

# Implementation of a Biotechnology in the Global South: A Moroccan case study



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- ❖ Motivation
- ❖ Project “Trans4Biotec”
- ❖ Case study analysis
- ❖ Conclusion
- ❖ Next steps & Outlook

**Room 4, SESSION XX**

**25<sup>th</sup> June 2021 13:15-13:30**

**Aerobic Treatment and Tools for Waste Management**

# Motivation

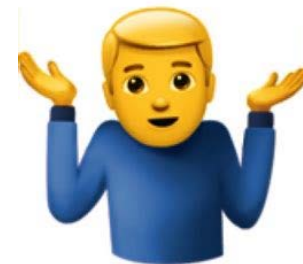


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What can  
be done?



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Maybe...

***BUT what happened in the past?***

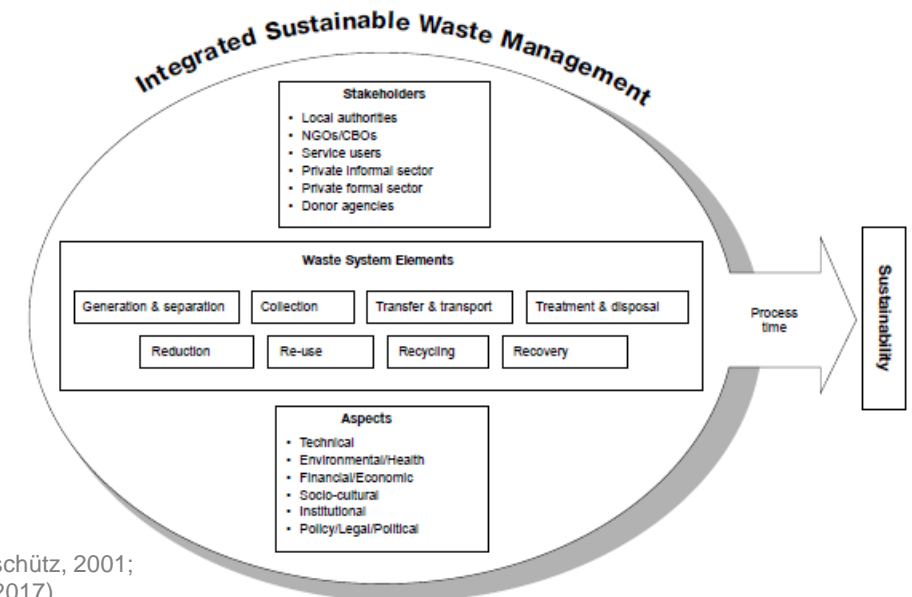


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- ❖ Purely implementation of technologies → **often failed**
- ❖ **Possible reasons:** technological constraints, lack of qualified personnel or technical infrastructure, or a missing legal basis as well as political will
- ❖ Systematic approaches → Integrated Sustainable Waste Management
- ❖ **Essential factor: Capacity building**



[https://tse3.mm.bing.net/th?id=OIP.TSMzJPIO\\_BGiv9Hrjx\\_KAHaHa&pid=Api](https://tse3.mm.bing.net/th?id=OIP.TSMzJPIO_BGiv9Hrjx_KAHaHa&pid=Api)



(Pfaff-Simoneit, 2012; van de Klundert and Anschutz, 2001; Wilson, 2007, Independent Evaluation Group, 2017)

# Project "Trans4Biotec"



DAAD



2017 - 2021

*Transfer of know-how in waste management to develop new biotechnology applications in developing countries*

Research and Education

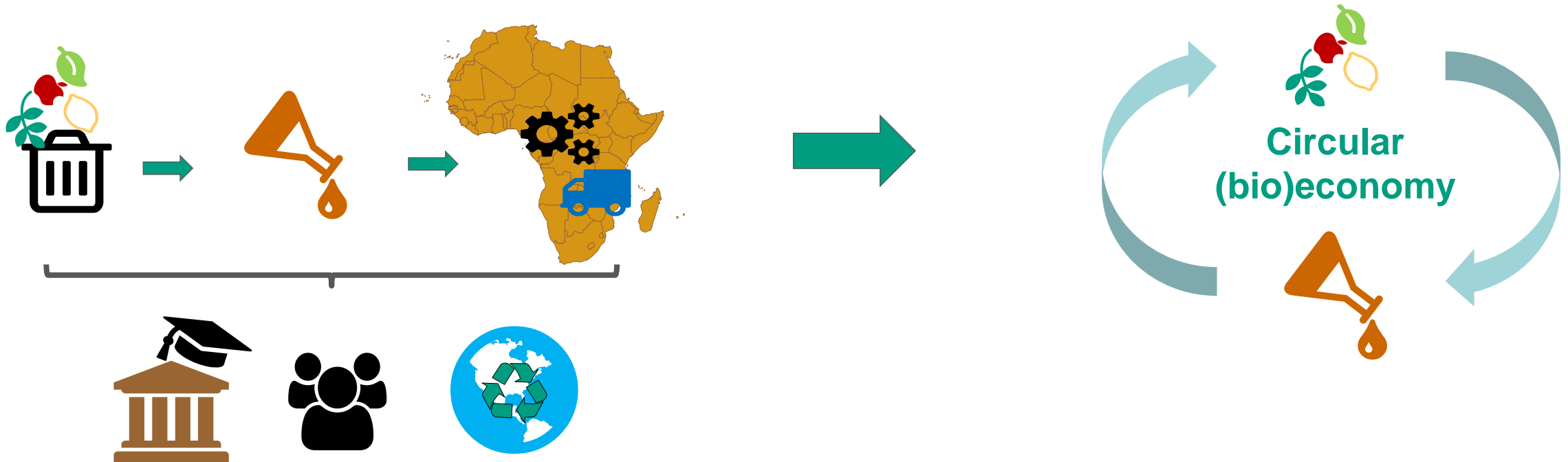


# The Idea behind the Research



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To produce bio-based products on the basis of medium chain fatty acids (MCFA) out of waste

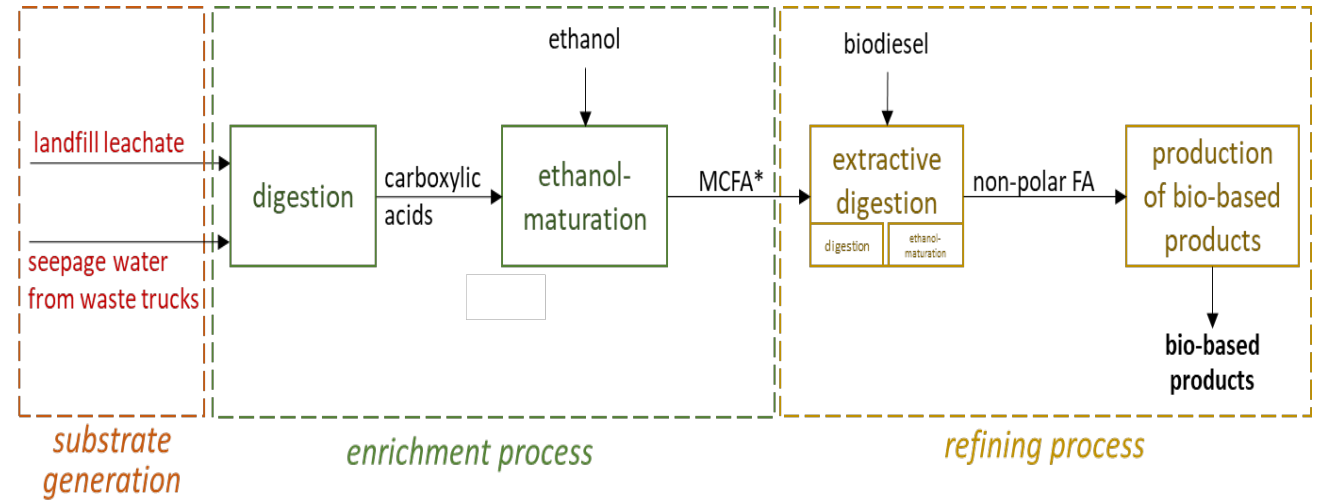
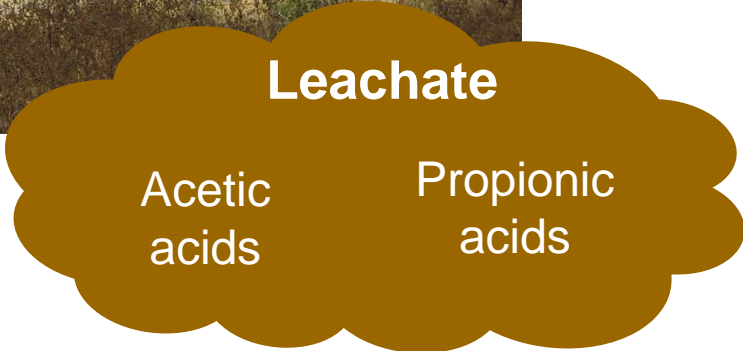


# Medium Chain Fatty Acids out of Leachate

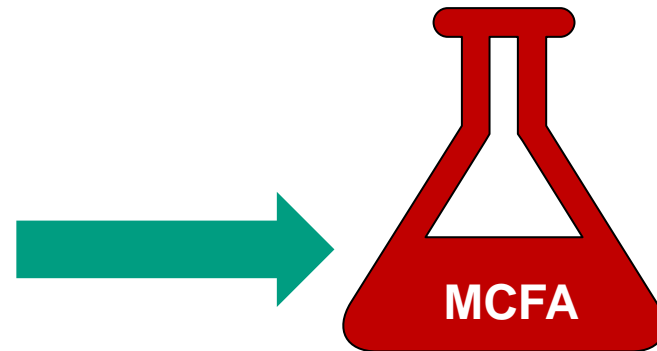


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## Landfill Gas



\* MCFA: medium chain fatty acids



# Case study Marrakech, Morocco



- ❖ 4<sup>th</sup> largest city in Morocco
- ❖ MSW generation between 850 to 900 daily
- ❖ waste collection and disposal by 3 private firms
  - ❖ high amount of organic waste (~70%) and moisture rate → huge leachate potential
- ❖ 2 landfills: Al Azzouzia (uncontrolled, closed since 2014) and El Mnabha (controlled, active)
- ❖ Leachate of El Mnabha, high MCFA potential
- ❖ **El Mnabha potential site for technology implementation**

# Implementation criteria and analysis



|   |
|---|
| <b>Technical criteria</b>                                   |
| Existence of leachate basins (minimum: controlled landfill) |
| Min. leachate generation: 30 m <sup>3</sup> /a              |
| Area to build an enclosed plant (30 to 40 m <sup>2</sup> )  |
| Access to electricity                                       |
| Access to good transport and road infrastructure            |
| Connection to a wastewater treatment plant                  |
| Local availability of construction materials                |
| Local availability of auxiliary and operating materials     |
| Regular monitoring / analysis of process parameters         |
| Presence of local refining facilities                       |
| <b>Non-technical criteria</b>                               |



# Conclusion and Recommendations for Actions

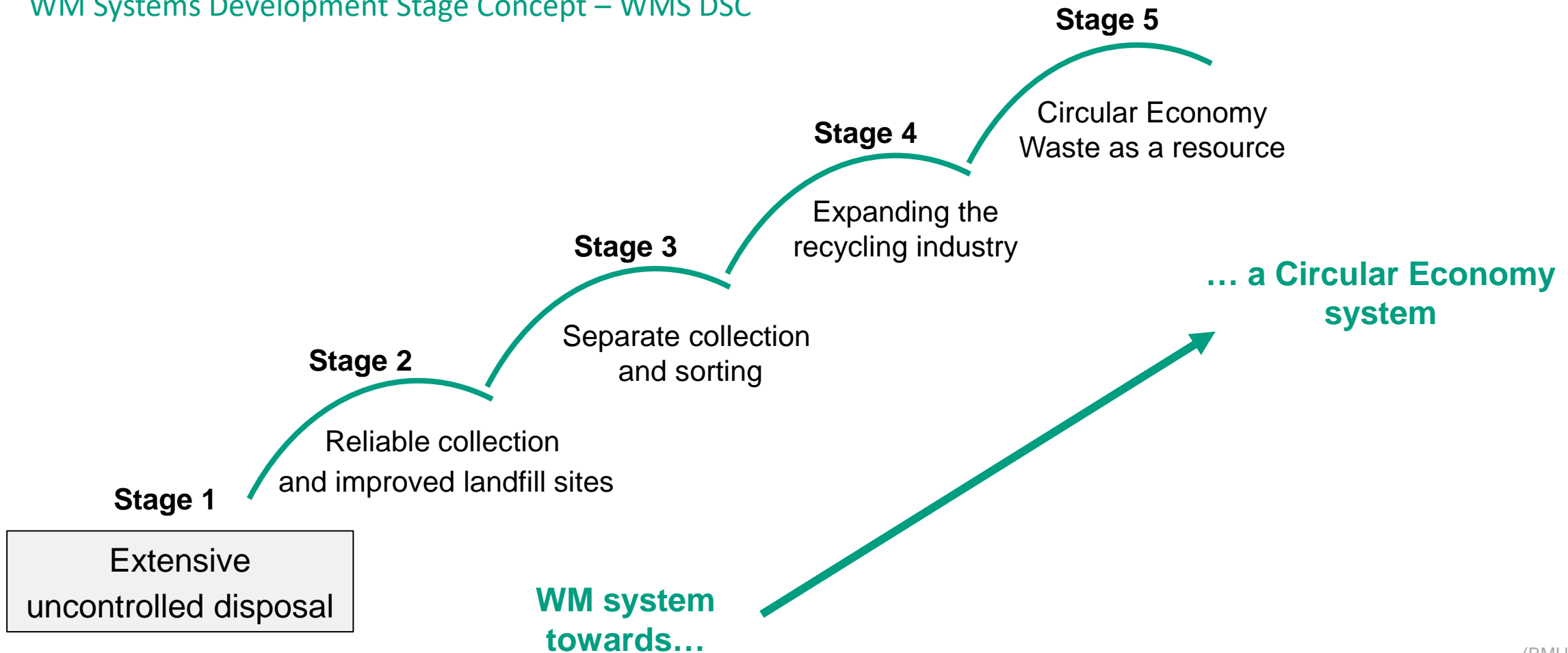
- ❖ implementation is generally feasible, but some verifications still needed for long-term perspective
- 1. **Verify**, if remaining extraction liquids are sufficient for direct discharge in WWTP or additional treatment needed.
- 2. **Check**, if connection of technology to existing WWTP is possible
- 3. **Adaptation** of explosion and fire protection concepts to landfill conditions
- 4. **Examination** of potential collaborations with local refining facilities for MCFA processing and potential customers.
- 5. **Develop** a concept for customer conviction to overcome existing prejudices regarding biobased products.

# Next steps WMS-DSC Tool



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## WM Systems Development Stage Concept – WMS DSC



(BMUB, 2016)

# WMS-DSC Structure

| Waste Management Development Stages |   |                                 |                                  |  |
|-------------------------------------|---|---------------------------------|----------------------------------|--|
| Waste removal                       |   | Closing the loop                |                                  |  |
| Stage 1                             | Stage 2   | Stage 3                         | Stage 4                          | Stage 5                                |
| Extensive uncontrolled disposal     | Reliable collection and improved landfill sites | Separate collection and sorting | Expanding the recycling industry | Circular economy - waste as a resource |

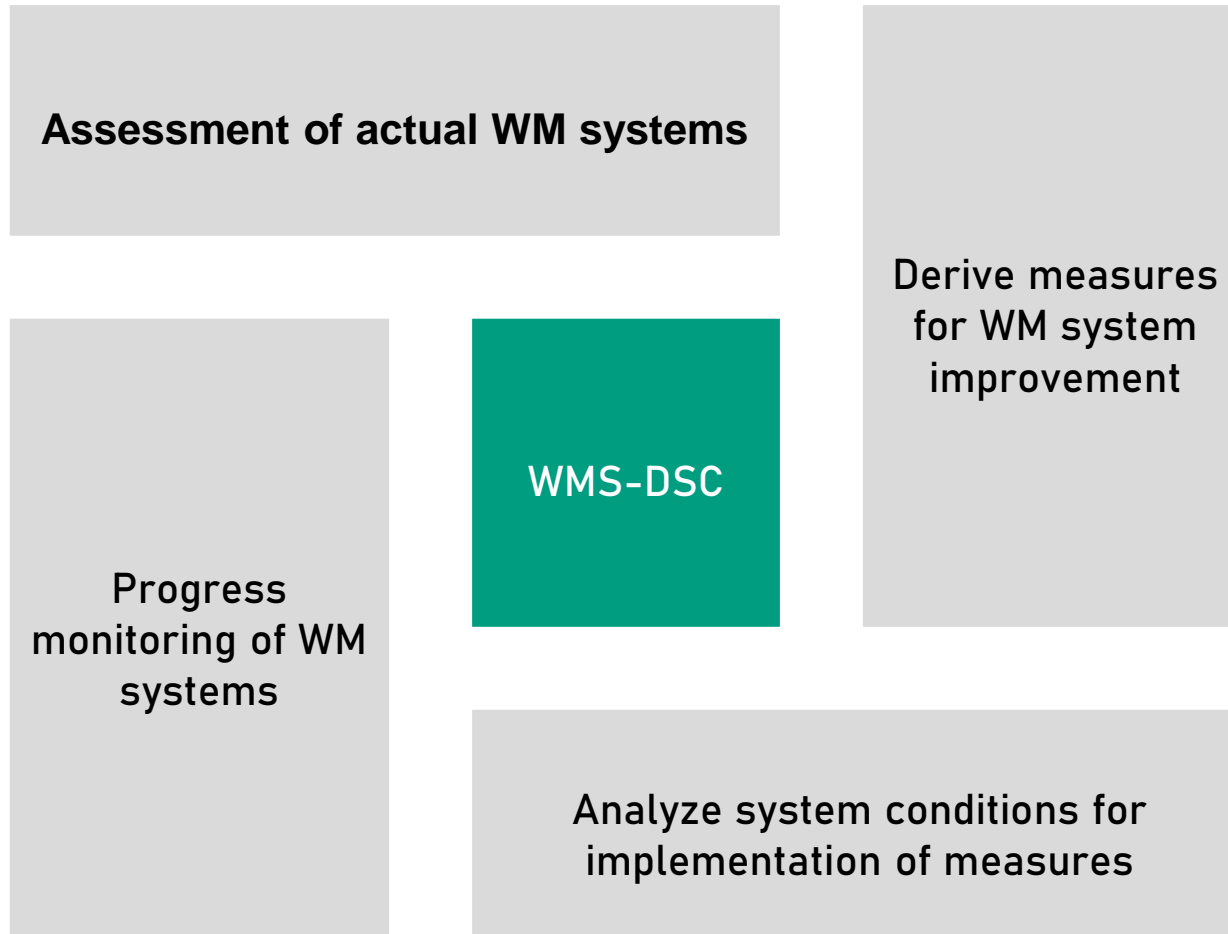
| Governance  |  |  |  |            |   |  |                  |   |   |                |  |  |                 |  |  |                 |  |   |                    |  |
|---|--|--|--|------------|---|--|------------------|---|---|----------------|--|--|-----------------|--|--|-----------------|--|---|--------------------|--|
| Waste market  |  |  |  |            |   |  |                  |   |   |                |  |  |                 |  |  |                 |  |   |                    |  |
| Collection and transport  |  |  |  |            |   |  |                  |   |   |                |  |  |                 |  |  |                 |  |   |                    |  |
| Waste disposal  |  |  |  |            |   |  |                  |   |   |                |  |  |                 |  |  |                 |  |   |                    |  |
| Energy recovery   |  |  |  |            |   |  |                  |   |   |                |  |  |                 |  |  |                 |  |   |                    |  |
| Waste recycling   |  |  |  |            |   |  |                  |   |   |                |  |  |                 |  |  |                 |  |   |                    |  |
| Waste prevention and re-use   |  |  |  |            |   |  |                  |   |   |                |  |  |                 |  |  |                 |  |   |                    |  |
|   |  |  | <table border="1"> <thead> <tr> <th>Governance</th> </tr> </thead> <tbody> <tr> <td> <ul style="list-style-type: none"> <li>Laws &amp; regulations</li> <li>WM on different political levels</li> <li>Control mechanisms</li> <li>Education &amp; Research</li> <li>Awareness raising</li> <li>Safety &amp; other measures</li> <li>...</li> </ul> <p style="text-align: right;"><b>16</b></p> </td> </tr> </tbody> </table> | Governance | <ul style="list-style-type: none"> <li>Laws &amp; regulations</li> <li>WM on different political levels</li> <li>Control mechanisms</li> <li>Education &amp; Research</li> <li>Awareness raising</li> <li>Safety &amp; other measures</li> <li>...</li> </ul> <p style="text-align: right;"><b>16</b></p> | <table border="1"> <thead> <tr> <th>Waste Collection</th> </tr> </thead> <tbody> <tr> <td> <ul style="list-style-type: none"> <li>Collection service provider</li> <li>Collection rates</li> <li>Waste separation</li> <li>...</li> </ul> <p style="text-align: right;"><b>8</b></p> </td> </tr> </tbody> </table> | Waste Collection | <ul style="list-style-type: none"> <li>Collection service provider</li> <li>Collection rates</li> <li>Waste separation</li> <li>...</li> </ul> <p style="text-align: right;"><b>8</b></p> | <table border="1"> <thead> <tr> <th>Waste Disposal</th> </tr> </thead> <tbody> <tr> <td> <ul style="list-style-type: none"> <li>Operational measures</li> <li>Leachate Management</li> <li>Landfill gas management</li> <li>...</li> </ul> <p style="text-align: right;"><b>6</b></p> </td> </tr> </tbody> </table> | Waste Disposal | <ul style="list-style-type: none"> <li>Operational measures</li> <li>Leachate Management</li> <li>Landfill gas management</li> <li>...</li> </ul> <p style="text-align: right;"><b>6</b></p> | <table border="1"> <thead> <tr> <th>Energy Recovery</th> </tr> </thead> <tbody> <tr> <td> <ul style="list-style-type: none"> <li>Thermal disposal &amp; recovery</li> <li>Incineration plants</li> <li>Raw material recovery</li> </ul> <p style="text-align: right;"><b>3</b></p> </td> </tr> </tbody> </table> | Energy Recovery | <ul style="list-style-type: none"> <li>Thermal disposal &amp; recovery</li> <li>Incineration plants</li> <li>Raw material recovery</li> </ul> <p style="text-align: right;"><b>3</b></p> | <table border="1"> <thead> <tr> <th>Waste Recycling</th> </tr> </thead> <tbody> <tr> <td> <ul style="list-style-type: none"> <li>Sorting of recyclables</li> <li>Recycling technologies</li> <li>Composting &amp; Fermentation</li> <li>Recycling of waste streams</li> <li>Recycling rates</li> <li>...</li> </ul> <p style="text-align: right;"><b>7</b></p> </td> </tr> </tbody> </table> | Waste Recycling | <ul style="list-style-type: none"> <li>Sorting of recyclables</li> <li>Recycling technologies</li> <li>Composting &amp; Fermentation</li> <li>Recycling of waste streams</li> <li>Recycling rates</li> <li>...</li> </ul> <p style="text-align: right;"><b>7</b></p> | <table border="1"> <thead> <tr> <th>Prevention &amp; Reuse</th> </tr> </thead> <tbody> <tr> <td> <ul style="list-style-type: none"> <li>Reuse strategies</li> <li>Product design</li> <li>Process optimization</li> <li>Innovative business models</li> <li>...</li> </ul> <p style="text-align: right;"><b>6</b></p> </td> </tr> </tbody> </table> | Prevention & Reuse | <ul style="list-style-type: none"> <li>Reuse strategies</li> <li>Product design</li> <li>Process optimization</li> <li>Innovative business models</li> <li>...</li> </ul> <p style="text-align: right;"><b>6</b></p> |
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| Prevention & Reuse  |  |  |  |            |   |  |                  |   |   |                |  |  |                 |  |  |                 |  |   |                    |  |
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# WMS-DSC

## *Applicability*



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### Applicable for:

- urban and rural WM systems
- all countries, from low-income to high-income)
- practitioners or decision makers, who are familiar with the WM system under review

# Outlook

## Case study & WMS-DSC



|                       |                             | Waste Management Stages         |   |                                 |                                  |   |
|-----------------------|-----------------------------|---------------------------------|---|---------------------------------|----------------------------------|---|
|                       |                             | Waste removal                   |   | Closing the loop                |                                  |   |
|                       |                             | Stage 1                         | Stage 2   | Stage 3                         | Stage 4                          | Stage 5                                     |
|                       |                             | Extensive uncontrolled disposal | Reliable collection and improved landfill sites | Separate collection and sorting | Expanding the recycling industry | Circular (bio)economy - waste as a resource |
| Waste management      | Governance                  |                                 | MA  | ↔                               | BioR                             |   |
|                       | Waste market                | MA                              |   |                                 | ↔                                | BioR  |
|                       | Collection and transport    |                                 | MA  | BioR                            |                                  | ⚡   |
|                       | Waste disposal              |                                 | MA  | ↔                               | BioR                             |   |
|                       | Energy recovery             |                                 |   |                                 |                                  |   |
| Circular (bio)economy | Waste recycling             |                                 |   |                                 |                                  |   |
|                       | Waste prevention and re-use |                                 |   |                                 |                                  |   |

**What has to be done to implement the BioR successfully in MA?**

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# Thank you for your attention



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## Any questions?



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