# KROG group - CIRCATHON 2025

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## Dogoše Circular Construction Center

*Construction Waste Optical-based facility and integrated Slovenian National Marketplace Platform*

The Dogoše Construction Waste Recycling Plant will be developed to operate with Construction Waste using the most advanced technologies in the field of Optical facilities (RGB high-resolution cameras), machine learning and online market-place.

The introduction of such equipments will aim to increased:

A. Non-supervised control of input waste (recognition of unwanted dangerous materials - machine learning developing)
B. Monitoring of waste composition (image recognition and IT deep learning)
C. Estimation of waste volumes (machine learning estimation)
D. New Slovenian National Online Market-Place for Recycled Materials based on IT data analysis on waste volume and composition.
E. Tailored suggestions for reuse applications based on Artificial Intelligence and data analysis.

The Business Model comprises the introduction of novel equipments in Dogoše:

The update of the Waste Plant sees the introduction of:

(1) **Conveyor belt** for primary screening of Waste
COST: 10,000€ *

(2) **RGB Optical Cameras** on top of the Conveyor belt for in-line (real time) image analysis.
COST: each cameras 1.500€ (x 4)*

(3) **Dogoše Construction Waste Plant Manager Software** (**DCWP** ®) by KROG group.
COST OF DEVELOPING (12 months): 50.000€

(4) **New Slovenian National Online Marketplace** for recycled materials (**KROG marketplace** ®) by KROG group
COST OF DEVELOPING (12-18 months): 40.000€

* The COSTs don't comprise the installation and initial testing of the technology at the Dogoše Sorting Plant which depends on the Slovenian National average work/hours cost but could be estimated around 10.000€

FINAL ESTIMATED COST: 106,000€

The plant consists of a (1) **conveyor belt-based sorting system**, where construction and demolition waste is continuously fed for automated analysis. Above the conveyor, a set of **high-resolution RGB cameras (2)** captures images of the waste stream in real-time, feeding data into an DCWP Manager Software (3).

The introduction of (1) and (2) is meant to leverage **real-time optical RGB camera technology** to efficiently categorize and separate materials based on their visual characteristics using the DCWP software (3). This system is designed to enhance material recovery rates, improve sorting precision, and optimize recycling processes within circular economy frameworks.

**Key Features:**

- **Multi-camera array** positioned at different angles to capture comprehensive visual data.
- **AI-driven image recognition** for material classification based on texture, color, and shape.
- **Continuous feedback loop** to refine classification accuracy based on operational data.

The DCWP Manager Software (3) uses **machine learning (ML) algorithms**, specifically **convolutional neural networks (CNNs)** trained on a vast dataset of construction materials. The system can differentiate between:

- **Concrete** (various shades of gray with rough textures)
- **Bricks and ceramics** (red, orange, or brown hues with a porous structure)
- **Wood** (beige to brown tones with fibrous grain patterns)
- **Plastics** (bright colors, smooth surfaces)
- **Glass** (transparent or reflective surfaces)
- **Metals** (shiny or dull surfaces, often with rust patterns)

Once identified, the system assigns each waste fragment a classification label comprising:

1) Type of waste (material composition)

2) Amount generated (tons)
3) RGB images of the waste
4) Location coordinates (GPS)
5) Quality of the materials (deterioration, ageing)
6) Economical cost (€/tons)

These data are shared in the (4) **New Slovenian National Online Marketplace** for recycled materials (**KROG marketplace).**

The KROG marketplace uses GPS to track the position of Slovenian stakeholders in the field of construction sector and also artisanal workers or local artists that might use recycled materials in their productions (New European Bauhaus).

The marketplace sends daily notifications to the persons, companies and local entities (administration, municipalities) in the Slovenia area subscribed to the KROG marketplace providing them the information as labeled from 1 to 7.

Based on **Artificial Intelligence, the KROG marketplace** platform associates the recycled materials produced (considering the parameters from 1 to 7) with potential final reuse practice.

The output is a suggestion to the subscribed community of possible applications for recycled material compared them to those available online:

(1) Technical Construction - application in the construction sector like concrete, mortars etc. (Google Scholar, Scopus library).
(2) Architectural Structures - Wood and Metals based application in the production of timbers and other structural elements for housing (Architectural Journals).
(3) Artisanal Works - (wood, metals) from Pinterest and other available reference libraries for home and external furniture (Ikea and other design websites).
(4) Arts and performance - application in the field of liberal arts and performance (Arts and performance websites).

Marketplace: the stakeholders can directly buy online the recycled materials and collect them or ask for delivery service.