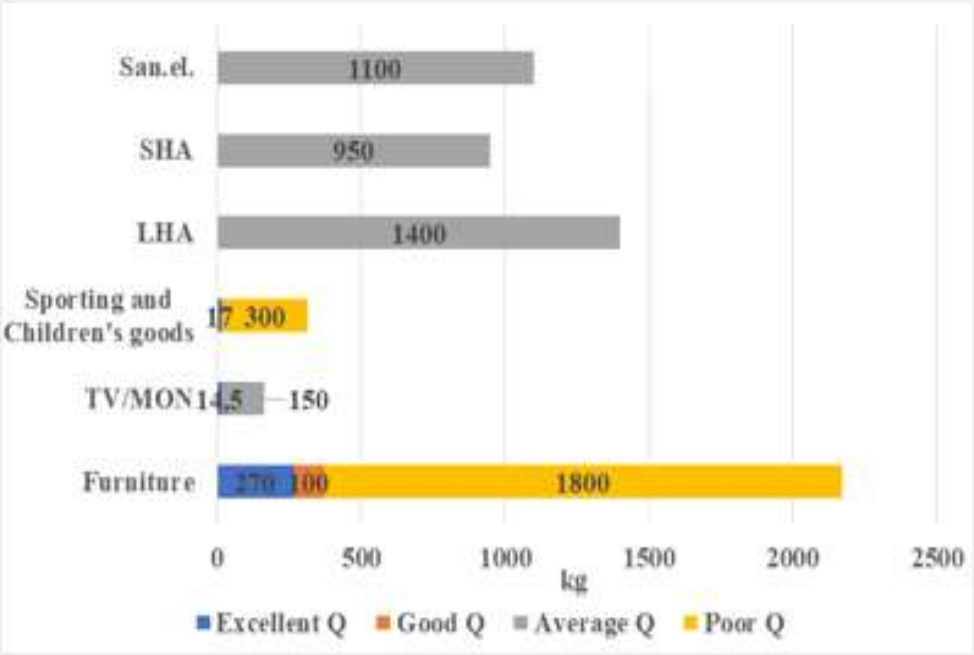
The door became a dinning table

The bedroom wardrobe became a writing nook

Materials

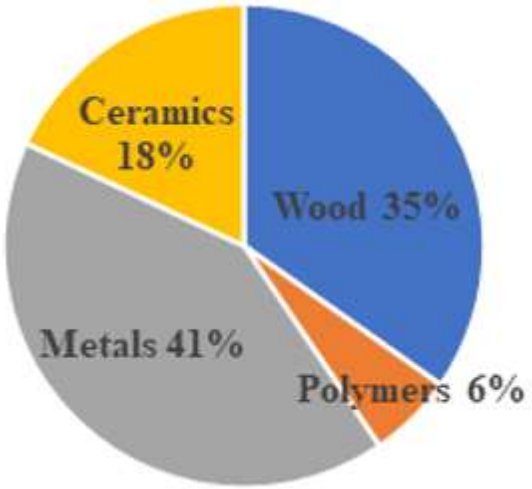
- ✓ The largest amount of material was furniture, followed by LHA, sanitary elements, sporting and children's goods and TV/MON.

Weight according to quality



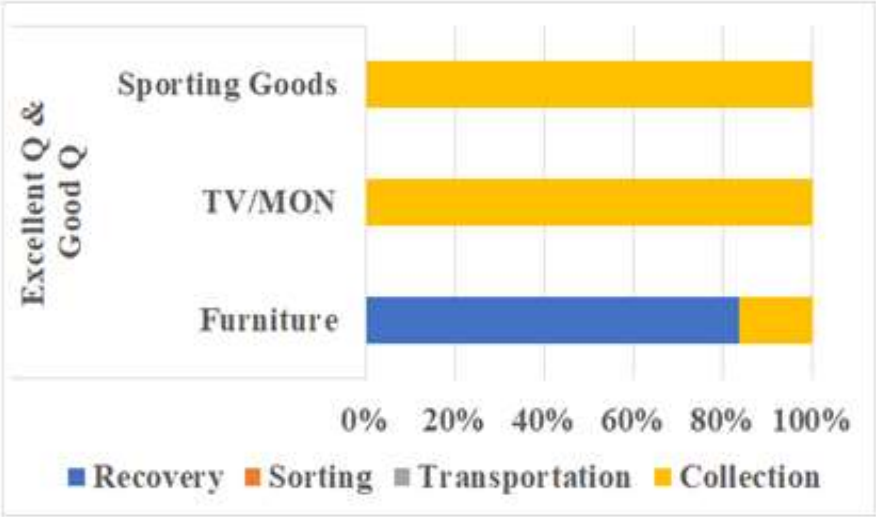
Main material composition of bulky waste

- ✓ The main material composition of bulky waste (>50 %):
  - ✓ metal (41 %),
  - ✓ wood (35 %),
  - ✓ ceramics (18 %) and
  - ✓ polymer based products (6 %).



Excellent and well preserved materials

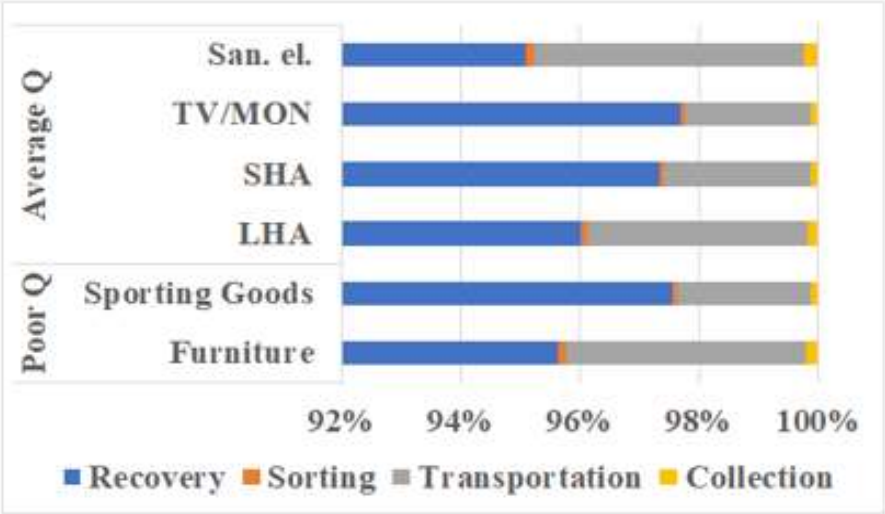
- ✓ Excellent and well preserved materials:
  - ✓ The GWP impacts of the sporting goods and TV/MON is only collection
  - ✓ GWP in insignificant in Excellent and Good quality of material.



Average and poorly perserved material

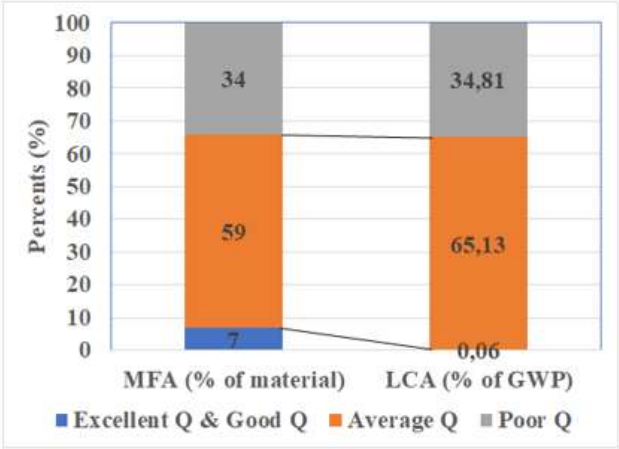
- ✓ Recovery process had the greatest impact on the GWP effect,
- ✓ From 95 % for recycling of sanitary elements to 97,7 % for recycling of TV/monitors,
- ✓ Transportation (2-4 %),
- ✓ Collection and sorting have minor GWP effects on environment.

Main material composition of bulky waste



Comparison of the results obtained in recovery process based on resource quality

- ✓ An insight into the comparison of the recovery process results reveals:
  - ✓ 7 % of excellent and well preserved bulky waste produce only 0,06 % of total GWP,
  - ✓ 34 % of poorly preserved material contribute 34,81 to GWP and
  - ✓ 59 % of average preserved bulky waste provide 65,13 % of GWP.
- ✓ Using both MFA and LCA demonstrated excellent and well quality preserved bulky waste intended for reuse can drastically reduce the effect of GWP.



Conclusion

- ✓ We tried to encourage other public service providers and waste processors to improve their implement of the waste hierarchy and systematic waste management.

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Thank YOU

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