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IMPROVING URBAN WASTE MANAGEMENT:
TWO APPLIED RESEARCH PROJECTS IN LUXEMBOURG

— Opportunities & impacts on exiting waste management systems

March 6th, 2019

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In collaboration with

POLYGONE
Des spécialistes à votre service

SUMMARY

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1. Introduction

- Mobility-related challenges in the **waste management sector**,
- New research trajectories,
- Technological opportunities.

2. Focus on: **waste management for the construction sector**

First research project: **OCTogone** (industrial waste)

➢ *Key issue: How to design and optimize waste sorting plants?*

3. Focus on: **waste collection processes**

Second research project: **SWAM** (mixed household and similar waste)

➢ *Key issue: How to improve existing waste collection processes by leveraging heterogeneous data sources?*

4. Conclusion

➢ *Waste management practices to benefit from digital innovation.*

OUTLINE

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1. Introduction

2. Focus on: waste management for the construction sector

3. Focus on: waste collection processes

4. Conclusion

INTRODUCTION

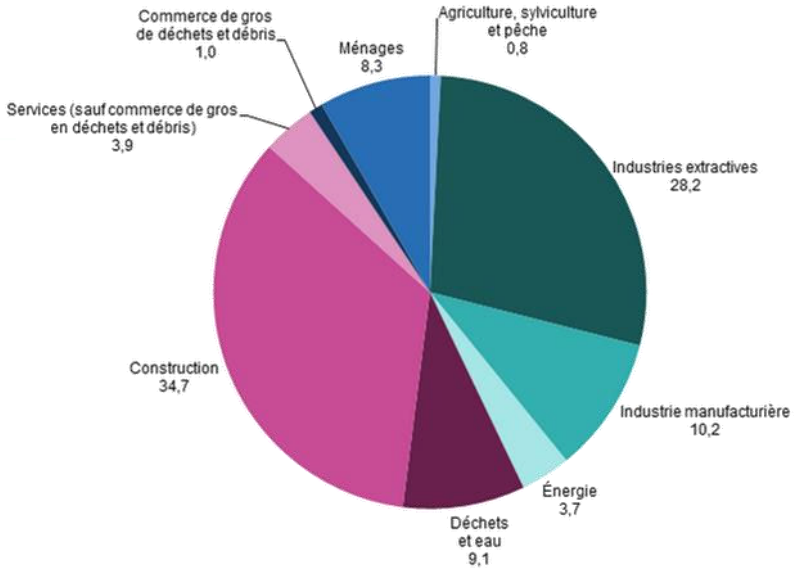
General scope: Significant room for improvement in resources consumption & waste management

Resources consumption

Source : www.footprintnetwork.org

Waste generation

Source : Eurostat 2014



➢ **How can we further promote the principles of "Reduce, Recycle, Re-employ, Re-think"?**

INTRODUCTION

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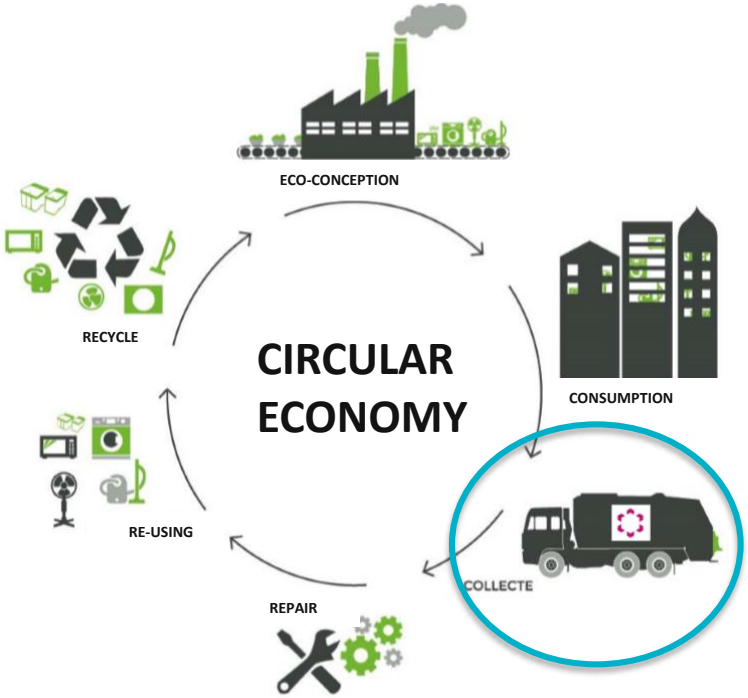
The research framework considered:



How to co-design an applied research trajectory? (public-private)

Concrete needs & research opportunities

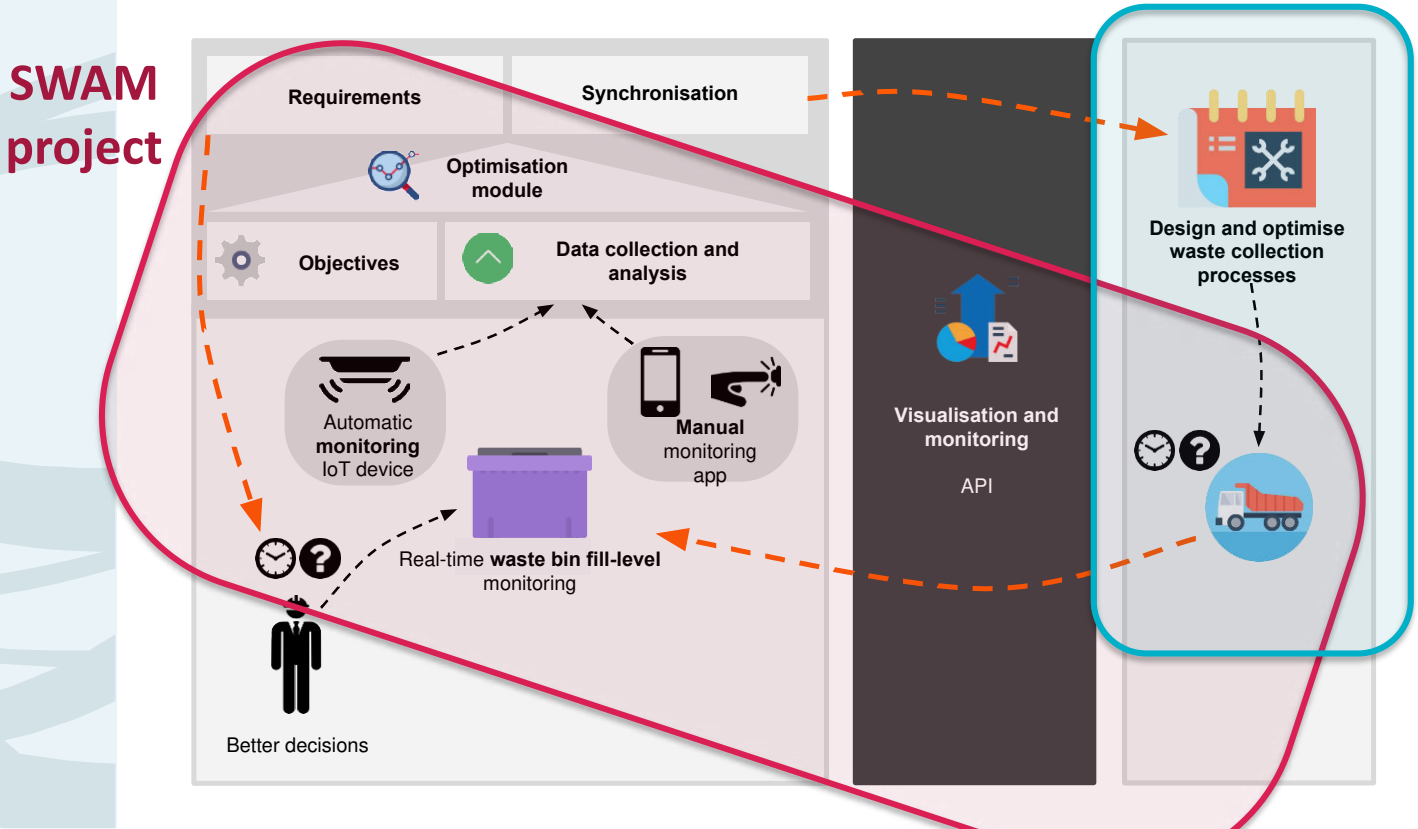
Optimize existing collection processes whatever the type of waste (industrial or household)

=

Innovate in the waste management sector

INTRODUCTION

What technological opportunities?
The envisioned technical scopes:



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2. FOCUS ON: WASTE MANAGEMENT FOR THE CONSTRUCTION SECTOR

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OCTogone collaborative research project

Objectives

- Automatic creation of optimal quotes (= initial offers for clients)
- Optimal choices of containers types (+ associated trucks) for any waste sorting center.

Provides the following benefits for Polygone:

1. **Optimized and fast** creation of quotes to answer calls for tenders,
2. **More competitive** proposal generation,
3. Development of **alternative billing choices** (‘à la carte’ or all inclusive, hand-tailored for customer),
4. Performing **multi-objective optimization** (available surface, trucks’ CO2, total cost).

Above target: prototype to be taken over directly by Sales team!

2. FOCUS ON: WASTE MANAGEMENT FOR THE CONSTRUCTION SECTOR

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OCTogone collaborative research project

Prototype produced - OCTogone's usage steps:

1. Polygone's Account/Sales Manager logs into the **web-based tool OCTogone** (from the office or directly from the customer's site),

2. He/She inputs the **customer requirements** (type of waste + (approximate) quantities) in a convenient pre-fromated Excel file,

3. OCTogone performs a **multi-objective optimisation** and yields several optimal waste sorting centers (w/ containers types+sizes & trucks) in an interactive figure (next slide),

4. One or several offers (quotes) can be selected from OCTogone directly **with the customer**, and then downloaded in formated Excel file.

2. FOCUS ON: WASTE MANAGEMENT FOR THE CONSTRUCTION SECTOR

OCTogone collaborative research project

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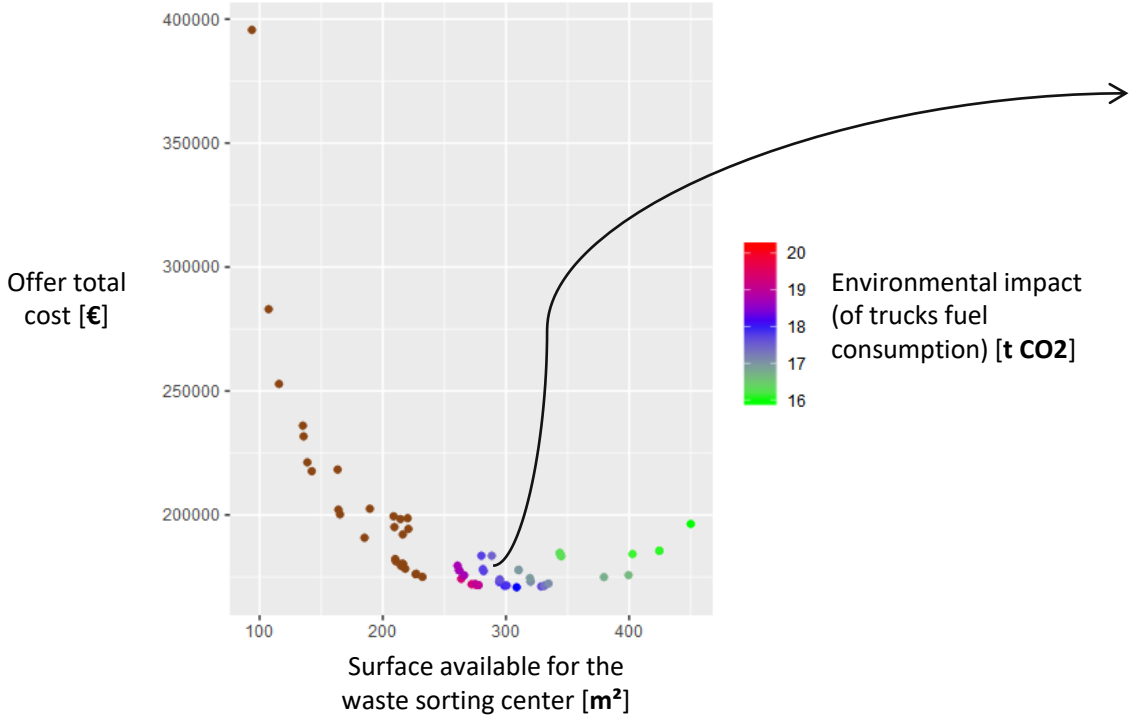
Figure to choose an optimal solution with the customer, fitting best to his/her needs:



All the points in this figure are **optimal compromises** (or 'trade-offs') between the following three chosen main criteria of a waste sorting center:

- **Total cost** (vertical axis)
- **Surface** available (horizontal axis)
- Trucks **CO2** output (color)

➢ This research project actually resulted in a new **'Technical Sales'** tool, that can be used directly as a 'Service de conseil' by Polygone with its customers.

2. FOCUS ON: WASTE MANAGEMENT FOR THE CONSTRUCTION SECTOR

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Conclusions

- OCTogone is a new tool researched and developed in the general contexts of **'companies and businesses digitization'** and of **mobility** (waste management in particular).
- Despite it being the outcome of an R&D project, its transition into **actual production** is already envisioned in the following months, after a period of validation/user adaptation.
- This resulting into Polygone proposing a **more competitive and greener service.**

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3. FOCUS ON: WASTE COLLECTION PROCESSES

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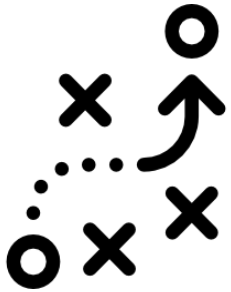
→ aims to propose and validate a **novel Smart Waste collection platform** relying on **multi-objective** optimisation processes, and considering heterogeneous data -including data generated by **new fill-level sensor technologies** integrated into waste bins.



Fonds National de la Recherche Luxembourg

3. FOCUS ON: WASTE COLLECTION PROCESSES

SWAM – FNR BRIDGE

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Main research challenges:

1) Research and validate a **real-time data collection and analysis system**, using heterogeneous data sources and **waste bin fill-level sensors**.
2) Research and validate **multi-objectives route planning optimisation models**, considering the company's own needs, constraints and contextual information from web services (e.g. weather, road traffic data).
3) Generate **personalised, real-time and predictive recommendations** through a web interface (for the dispatcher), and a mobile app (for the drivers).

Outcomes:

- Create a **platform prototype**, able to manage multi-constraints and multi-sources scenarios.
- **Distribute the decision** on multiple device types to support different levels of action: from management to operations, from traffic jams to client service.

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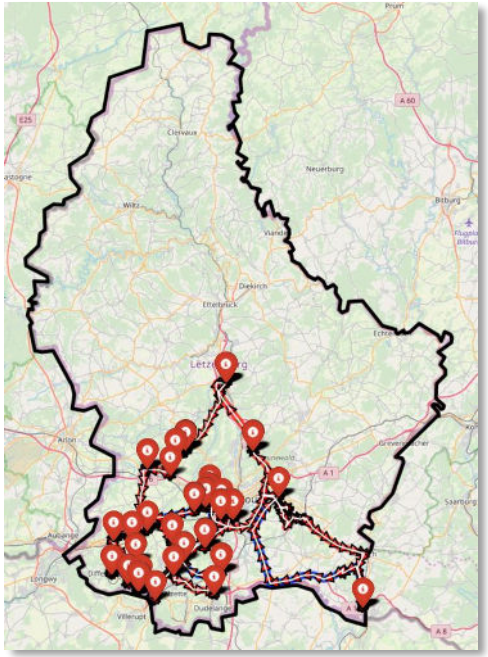
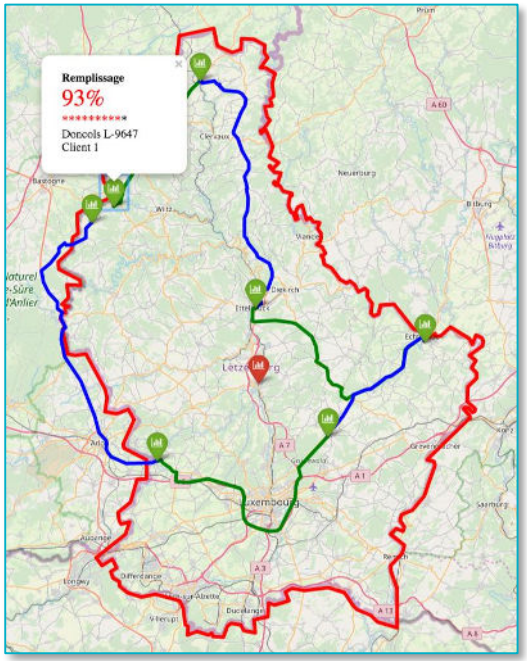
3. FOCUS ON: WASTE COLLECTION PROCESSES

SWAM – FNR BRIDGE





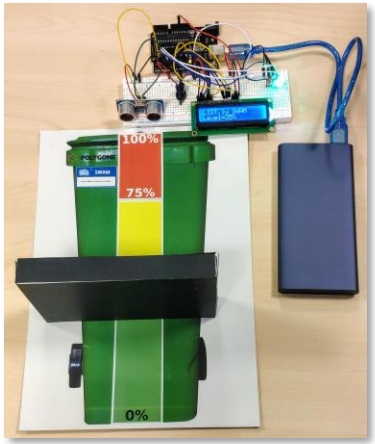
Multi-point, predictive optimal routing (apriori planning & real-time adjustments), taking into account several sources of data (state of bins in particular).

3. FOCUS ON: WASTE COLLECTION PROCESSES

SWAM – FNR BRIDGE

Want to know more about SWAM?

- → **Visit our poster (just outside conference room)**
- → **Contact us: *sebastien.faye@.list.lu***



← *LIST's demonstrator & fill-level sensors*

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4. Conclusion (brief)

CONCLUSION

- *Waste management practices to benefit from digitization & digital innovation.*

- “No data (of quality), No chocolate”

Interested by our projects? Please feel free to contact us!

OCTogone: *emile.simon@list.lu*
SWAM: *sebastien.faye@list.lu*