



Development of the Circular Economy within Developing Regions: a Comparative Analysis of Advantages and Opportunities for Waste Valorization

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1. INTRODUCTION

Circular Economy (CE) is the system that would turn goods that are at the end of their service life into resources for others.

Stahel, Nature, 2017

A successful implementation of **CE** policy requires efforts at three levels:

- Micro-level (factories)
- Meso-level (Cooperation through private and public)
- Macro-level (National levels)

where the complexity of practices increase when the scale level rise.

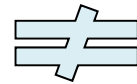
Su et al., J. Of Cleaner Production, 2013



1. INTRODUCTION



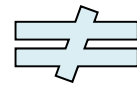
High Income Countries



Low Income Countries



EU Countries



No-EU Countries



- Many Management Issues

- No effective changes in short terms

So, why a developing country should introduce the Circular Economy?



2. OBJECTIVE

List and compare the current opportunities for developing a **Circular Economy** system in two developing countries:

- ➔ • **Romania:** European Middle-Income developing country
- **Bolivia:** Low-middle Income developing country



2. METHOD

- ➔
1. Study of the **scientific and local literature**
 2. Suggesting a possible **Circular Economy Model**
 3. International Cooperation and the implementation of **International agreements** between
 - Italian and Romanian Universities
 - Italian and Bolivian Universities



2. MATERIAL

BOLIVIA

10,500,000 inhabitants
3,000 US\$ GNI
1,098,581 km²
9.5 inhabitants per km²

- Lack of scientific literature



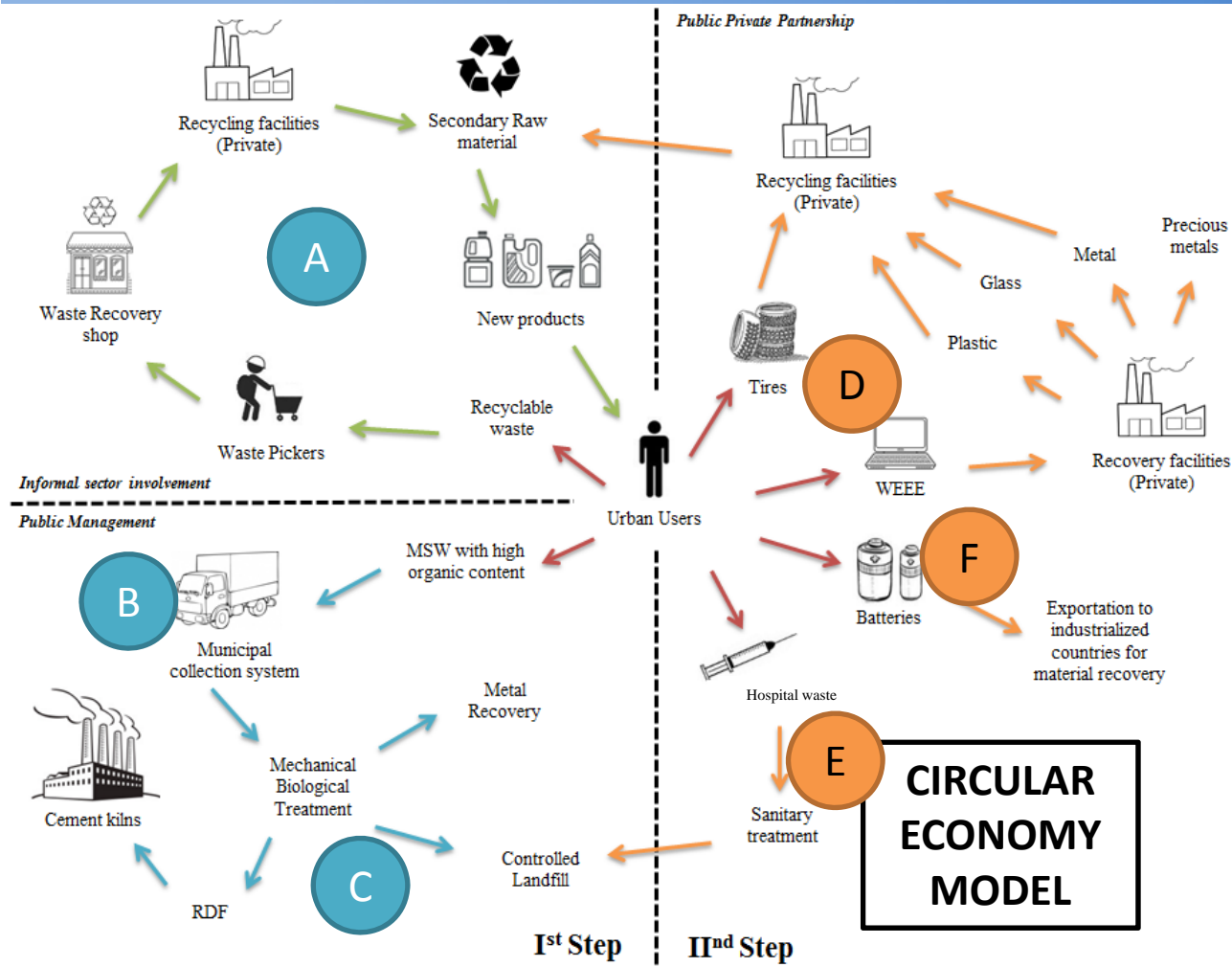
ROMANIA

21,584,365 inhabitants
9,500 US\$ GNI
238,391 km²
90.5 inhabitants per km²

- Abundance of scientific literature



2. MATERIAL



Hypothesis:

First step

- ➔ Informal sector inclusion
- B. No selective collection required by the Municipalities
- C. Production of RDF and waste stabilization by MBT before landfill



Second step

- D. Tyres and WEEE recovery
- E. Hospital waste treatment
- F. Used Batteries collection and exportation for recovery



2. MATERIAL

Main Advantages and Disadvantages of the Solid waste management Model

	WASTE PICKERS	MUNICIPALITY	PRIVATE SECTOR	HOUSEHOLD
	<ul style="list-style-type: none"> • Sanitary assistance • Retirement guaranteed • Public acceptance 	<ul style="list-style-type: none"> • Improvement of public sensitivity • Reliable information • Landfill sustainable management 	<ul style="list-style-type: none"> • Enhancing recycling activities • New markets introduced within the area 	<ul style="list-style-type: none"> • Curbside collection for free • Upgrading of street cleanliness
	<ul style="list-style-type: none"> • Introduction of a regulation within the daily collection activity • Change in habits • Limited Collection areas 	<ul style="list-style-type: none"> • New policies should be introduced • Preliminary investments required • Long time for seeing a visible change 	<ul style="list-style-type: none"> • Competition with new companies in the system 	<ul style="list-style-type: none"> • Efforts required to change the usual MSW delivering



3. RESULTS

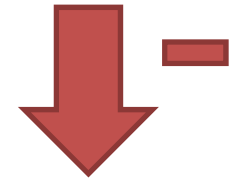
Romania

Current Solid waste management

- MSW generation (2011): 0.78 – 1.03 kg inh⁻¹ d⁻¹ (Mihai, F. C., 2011)
- Informal collection: about 40,000 workers (European Commission, 2017)

- Recycling rates: 3% (Fischer, C., 2004) - 13% (European Environment Agency, 2017)
- MSW Collected and treated: 80% (Căilean, D., 2016)


- High demand of energy from Cement-kilns: RDF requirements ten times higher than the currently available quantities (Almasi, A. M, 2017)
- High recycling rate in plastics materials (55%) (European Environment Agency, 2017)



3. RESULTS

The European Framework (European Commission, 2017)

EU TARGETS FOR 2030

- 
- **Discourage** landfilling
 - Recycling 75% of **Plastic waste**
 - **Reduce landfilling** to 10% of the MSW produced
 - **Recycling** the 65% of MSW

HORIZON 2020





- 3% of the EU's GDP to be **invested in Research** and Development
- **Greenhouse gas emissions** 20% lower than 1990, 20% of energy from **renewables**, 20% increase in **energy efficiency**
- At least 20 million fewer **people in or at risk of poverty**



3. RESULTS

Romania

Targets set up for MSW management provided by EU (Atudorei A., 2006)

	Reduction of biodegradable MSW to landfills	Packaging waste Recycling rate	Recycling rate
2011	25%		
2013		 55%	
2015	50%		
2016	 65%		
2020			  50%

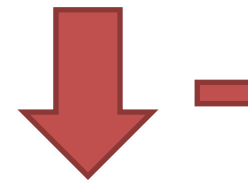


3. RESULTS

Bolivia

Solid waste management

- 1,677,650 tons per year of MSW
 - About 0.5 kg inh⁻¹ y⁻¹ in urban areas
 - About 0.2 kg inh⁻¹ y⁻¹ in rural areas
- 51% of municipalities without sanitation services
- 40-60% of costs covered by urban charges
- Recycling rate: 4.6%
- **Current Data are not available at national level!**
- Informal Pickers: about 10,000 people



3. RESULTS

The comparison between Bolivia and Romania

	GNI	Waste production	Recycling rate	Informal sector activities	Coverage of the collection service	Waste collected and treated
	(USD)	(kg inh ⁻¹ d ⁻¹)	(%)	(number of workers)	(%)	(%)
Bolivia	3 000	0.2-0.6	4.5	10 000	49	45
Romania	9 500	0.78-1	13	40 000	70	80



Sanitary landfill: 8%



4. DISCUSSION

Pros & Cons of EU regulations for a developing county

PROS

- **Regulation system** ready to be introduced
- **Economic aids** and European funds
- Reliable **information sets required** by EU
- Obligatory introduction of **CE principles**
- **Technical support** and open markets

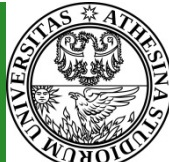
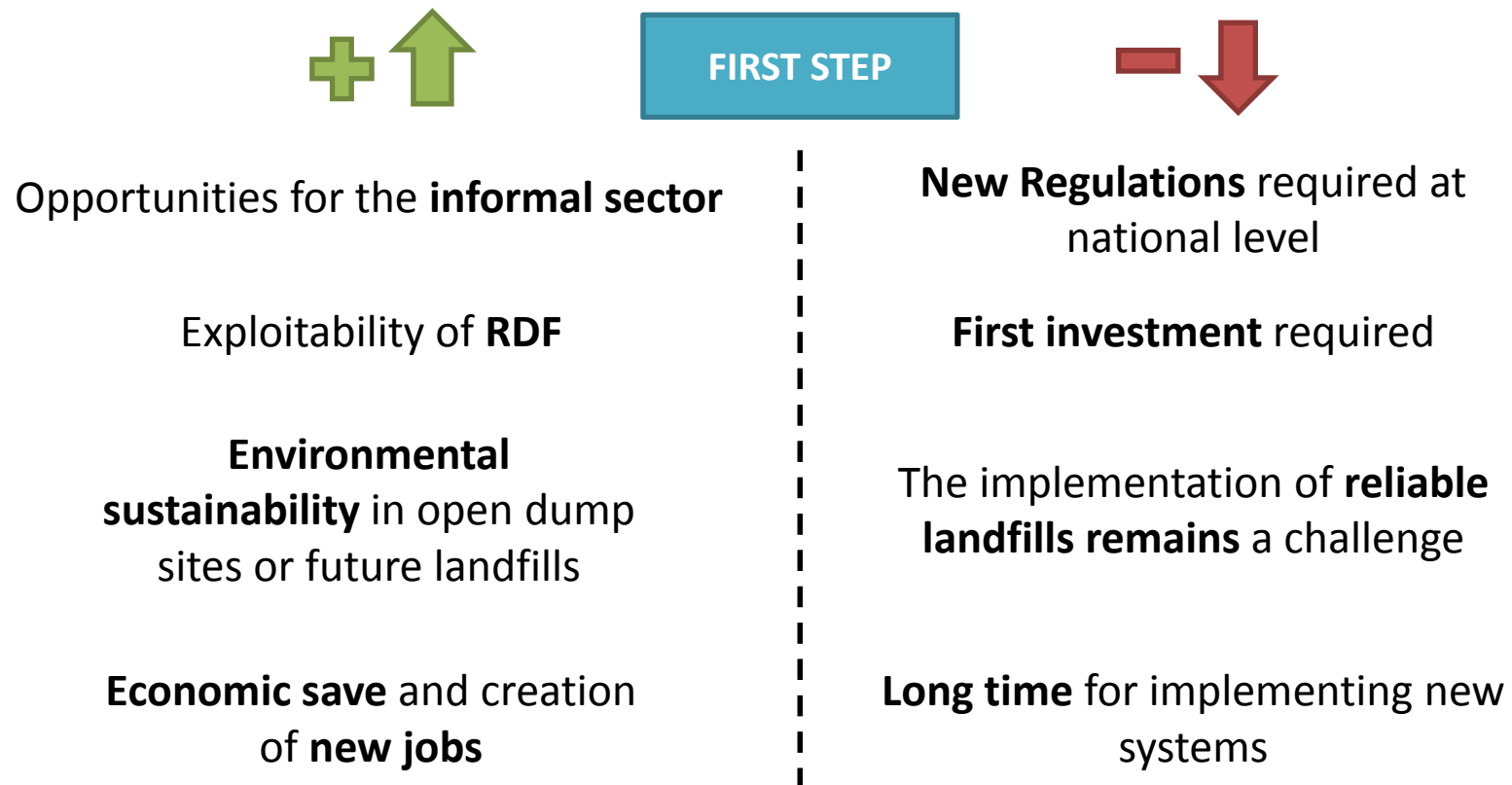
CONS

- **Goals quite strengths** for a developing region
- **Scarce indications** for achieving the recycling rate required
- **Expensive penalties** which should be paid in case of failure
- Poor consideration of current SWM practices (**informal sector**)



4. DISCUSSION

SO, WHY A DEVELOPING COUNTRY SHOULD INTRODUCE THE CIRCULAR ECONOMY?

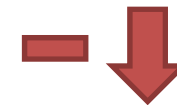


4. DISCUSSION

SO, WHY A DEVELOPING COUNTRY SHOULD INTRODUCE THE CIRCULAR ECONOMY?



SECOND STEP



Reduction of **waste** inflow into the landfill

Management of **hazardous materials**
which threatens the health of citizens

New source of **income**

New **investment** from the private
sector

Creation of **new jobs**

Lack of **know-how**

Long time required

International cooperation and
improvement of **national regulations**

Management issues for introducing
the systems



5. CONCLUSIONS

- ➔ 1. **Bolivia and Romania** can be considered effective case studies for comparing management issues in MSW management inside and outside the EU: **management issues are comparable;**
2. **Circular Economy models can be a viable way for improving the future environmental and economic state** in developing countries although many management issues are still present;
3. **EU has an important role** for improving environmental management state of middle income countries although the **objectives forecasted could be too difficult to achieve;**
4. **International cooperation plays an important role** in developing sustainable future plans;





Any Question?

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