UNIVERSITY OF GHANA
DEPARTMENT OF GEOGRAPHY AND RESOURCE DEVELOPMENT

University of Stuttgart
Germany

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SuCCESS 24
Sustainable Cities
Circular Economy
Sub-Saharan Africa

Transferability Workshop

Accra

08.07.2024, 09:00 – 17:30

SDG colour wheel: https://www.un.org/sustainabledevelopment/news/communications-material/

Transferability Workshop – Agenda

• Arrival & Official intro from UoG (Prof. Oteng-Ababio)	09:00-09:45
• Project Introduction (M.Sc. Toriello Espana)	09:45-10:15
• Introduction round participants	10:15-11:15
15min break	
• Workshop Goal	11:30-11:50
• Waste Management Systems Ethiopia (Dr. Shimelis)	11:50-12:00
• SDGs und tool methodology (M.Sc. Weissert)	12:00-12:20
• Tool introduction (Cand. M.Sc. Eberle)	12:20-13:00
• Task definition for the afternoon	13:00-13:15
1 h Lunch break	Group picture! ☺
• **Work tables**	14:15-15:45
15min break	
• Presentation of results	16:00-16:30
• Recap	16:30-17:00
• Good bye	17:00-17:15

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of Education
and Research

Joint Research Project SuCCESS24

Natalia Toriello Espana

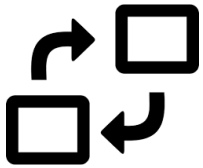
Sustainable Cities, Circular Economy in Sub Sahara Africa 2024

Overall objectives of the project

- **Strengthening circular economy and waste management** through methodological development

- Development of a simplified **toolkit for the analysis, assessment and optimisation** of circular economy and waste management systems in cities and urban areas in sub-Saharan Africa

- Development of a **joint postgraduate education and training programme**



- **Intercultural exchanges**
- **Knowledge exchanges** between the participating universities as well as between academics, students, technicians, decision makers, etc.

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Your workshop team

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Prof. Martin Oteng-Ababio
University of Ghana

Prof. Gerald Yiran
University of Ghana

Dr. Shimelis Kebede
Addis Ababa University

Natalia Toriello Espana
University of Stuttgart

Manuel Lorenz
EcoSquare Consulting GmbH

Julia Weissert
University of Stuttgart

Project Partners:

- University of Stuttgart (ISWA and IABP)
- AT-Association, association for the promotion of socially & environmentally appropriate technologies e.V.
- Addis Ababa University (AAiT)
- ENDA (Environmental Development Action)
- City Government of Addis Ababa, Solid Waste Management Agenca
- University of Ghana (Department of geography and resource development)
- WASCAL (West African Science Service Centre on Climate Change and Adapted Land Use)
- AMA (Accra Metropolitan Assembly)

Funding:

- BMBF (Federal Ministry of Education and Research)
- DAAD (German Academic Exchange Service)
- DLR-PT (DLR Project Management Agency)

Stakeholders

- City administration
- Workers in the waste sector (management, waste sites, collection, transportation, etc.)
- Workers in the environmental sector
- Academics
- Students

Main Activities in SuCCESS24

- SDG Workshop in Accra, Ghana (2021)
- SDG Workshop in Addis Ababa, Ethiopia (2022)
- SDG Workshop and Indicator Set finalisation in Stuttgart, Germany (2022)
- Several case studies in Ethiopia - Mojo, Dukem, Bishoftu Town (2022, 2023)
- Data Collection Workshop in Bishoftu Town, Ethiopia (2023)
- Summer School in Addis Ababa, Ethiopia (2023)
- Transferability Workshop (Today)
- Summer School in Accra, Ghana (beginning tomorrow!)

Federal Ministry of Education and Research

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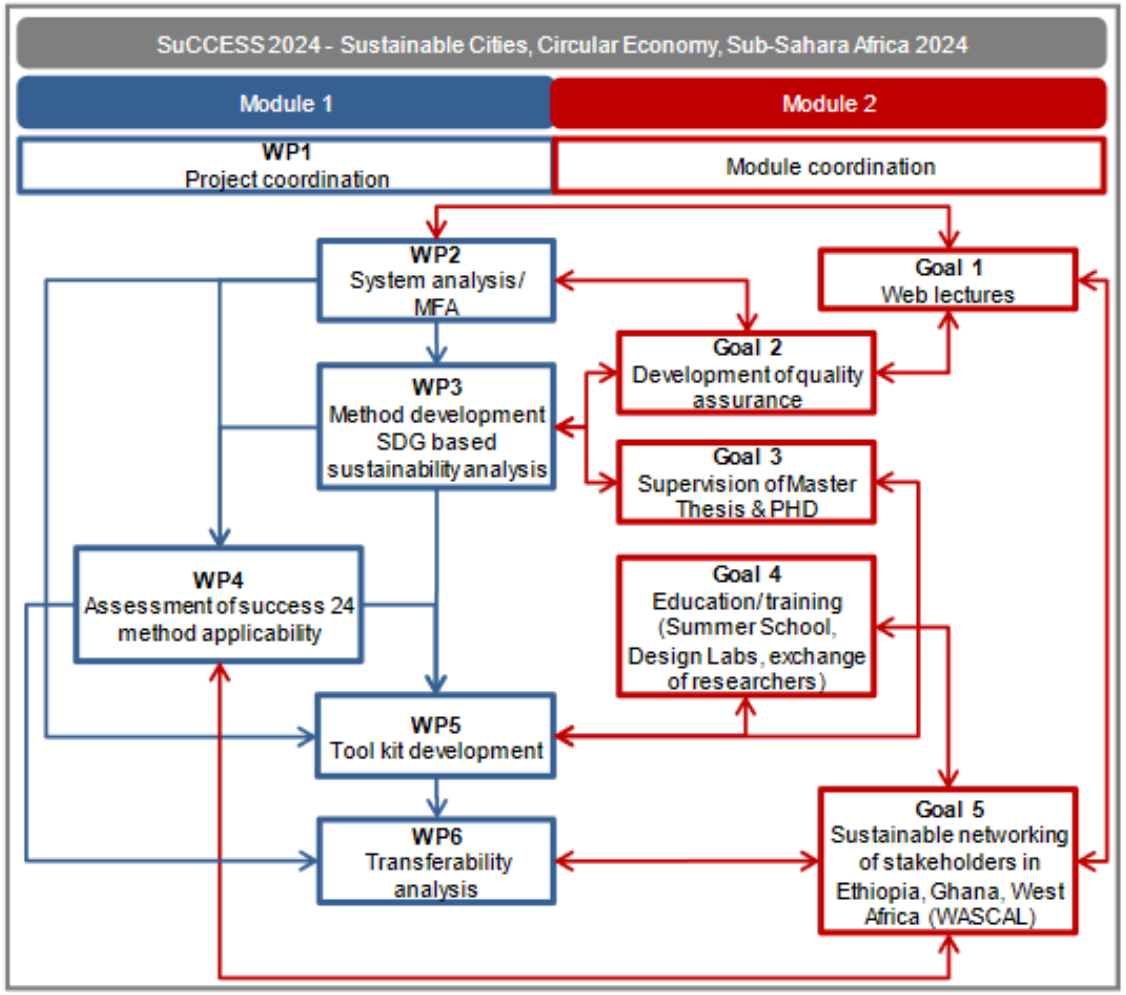
MFA




Module 2
TEACHING
workshops
online lectures
summer-schools
postgraduate
Module 1
RESEARCH
Municipal Solid Waste
Material Flow Analysis
Life Cycle Engineering
Circular
Economy
SDGs

Thank you for your participation!

Kindly note that we will share photos of this workshop on, e.g., our project webpage: Joint research project SuCCESS 24 | University of Stuttgart (uni-stuttgart.de)

Please let us know in case you don‘t want us to take pictures of you for our project webpage.

We are looking forward to a fruitful day!

Natalia Toriello Espana

Introduction Round

Introduction Round

- Please, stand in the corner with the life cycle phase (Collection & Transportation, Recycling, Final disposal, Overall) that best matches your work area.

- What is your name?
- Occupation and company / association / etc.
- Are you more familiar with formal or informal processes?
- In your opinion, what is the biggest challenge for sustainable waste management in Ghana? Which boundary conditions hamper a sustainable development in this area?

15 min Coffee break

08.07.2024
Photo: https://pixabay.com/images/id-4193591/

Workshop Goal

What have we done so far?

- **SDG Workshop** in December 2021
- **Methodology** development for **Life Cycle Sustainability Assessments** for Waste Management Systems in Ethiopia
- Based on this methodology, we are about to develop a **tool** which should facilitate the application of the method

What output do we want to get today?

- Find out which **adaptations** must be made in order to make the **tool** applicable **for Ghanaian Waste Management Systems**

Why do we need you?

- WMS are complex
- (Secondary) Data availability is rare
- **You are the experts! Your insights are very valuable.**

Dr. Shimelis Kebede Kassahun

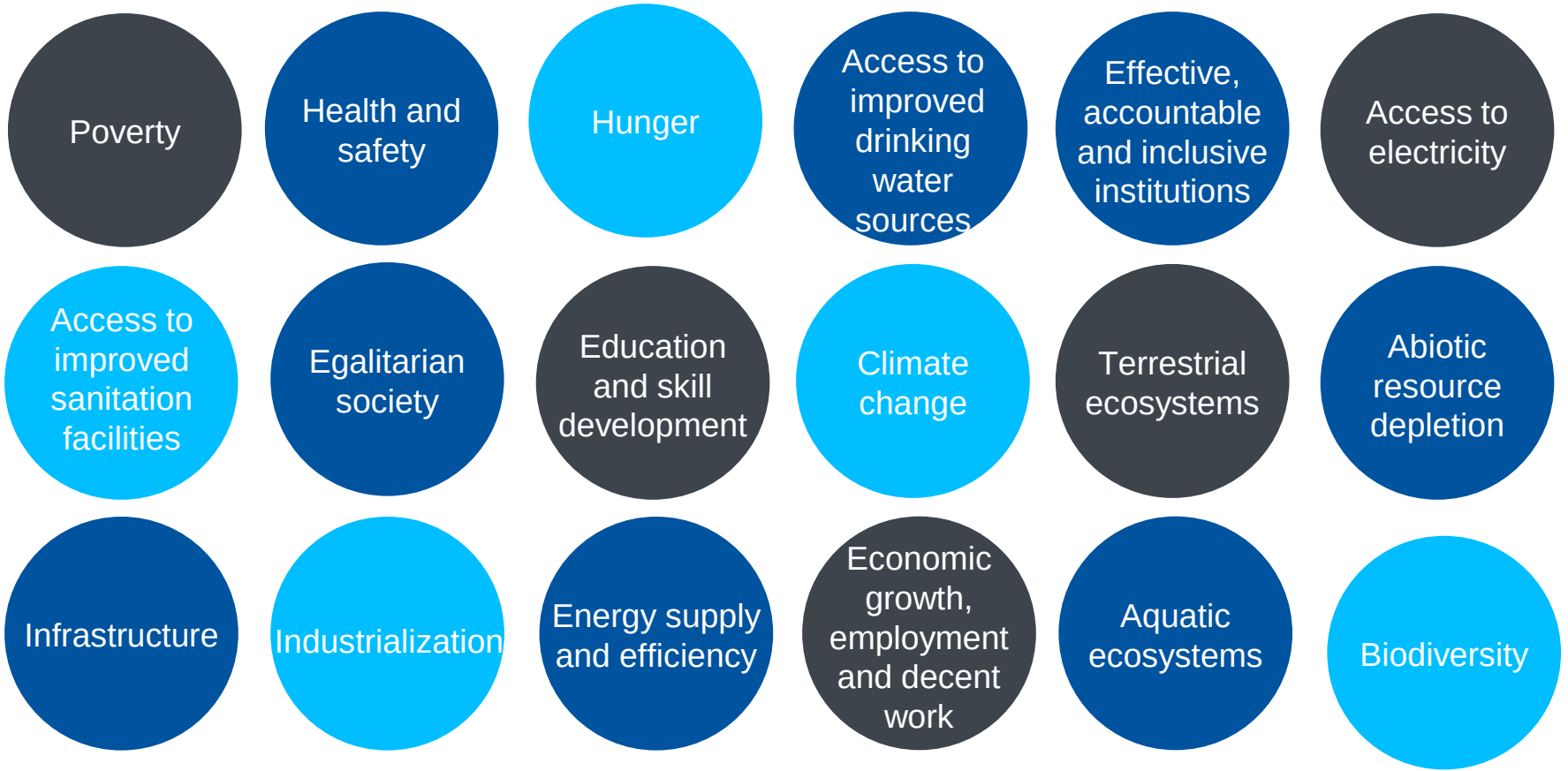
Evaluation of waste management and recycling systems in Ethiopia

Julia Weissert

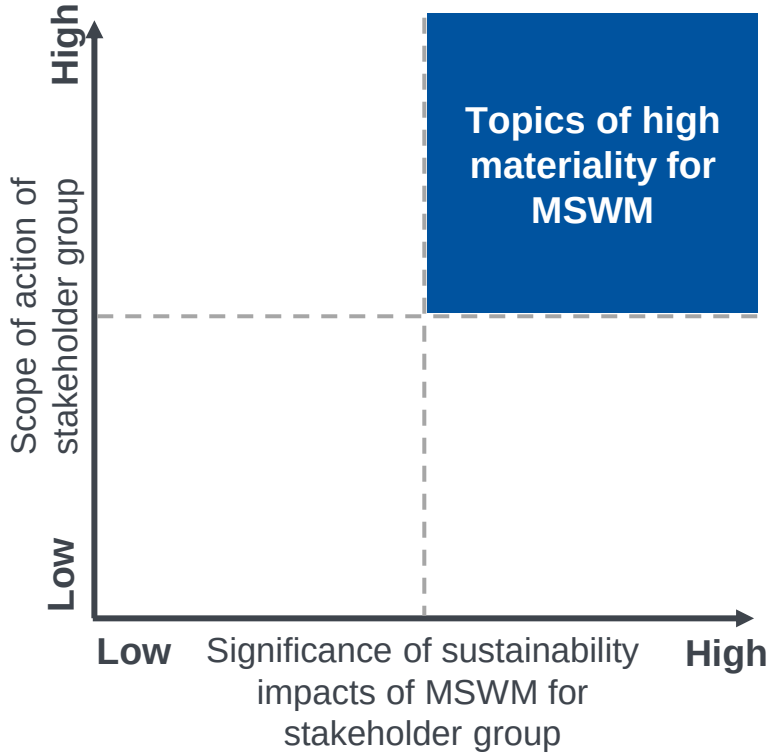
Sustainable Development Goals

© United Nations [6]

Sustainability Topics



Relevance Definition and materiality matrix



Relevance of a sustainability topic:

1) Stakeholder group can **act effectively** in the field
2) Stakeholder group is **affected** by the economic/ social/environmental **sustainability impacts** of MSWM

MSWM: Municipal Solid Waste Management

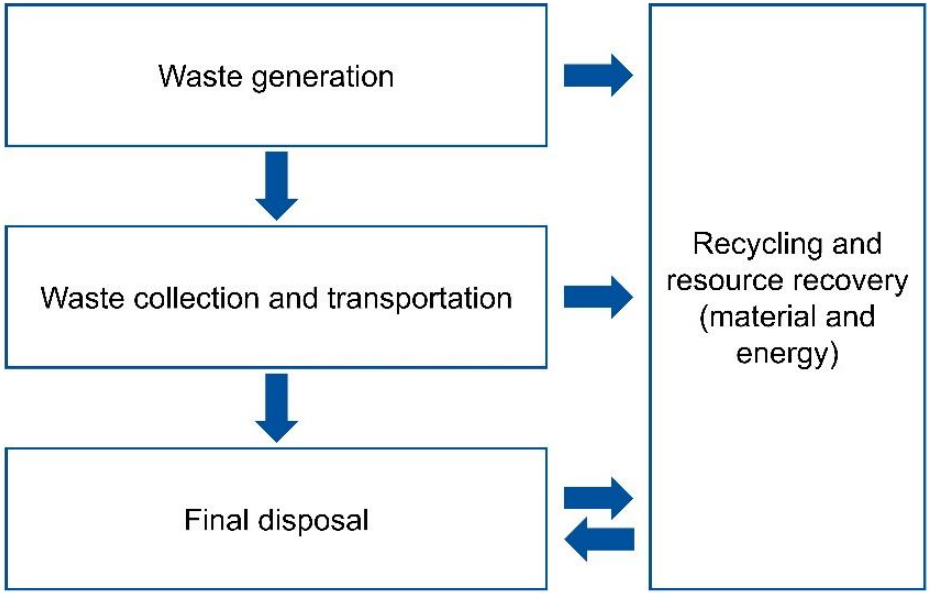
[2]

SDGs in the context of municipal solid waste management

Julia Weissert

Sustainability Assessment Framework

Life Cycle Phases in a MSWM system



[1]

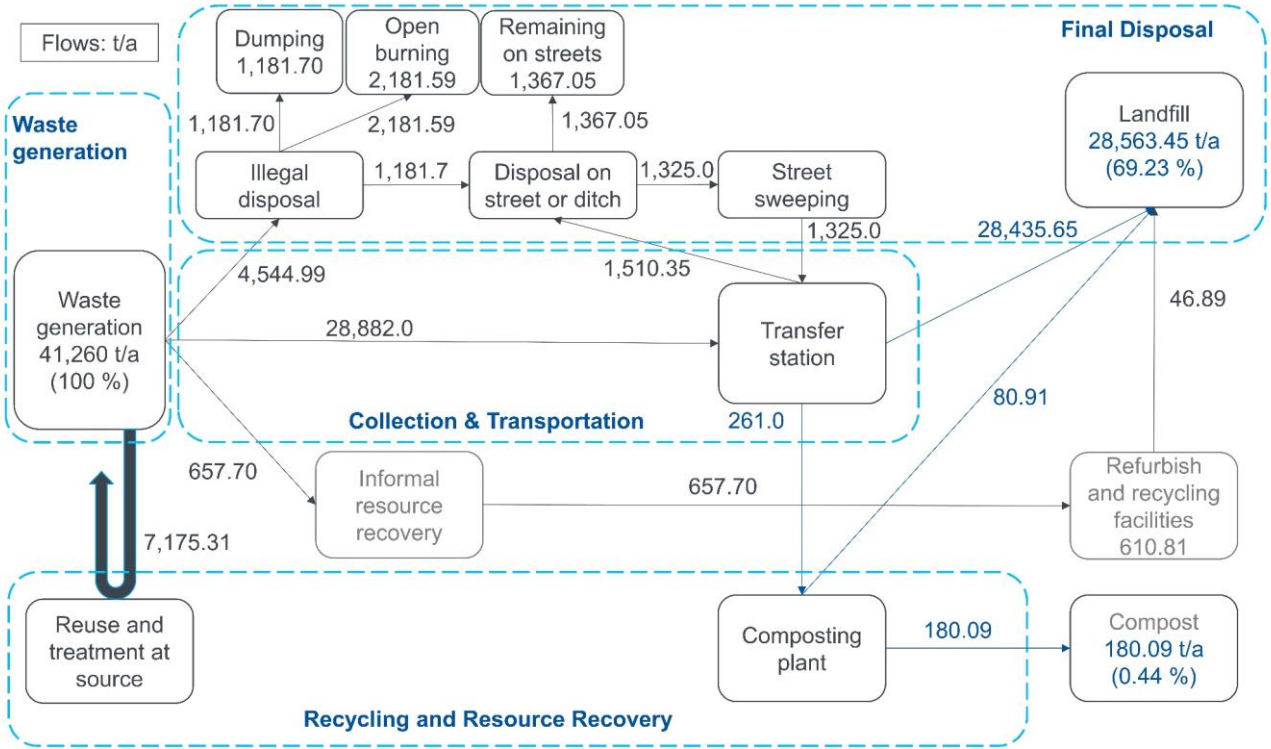
Bishoftu Town, Ethiopia

© GoogleEarth [8]

[1]

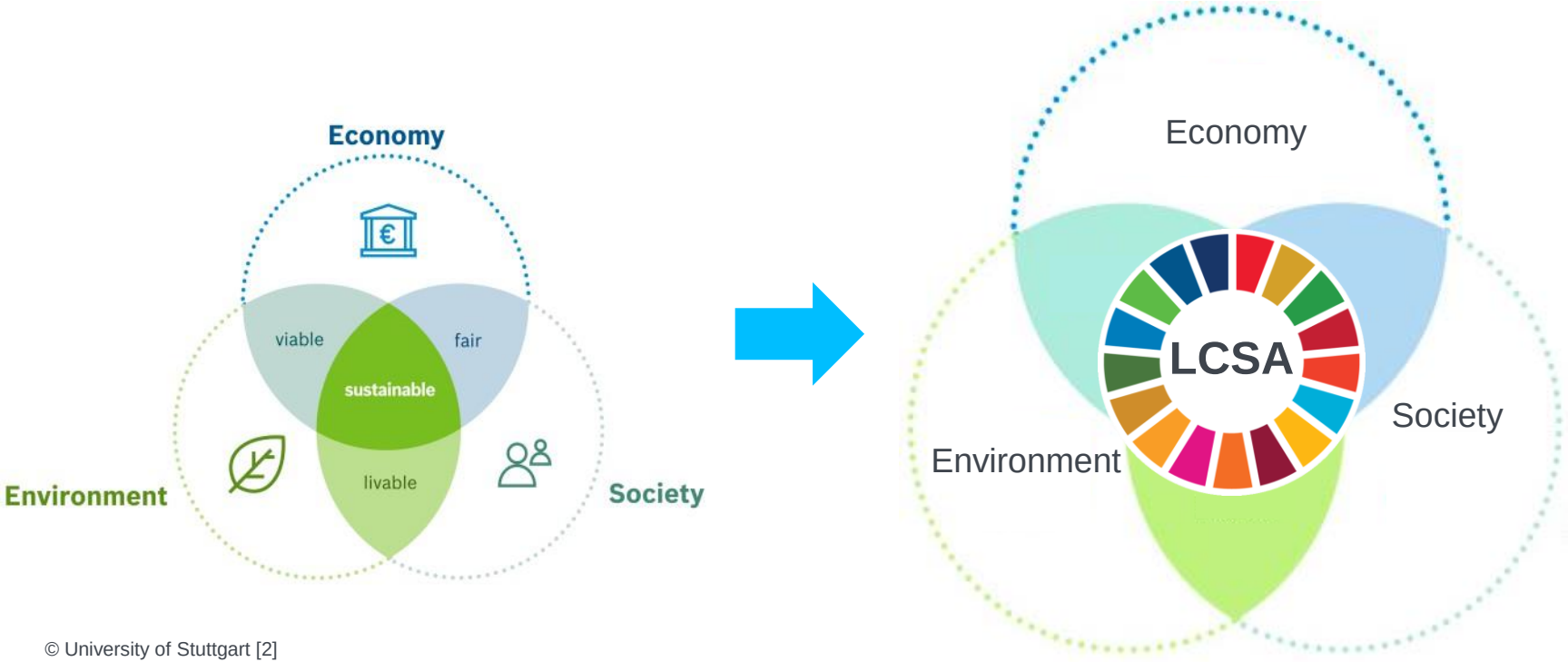
Modelling

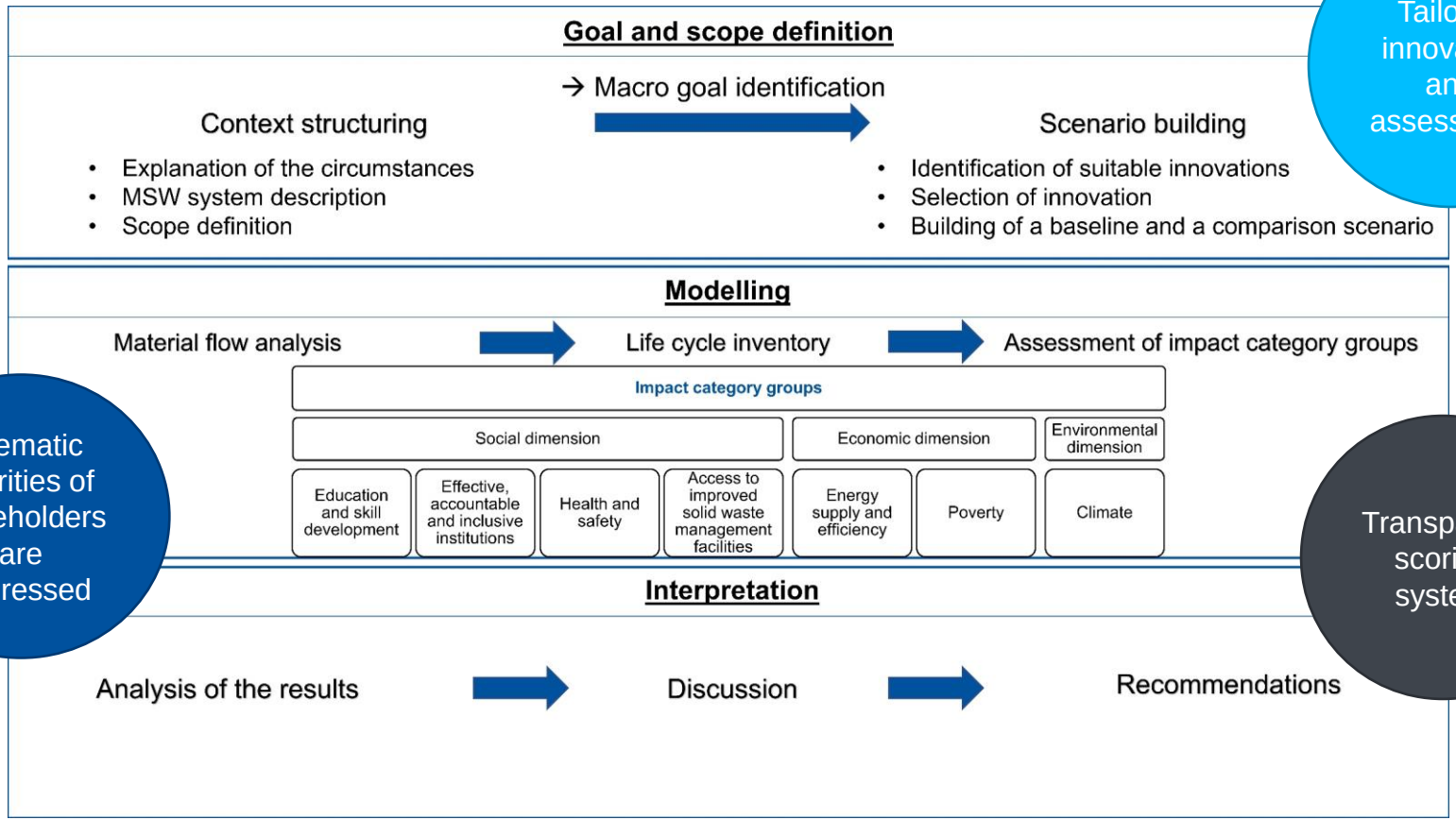
MFA: Baseline scenario – based on Admassu, 2022



[1]

Life Cycle Sustainability Assessment (LCSA)





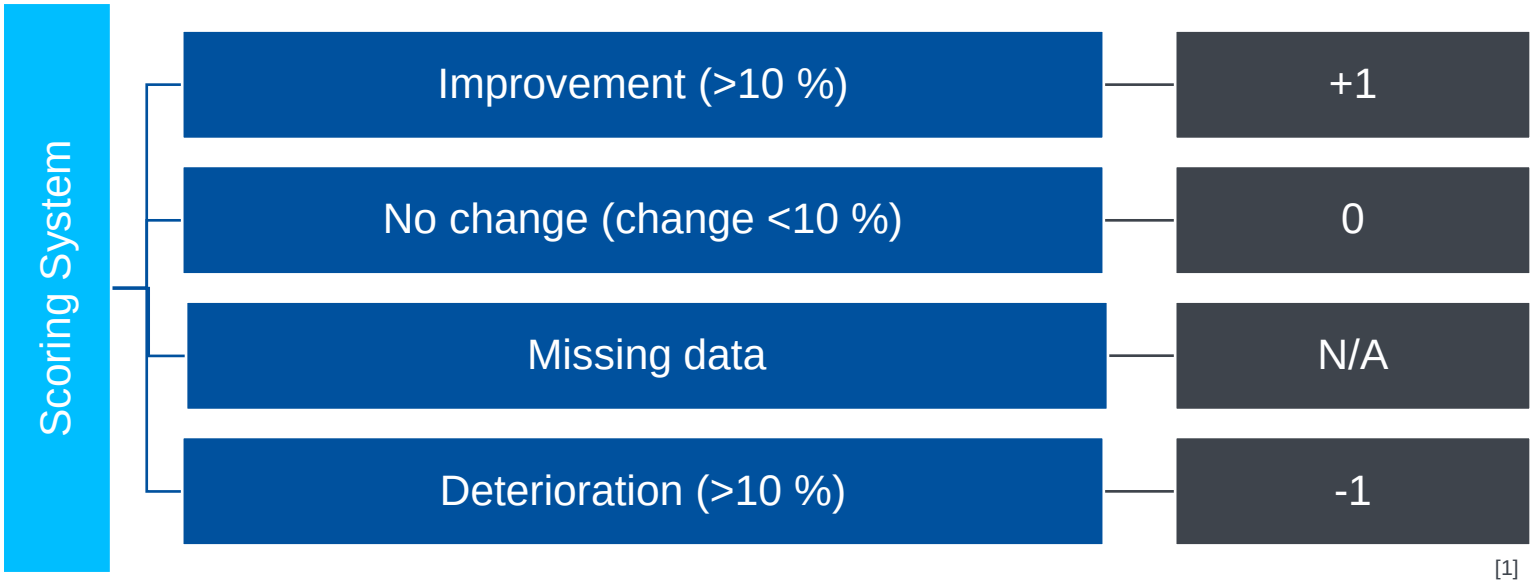
Tailored innovation and assessment

Thematic priorities of stakeholders are addressed

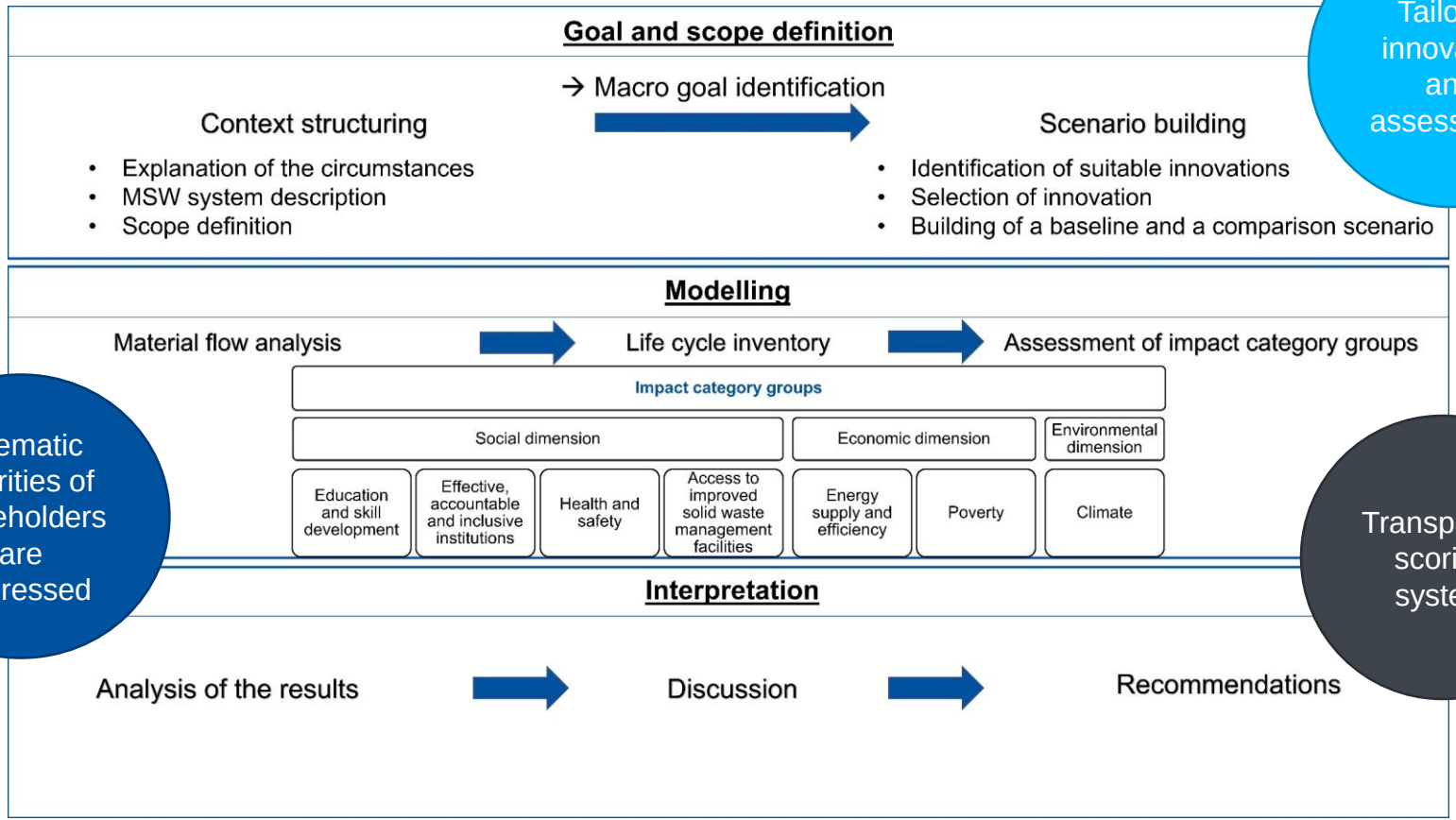
Transparent scoring system

[1]

Scoring System



[1]



Tailored innovation and assessment

Thematic priorities of stakeholders are addressed

Transparent scoring system

[1]

Indicator workshop

- **Goal:** "To keep the methodology relatively simple and clear the number of indicators is reduced to a core set of general indicators".

- **Number** of indicators → applicability
- **Data availability**
- Application of indicators for all **life cycle phases**
- **Clear connection** between indicator and MSWM

Photo of Indicator Workshop in Stuttgart: SuCCESS24 project

Sustainability Dimension	Impact Category Group	SDG	Impact Category	Indicators
Social	Education and skill development	4	Training / education	1. Provision of training / campaigns (workers / residents)
				2. Participation rate of training / campaigns
			Effectiveness of education / training	3. Number of people applying knowledge
				4. Proportion of workers reporting having personally felt discriminated against or harassed or stigmatized or not appreciated withing a set period of time – based on a ground of discrimination prohibited under international human rights law
				5. Social participation in solid waste separation
				6. Social perception towards waste management
			Quality of training / education	7. Satisfaction of the people with their training
	Effective, accountable, and inclusive institute	16	Cost of waste management services	8. Cost of waste management services for operating stakeholders involved in the waste management (e.g., disaggregated by municipality, associations (formal and informal sector))
			Effectiveness of waste management services	9. Rate of waste collected / transported / recycled / disposed of
			Inclusivity	10. Rate of female and male and diverse workers, by occupation, age and persons with disabilities and ethnicity in decision-making institutions / municipality / associations (formal and informal sector)
			Accountability	11. Proportion of workers who believe that decisions regarding waste management were implemented by the municipality / associations (formal and informal sector) as agreed upon
				12. Number of complaint units and their availability
	Health and safety	3	Accidents and health incidents	13. Workers' risk of accidents (disaggregated by sex and migrant status / ethnicity, etc.)
				14. Workers' perceived risk of health issues
				15. Particular matter formation
			Human toxicity	16. Human toxicity potential
	Access to improved solid waste management facilities	11, 12	Frequency of waste management services	17. Frequency of waste collection (disaggregated into different modes of collection)
			Waste treatment efficiency	18. Proportion of solid waste (disaggregated into different sectors) managed out of total waste generated
				19. Waste collection coverage
				20. Waste recovery and waste recycling rate
Economic	Energy supply and efficiency	7, 8, 9	Energy usage	21. Primary energy consumption (renewable and fossil)
			Energy Intensity	22. Energy intensity
	Poverty	1	Standard of living	23. Decent minimum basket of living compared to real consumption of workers
				24. Expenditure of workers
			Income	25. Income of formal workers by occupation, living below the international / national poverty line (disaggregated into municipality, association, private companies)
				26. Rate of formal workers, by occupation, living below the international / national poverty line
Environmental	Climate	13	Climate change	27. Global warming potential

[1]

Examples of suitable indicators

Sustainability Topic: Effective, accountable and inclusive institute
Impact Category: Cost of waste management services

Indicator	**Costs of waste management services for operating stakeholders involved in the waste management**
Unit	Birr/t or Cedi/t
Data requirements	Expenses of all waste management facilities/ actors for waste management services
Comments	Include questions on specific rates for waste collection services in questionnaires for different neighborhoods/ income levels

[2]

SDG-based Sustainability Assessment Framework

- The developed methodology was tested in the case of Bishoftu Town, Ethiopia. It is proven to work, helps **identify hot spots** and can help **optimise an MSWM** system according to the **stakeholder interests**.

- However the methodology is data intensive and complex therefore a **tool must be developed**, which facilitates the application of the LCSA Methodology.

[1]

Lisa Eberle

SDG-based Tool for the Sustainability Assessment of a MSWM-System

1. Purpose of the Tool

Purpose:

- Provide targeted measures adapted to the conditions of the solid waste management system
- Covers all sustainability dimensions (social, economic, environmental)
- Monitoring and decision support tool
- Integration of scenario development and optimization potentials to promote sustainable development
- Making the scientific method user-friendly

2. Tool Functionalities

Functionalities:

- Support analysis, evaluation and continues improvement of circular economy
- Monitoring tool with recommendations for action and scenario development
- Integration of hotspot analysis to display optimization potential
- Option to select evaluation parameters and assign different weightings

3. Structure

1. Manual / User guide:

- Explanation on how to use the tool

This tool was developed as part of the SuCCESS24 Project. The Project is a research project, focused on enhancing sustainable development in the sub-Saharan region by employing circular economy principles and resilient waste management practices. To provide targeted measures adapted to the conditions in this region, data regarding solid waste management systems has to be assessed. This tool facilitates this assessment and evaluation. The toolkit serves as a monitoring and decision-support system, integrating scenario development and optimization potentials to drive sustainable development in the corridor from Addis Ababa to Adama, Ethiopia.
The tool is used to assess municipal waste management systems using the Life Cycle Sustainability Analysis framework methodology and a set of SDG-based indicators.

The SuCCESS24 Project's website can be visited by clicking on the logo.
The Project is funded by BMBF and DAAD.

General Information:

In general, the tool is divided into different Excel worksheets, which are color-coded.

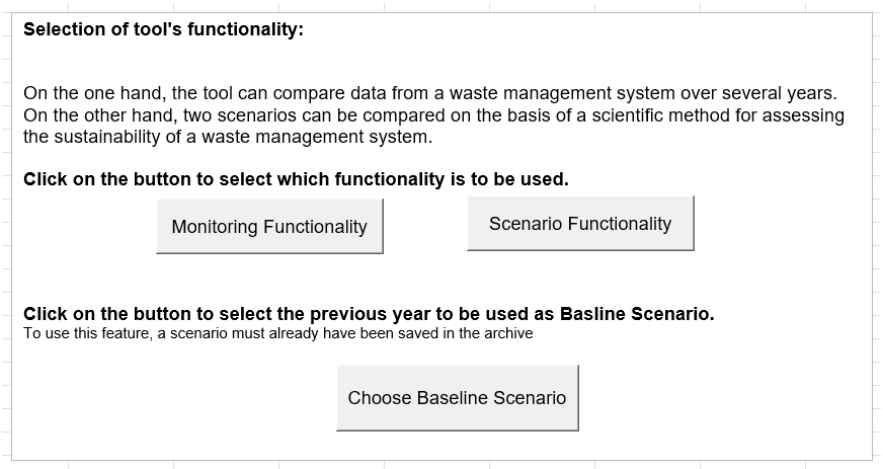
Blue tab colors contain instructions or assumptions that have been made in the calculations. Buttons can be selected here to define the desired functions of the tool, as well as to save or delete input data.

Entries can be made on the **green** Excel sheet for the waste management system to be analyzed. General information on the mass flows and waste composition is entered on the "MFA" (Material Flow Analysis) worksheet. More specific information on the different Life Cycle Phases can be entered on the separate worksheets provided for this purpose. The Life Cycle Phases include Transport & Collection, Recycling, and Landfilling. In this tool, transport and collection of the waste are considered together as one Life Cycle Stage because these processes are carried out by the same institution.

3. Structure

1. Manual / User guide:

- Selection of the tool's functionality
  - **Monitoring:** Compares data of MSWM System over several years
  - **Scenario:** Compares different Scenarios based on the LCSA framework methodology



3. Structure

1. Manual / User guide:

- Assumptions that were made for calculations

4. Processes that take place in the informal sector are not taken into account, as no data is available.

5. Greenhousegas emissions related to used equipment (vehicles, sifters, rakes, etc.) and the construction of waste management facilities are excluded.

6. The **Scoring System** for the indicator values is based on the following rules [2]:

Sustainability Topic	Score if indicator results in Comparison Scenario with the Baseline Scenario	
	Lower	Higher
Costs of waste management services; Accidents and health incidents; Human toxicity; Income; Climate change	+1	-1
Training / education; Effectiveness of training / education; Quality of training / education; Effectiveness of waste management services; Inclusivity; Accountability; Frequency of waste management services; Waste treatment efficiency; Primary energy consumption; Energy intensity; Standard of living	-1	+1

7. When querying the working hours of employees, it is assumed that they work 52 weeks a year. Public holidays are not taken into account.

3. Structure

2. Determination of Sustainability Topics:

Sustainability Dimension	SDG Goal [3]	Sustainability Topic	Impact Category	Consideration of Sustainability Topic
Social		Education and skill development	Training / Education	Consider Sustainability Topic
			Effectiveness of training / education	
			Quality of training / rducation	
		Effective, accountable and inclusive institutions	Cost of waste management service	Consider Sustainability Topic
			Effectiveness of waste managment services	
			Inclusivity	
			Accountability	
		Health and safety	Accidents and health incidents	Consider Sustainability Topic
		Access to improved solid waste management facilities	Waste treatment efficiency	Consider Sustainability Topic
Economy		Energy supply and efficiency	Energy usage	Consider Sustainability Topic
			Energy intensity	
		Poverty	Standard of living	Consider Sustainability Topic
			Income	
Environmental		Climate	Climate change	Consider Sustainability Topic

3. Structure

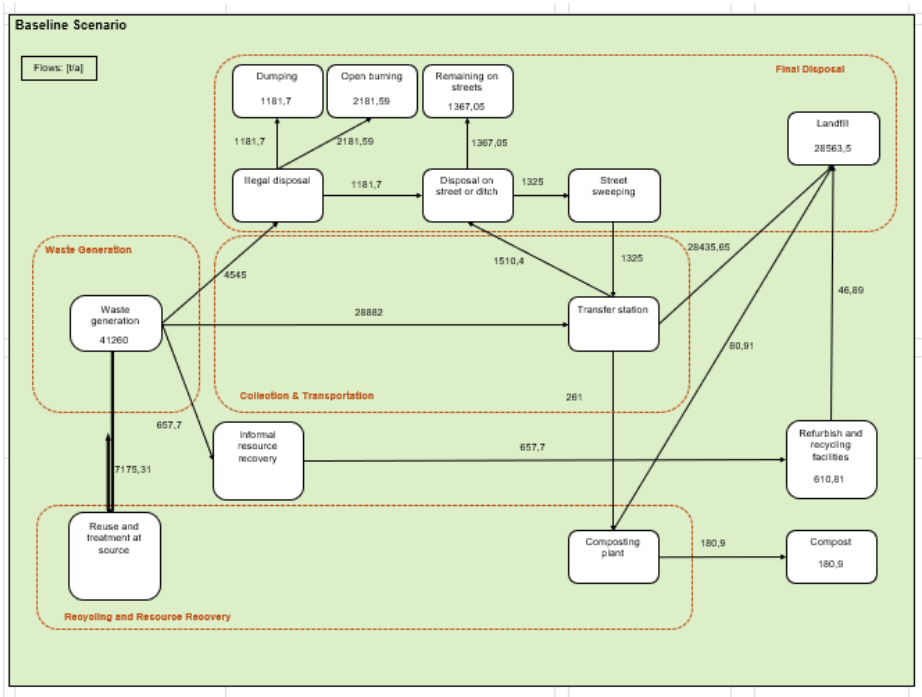
3. Material Flow Analysis (MFA):

Material Flow Analysis

Flows		Baseline Scenario [t/a]	Alternative Scenario [t/a]
Municipal solid waste generation		41260	41260
Collection & Transportation	Transport waste generation to transfer station	28882	28882
	Waste at transfer station		
	Transport transfer station to comopsting plant	261	9983
	Transport transfer station to landfill	28435,65	18713,65
	Transport transfer composting plant to landfill	80,91	3094,73
	Transport refurbish and recycling facilities to landfill	46,89	46,89
Informal resource recovery		657,7	657,7
Refurbish and recycling facilities		610,81	610,81
Recycling and Resource Recovery	Reuse and treatment at source	7175,31	7175,31
	Composting plant		
	Produced compost	180,9	6888,27
Final Disposal	Landfill	28563,5	21855,27
	Dumping	1181,7	1181,7
	Open buring	2181,59	2181,59
	Remaining on streets	1367,05	1367,05
	Disposal on street or ditch	1181,7	1181,7
	Waste disposal on street or ditch from transfer station	1510,4	1510,4
	Illegal disposal	4545	4545
	Street sweeping	1325	1325

3. Structure

3. MFA:



3. Structure and Calculation

4. Life Cycle Phases:

- Input Worksheets for Transport & Collection, Recycling / Composting and Landfill
- Some Input fields can be pre-filled with information from MFA

Assessment Transport & Collection

Impact Category			Baseline Scenario	Alternative Scenario
Training / Education	Provision of trainings / campaigns	[-]	No	Yes
	Topics of trainings / campaigns	[-]	Transportation	Transportation, Collection
	Responsible organization	[-]	Health officer	Health officer
	Offered training / campaign frequency	[-]	One-time	Annually
	Praticipation rate of trainings / campaigns	[%]	20	30
	Format of trainings / campaigns	[-]	Door-to-door	Door-to-door
Effectiveness of training / education	Share of people applying knowledge	[%]	20	30
	Participation rate in solid waste separation	[%]	20	20
Quality of training / education	Share of people satisfied with training	[%]	67	100
Accidents and health incidents	Workers' risk of accidents	[%]	10	10
	Workers' precieved risk of health issues	[%]	20	20
Waste treatment efficiency	Proportion of solid waste managed out of total waste generated	[%]	74,81	
Energy usage	Primary energy consumption per year (renewable)	[kWh]	0	0
	Primary energy consumption per year (fossil)	[kWh]	139962,83	139962,83
Energy intensity	Energy intensity	[kWh/t treated waste]	4,85	4,85
Standard of living	Income above minimum expenditure basket	[-]	No	No
Income	Rate of formal workers living below international poverty line	[%]	63	63
Climate change	Global Warming Potential	[kg CO_2e/year]	38,28	38,28

3. Structure

4. Life Cycle Phases:

- If data is missing, some values can be calculated with default values using auxiliary calculations

Auxiliary Calculation GWP			
		Baseline Scenario	Alternative Scebario
Fuel Consumption per year	[l/year]	0,00	0,00
Fuel Emission Factor	[kg CO_2/l]	2,68	2,68
GHG Emissions Fuel Consumption	[kg CO_2e/year]	0,00	0,00
Waste dumping	[t/year]	1181,70	1181,70
Waste remaining on streets	[t/year]	1367,05	1367,05
Total amount of waste landfilled	[t/year]	28563,50	21855,27
DOC		0,30	0,30
Fraction of DOC dissimilatd		0,50	0,50
Methane correction factor MFC (unmanaged shallow)		0,40	0,40
Fraction of Methane in developed gas (F)		0,50	0,50
GWP Methane		25,00	25,00
GHG Emission Waste Dumping	[kg CO_2e/year]	1181700,00	1181700,00
GHG Emission Waste remaining on street	[kg CO_2e/year]	1367050,00	1367050,00
GHG Emission amount of waste at landfill	[kg CO_2e/year]	28563500,00	21855270,00
Waste Open Burning	[t]	2181,59	2181,59
CH_4 Emission Factor for Waste Burning	[kg CH_4/t treated waste]	6,50	6,50
GHG Emission Open waste burning	[kg CO_2e/year]	354508,38	354508,38
Total GHG Emission	[kg CO_2e/year]	31466758,38	24758528,38

3. Structure

5. Calculations:

- Calculations carried out in the background
- Scenarios are compared and values assigned to the indicators
- Results of the assessment displayed in diagrams

Baseline scenario	Alternative scenario	Intermediate calculati step Baseline Scenari	Intermediate calculation s Alternative Scenario	Scoring System Score
0	0			FALSCH
0	0			0
0	0			
0	0	#NV	#NV	#NV
0	0			0
0	0			
0	0			0
0	0			0
0	0			0
741000	5429057			-1
19	36			
6	8			
3	5			
1500	4000			
0	0			
0	0			
0,459	0,459			
52	52			
8675	8675			
0,0013	0,05			
1,53	1,53			
67,3	67,3			
0	31121,46			
0	0			
0	31121,46			
342000	4608000			
1627,198513	2944,9134			
4096,185738	788,1597266			
19,42295201	35,67930199			1

3. Structure

7. Results:

- Two worksheets with the results summary, which appear depending on which functionality has been selected at the beginning

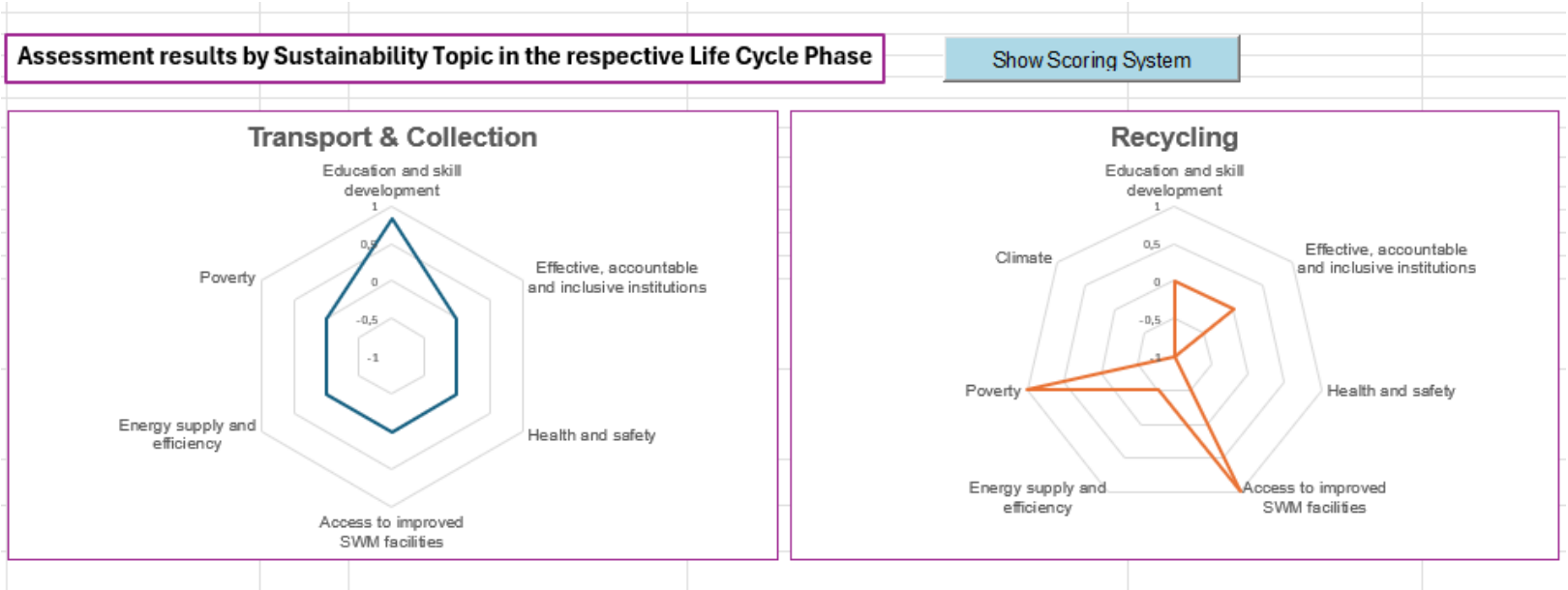
- Scores of the assessment according to the Sustainability Topics

Sustainability Dimension		Sustainability Topic	Impact Category	Transport & Collection Score	Recycling Score	Landfill Score
Social		Education and skill development	Training/ Education	0	0	0
			Effectiveness of training/education			
			Quality of training/education			
		Effective, accountable and inclusive institutions	Cost of waste management service	0	0,25	-0,25
			Effectiveness of waste managment services			
			Inclusivity			
			Accountability			
		Health and safety	Accidents and health incidents	0	-1	0,5
		Access to improved solid waste management facilities	Waste treatment efficiency	0	1	0
Economy		Energy supply and efficiency	Energy usage	0	-0,5	0,5
			Energy intensity			
		Poverty	Standard of living	0	1	0
			Income			
Environmental		Climate	Climate change	0	-1	1

3. Structure

7. Results:

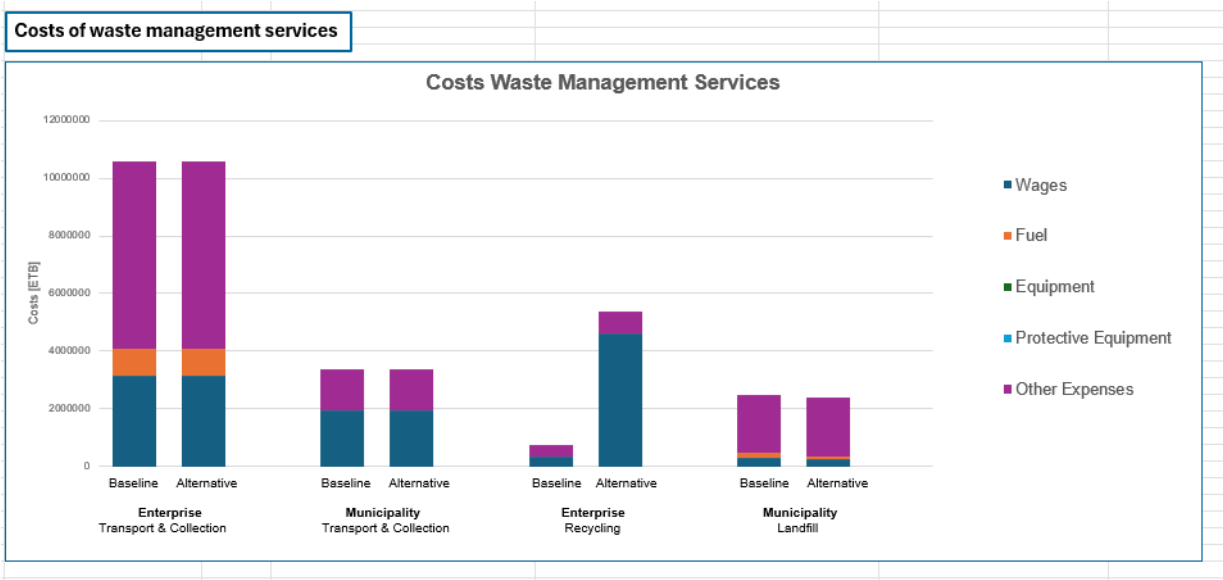
Graphical representation of the assessment according to the Sustainability Topics



3. Structure

6. Results:

- Compares Baseline and Alternative Scenario through graphs:
  - Costs of waste management
  - Rate of managed waste
  - Energy consumption
  - Global warming potential



University of Stuttgart
Germany

Thank you!

Lisa Eberle

e-mail lisa-m.eberle@web.de
Phone +49 15172923477

University of Stuttgart
Insitute for Acoustics and Building Physics
Life Cycle Engineering GaBi

Outlook work session

- 2 different tasks: detailed descriptions will be available on the work tables

TASK 1

Group 1 and 2:
Please identify differences of Ghanaian to Ethiopian MSWM systems and generate a generic Material Flow Analysis (MFA) for the case of a Ghanaian MSWM system.

- Life cycle phases
- Waste management processes
- Associated stakeholders

TASK 2

Group 3 and 4:
Please provide feedback on the tool‘s indicators and data set for their adaptation to Ghanaian MSWM systems.

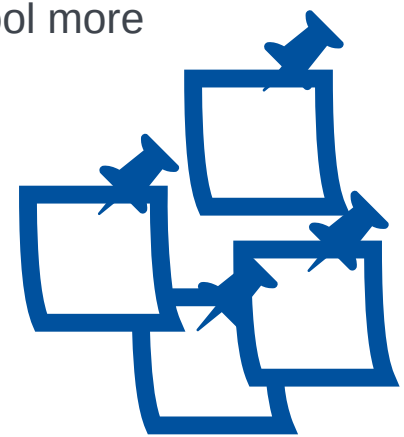
- Applicability of existing indicators
- Data availability

- In the upcoming Summer School, our students will have to work with today's outcomes.

General feedback on the tool

- Were the instructions and help text clear and sufficient?
- Is the structure clear?
- Would you like to see additional input information?
- Who do you expect to use the tool?
- What specific improvements would you suggest to make the tool more useful and user-friendly?

Please use the pinboard to share them with us!



Lunch break

Thank you for your kind attention.

Group work

Recap

- Insights into project work of SuCCESS24
- Overview of Ethiopian Waste Management Systems
- Overview of SDG-based assessment methodology (LCSA framework)
- Overview of LCSA tool
- Understanding and identification of the system boundaries, waste management processes, stakeholders and suitable indicators

Thank you very much!

Take care!

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