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DESIGNING MUNICIPAL WASTE MANAGEMENT PROGRAMS USING CHOOSING BY ADVANTAGES ADVANTAGES AND DESIGN STRUCTURE MATRIX

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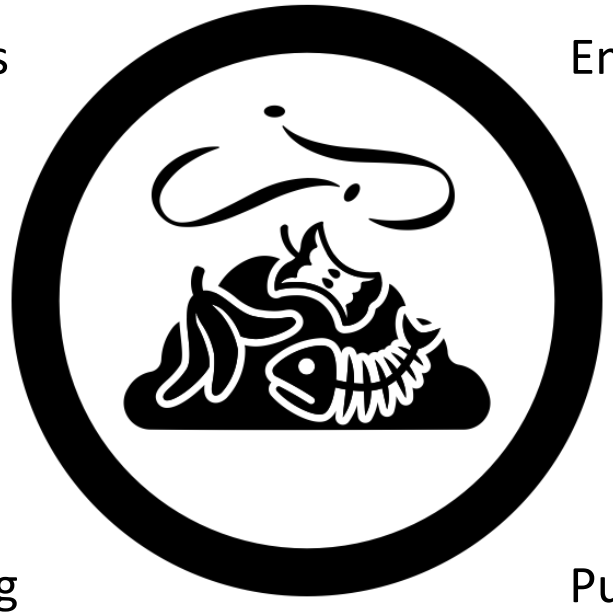
MUNICIPAL SOLID WASTE (MSW) MANAGEMENT

GHG Emissions

Employment Generation



Large occupation of Landfills

Largest Budget of Local Governments

Flooding

Public Health

Air Pollution

DESIGNING MSW MANAGEMENT POLICIES AND PROGRAMS

Benefits

- Improve human health and environment
- Promote reuse and recycling
- Implement extended producer responsibility collectively

(Pires, Martinho, & Chang, 2011)

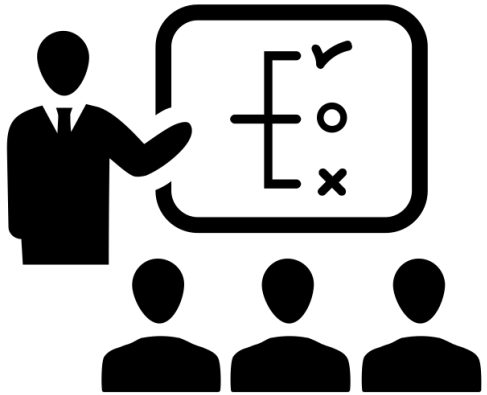
Challenges

- Many interrelated variables and information created during the design process
- Involvement of multidisciplinary fields
- Complexity of the problem and uncertainty of the process

How to proceed

- Addressing social, environmental and economic dimensions of the problem
- Managing stakeholders' preferences, including the community's visions
- Managing interrelated decisions and information during the process

CBA AS A MCDM SYSTEM



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from Noun Project

A multicriteria decision making (MCDM) approach is needed to **address high uncertainty, multiple stakeholders** and their preferences, and **different aspects of sustainability** (Wang et al., 2009).

Studies that compares some MCMD methods with **Choosing by Advantages** (CBA) shows that CBA is better than the others to make **sustainable decisions** (P. Arroyo, Tommelein, & Ballard, 2015; Kpamma, Adinyira, Ayarkwa, & Adjei-Kumi, 2016)

Kpamma et al. (2016) used CBA to **manage the preferences of users** during design stage in the construction industry. As a result, the method **promoted a collaborative environment** among stakeholders and **fostered an atmosphere that enabled knowledge sharing** and **common understanding** of information

CBA DO NOT CONSIDER INTERRELATION OF INFORMATION AND DECISIONS

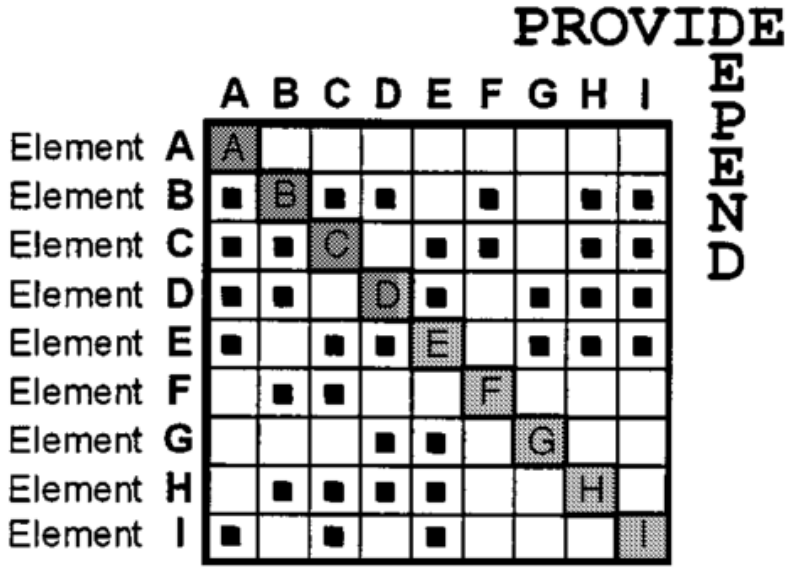
MANAGING INTERRELATED DECISION-MAKING

Design Structure Matrix is a tool that allows analyze projects with the purpose of decomposing and integrating problems

There are several studies that focus on applying DSM in the design stage (e.g. Browning, 2001; Pektaş & Pultar, 2006; Tuholski & Tommelein, 2010).

DSM helps to

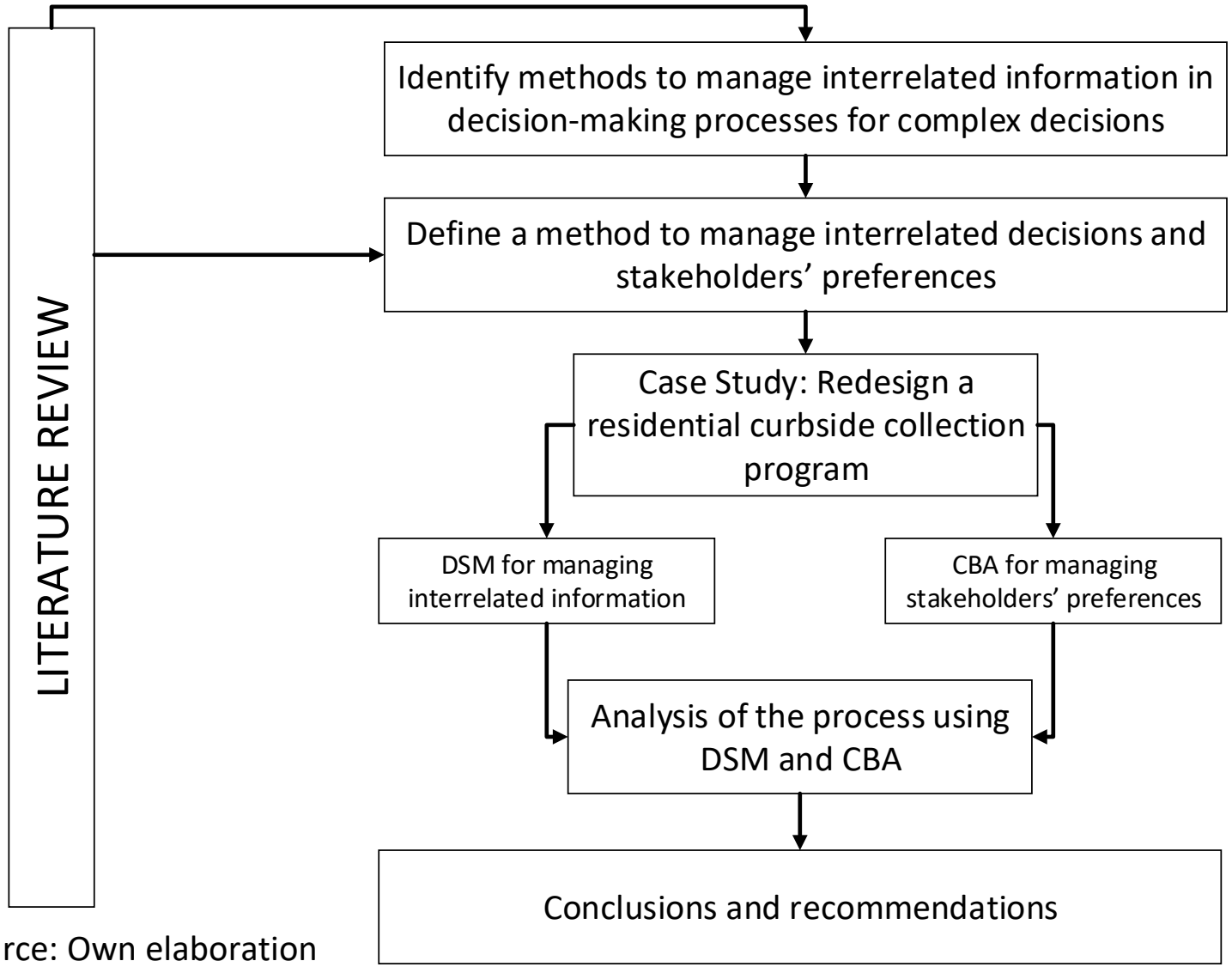
- Document and understand activity dependencies
- Share available information in early stages of design
- Put effort into coordination
- Expose conflicts due to the interrelation of tasks and planning iterations



(Browning,2001)

RESEARCH METHOD

Purpose: Establish a systematic approach to design public environmental policies that consider and manage interrelated decisions and information created during the process.



Source: Own elaboration

CASE STUDY: REDESIGN PROCESS OF A WASTE COLLECTION PROGRAM

Scope

- Evaluating the existing recycling program
- Designing an organic waste collection program
- Evaluating the program of waste collection
- Defining financing options, cart sizes, depots, and collection frequencies

Decisions made using CBA

- Defining the Recycling Program
- Defining the Organics Program
- Development of a variable rate waste utility (PAYT Utility) programs

Main problems with the implementation of CBA

- Defining key decisions
- Defining factors to assess the decisions
- Interconnected information

Using **DSM to decompose and reintegrate** the problem, and **define the optimal order of decisions**

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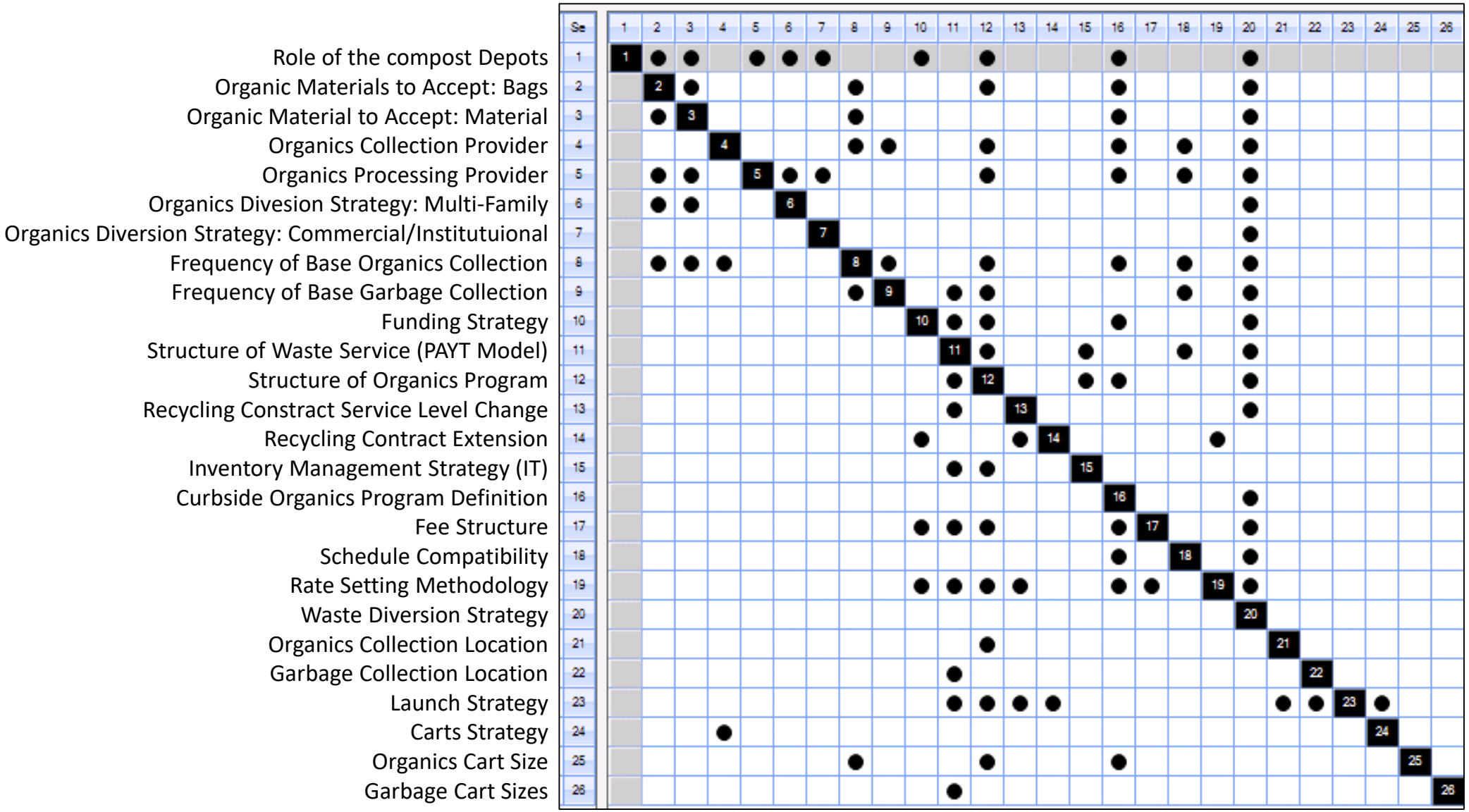
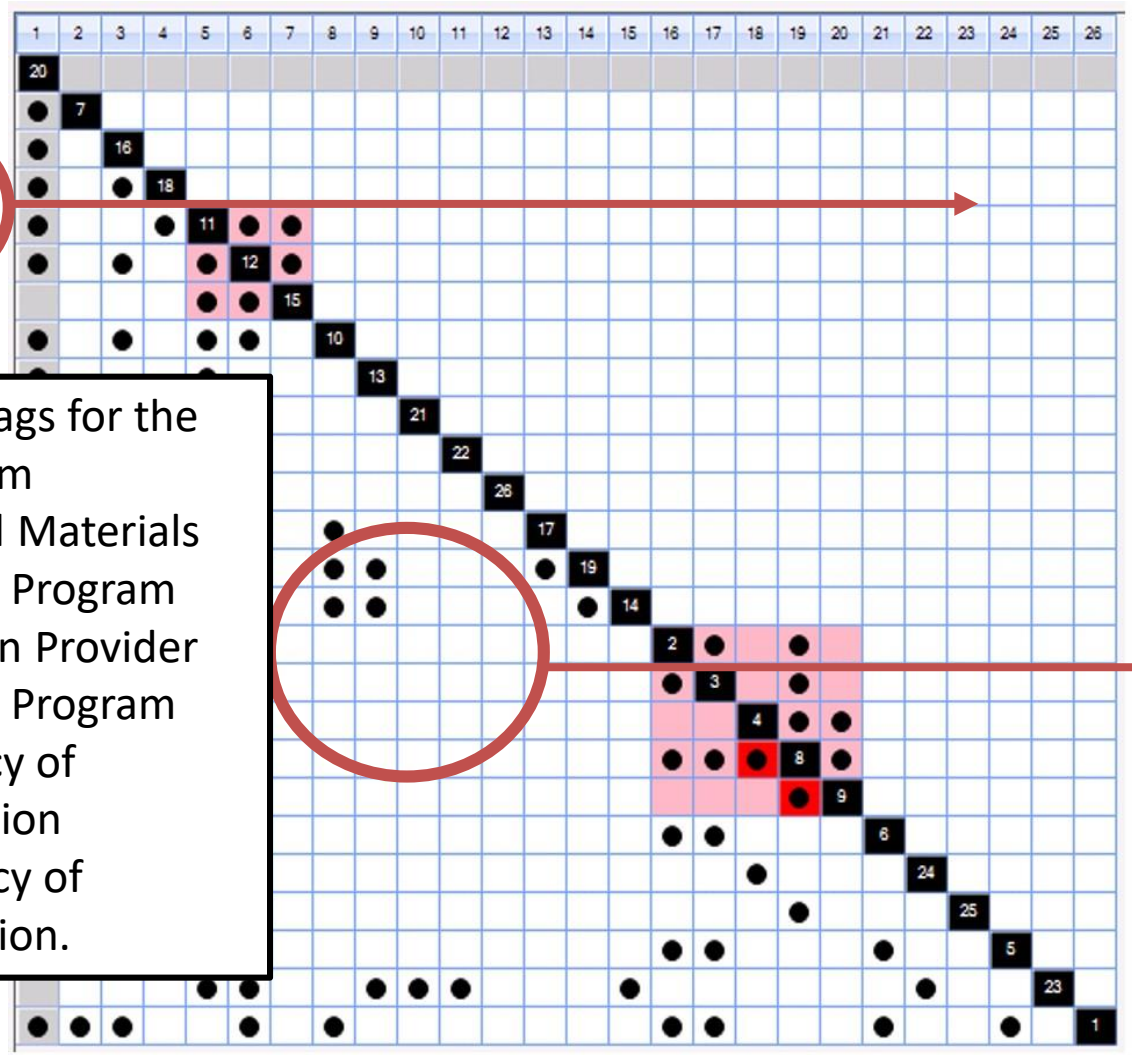
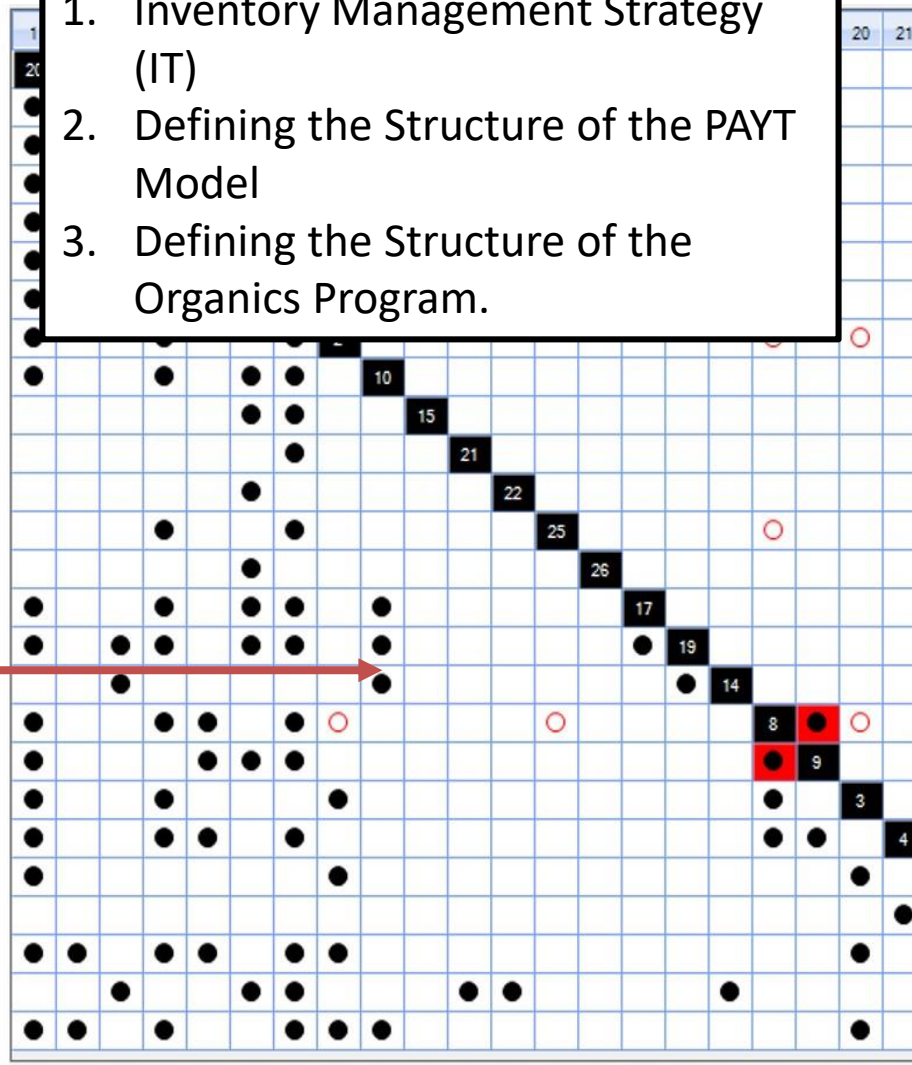


1. Define role of bags for the Organics Program
2. Define accepted Materials for the Organics Program
3. Define Collection Provider for the Organics Program
4. Define frequency of Organics Collection
5. Define Frequency of Garbage Collection.



1. Inventory Management Strategy (IT)
2. Defining the Structure of the PAYT Model
3. Defining the Structure of the Organics Program.



(a) (b)

INTEGRATING CBA AND DSM

The proposed approach allowed for

- Documentation of interdependencies of activities in a fast and simple manner
- Manipulation of high complexity levels in contrast to traditional tools
- Documentation of assumptions required to move forward along a linear/sequential path.
- Identify the optimal order of decisions by not influencing the sequence based on undocumented knowledge.

Created by Gregor Cresnar
from Noun Project

CONCLUSIONS

This work contributes to the body of knowledge by using CBA together with DSM for make complex decisions to formulate environmental public policies.

- CBA allowed practitioners to assess multiple aspects in Organics, PAYT Utility, and Recycling Program decisions to achieve sustainable solutions.
- CBA allowed including community and municipality visions, along with environmental and economic factors
- DSM used to decrease the size of iteration loops and negative iteration
- The proposed method helped to find the optimal order of decisions, document assumptions to move forward in the process, and identify iteration loops

Future work should measure the impact of using CBA together with DSM to know if negative iteration decreases during the design stage.

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