The 70th TIEC Research Presentation

Solid Waste Composting Feasibility through Cash Flow Analysis
Case study in Rabat region, Morocco

27 November 2021

Presented by:

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Introduction

Population growth

- Excessive solid waste generation
  ➔problems related to MSW

Common situation in Many developing countries

- Economical growth
- Consumer habits changing

Agriculture

- acts as a **soil nutrient**
- **soil conditioner**

Waste Management

- Reduce landfilled waste

➔ prolong landfill lifetime

➔ **Is compost feasible in the area of study ?**

Research question:

Is composting economically feasible in the context of the study area?

Previous experiences of composting -in developing countries especially- have shown that it **has not been** particularly **successful** (except for a few success stories).

In Nigeria and in other developing countries **most of the composting plants have failed**. For instance, **nine out of eleven plants** have been closed in India and **eighteen out fifty-four** facilities failed in Brazil between 1974 and 1996 (UNEP, 1996; Hoornweg,1999).

The failures were attributed to: (Hoornweg *et al.*, 1999)

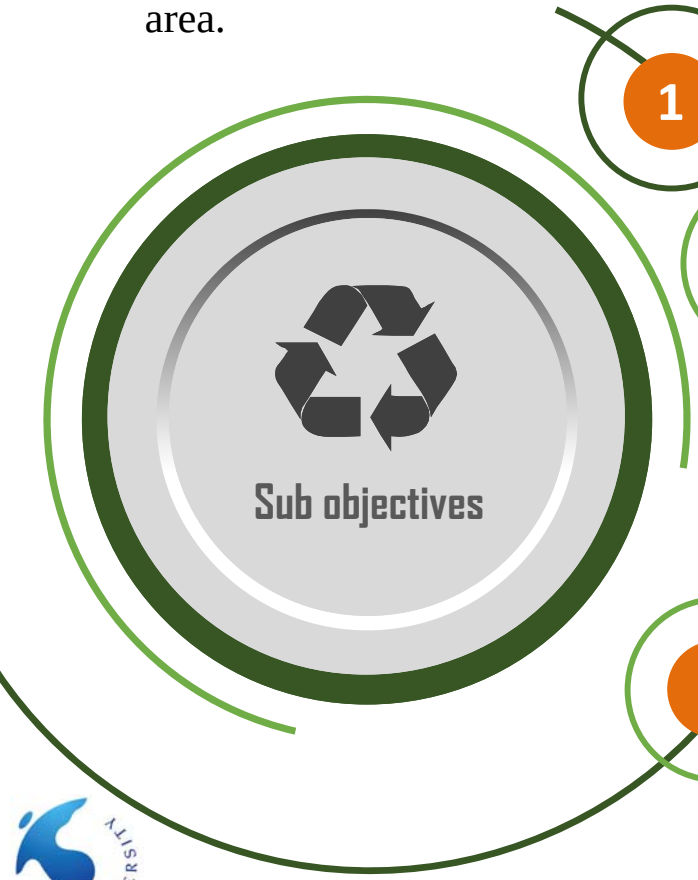
- Lack of understanding and maintaining biological conditions
- High costs
- Poor presorting of **incoming wastes**
- **Failure to understand market** condition

Composting activity in Marrakech Organics Summer Program, June 24th – July 6th, 2019

- **Is compost feasible in the area of study ?**
- **Farmers acceptance**
- **Benefit to cost analysis**

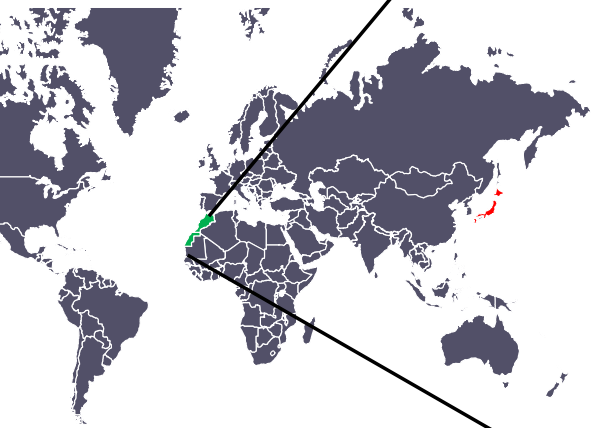
Aims and objectives

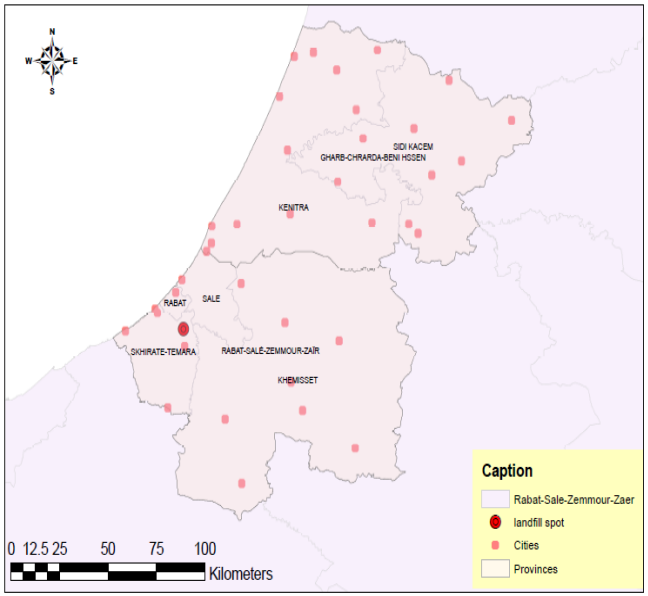
The **main objective is to** Assess the **financial feasibility of solid waste composting** within the context of the study area.



1. Assess the **current situation** of composting industry in Rabat area
2. Identify the **inhibitors** or challenges that are keeping composting from succeeding
3. Determine **cashflow** and **material flow** for compost in the Area of study
4. Assess the financial **feasibility through** a cash flow analysis model

Delimitation of the study area





- Includes **3 prefectures** subdivided into **7 municipalities.**
- Surface: 1858, 5 km².
- **68 800 ha** of agricultural area
- **600 mm** average annual rainfall
- **1 878 958 inhabitants** according to the National census of 2014

Compost in Morocco : General Context

- Compost production in Morocco : **very limited**, only few pilot experiments in the country over the last decades.

- In recent years, some **small scale** composting units (like Green Elephant in Rabat). The composted materials are either **household waste**, **restaurant** remains or **green waste** in the case of Rabat.
- Reports indicated **low commercialization of compost** because of several **issues.**

Composting activity in Marrakech Organics Summer Program, June 24th – July 6th, 2019

Composting Experiences in Morocco

City	Inauguration year	Nominal Capacity (t/day)	Managing entity	Year of demise
Rabat	1971	180	RED	1971
Tetouan	1964	50	Municipality	Never started
Marrakech	1976	140	Municipality	1980
Meknes	1980	200	Municipality	1986
Casablanca	1975	700	Municipality	1975
Rabat	2016	41	Elephant vert	2017
Meknes	2015	60➔120 (2016)	Elephant vert	Still in service

Source : Master plan for SWM in Tiznit Area-Mission III (2011)

From the 1960s, Morocco set up a dozen composting facilities. However, since 2000, all have had to close under the weight of technical and economic constraints (ECUNA,2014)

- First plants: **French technology** + **Local conditions** of collection and separation not considered;
- **Quality**: large quantities of plastics,(impurity >10%) (source : Master Plan for SWM);
- **Managing entities**: public ;
- **Advertisement;**
- **Irregularity** in production.

Photo of compost produced by"Elephant Vert" NGO In Meknes city (2017)

Current situation of composting

Photos of some EV adjusted "biofertilizer Products (source EV Website)

One of the main differences in the successful plant is its efforts to market its compost as " **biofertilizer**" and **adjust** its quality and NPK contents to farmers needs

Model : flowchart of cash and matter.

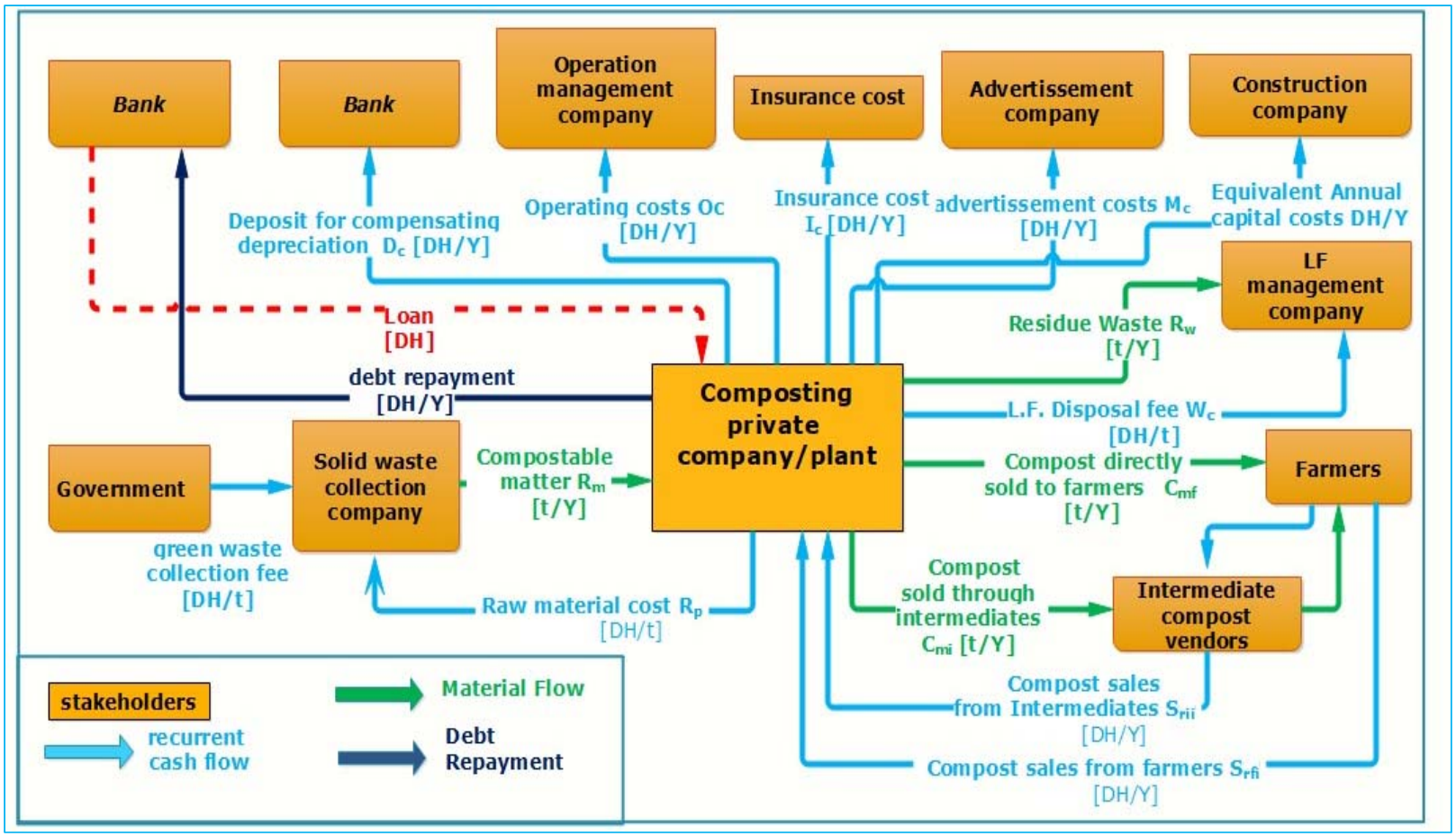


Figure: cash and material flow of composting

costs estimation

- **Capital costs** estimation were based on local prices and practices (such as **windrows, straw roof ,wooden posts** and local labor force prices).
- The table shows the different capital costs borne by the composting plant in Dh (1DH =11yen)

Item	Details	designation	Quantity	Unit price [€]	Total price [€]	Total price [DH]
construction	administration area		-	-	-	505,640.0
	Parking		-	-	-	85,000.0
	storing area		-	-	-	342,340.0
	composting area		-	-	-	439,500.0
	conditioning area		-	-	-	135,950.0
Construction total cost [DH]						1,464,495.1
Initial Equipment	truck scale	80 ton + foundations etc.	1	36,900	36,900	1,547,147
	wheel loader	wheel loader with 50 m^3 refuse bucket (caterpillar 924K)	1	65,400	65,400	2,742,097
	dump truck	16 m^3, 10 ton	1	40,320	40,320	1,690,541
	water tanker	8000 liters	1	7,380	7,380	309,429
	shredder	cap. 30 tons/hr, 175hp	1	41,000	41,000	1,719,052
	trommel	Screen 8 mm, & conveyors	1	51,000	51,000	2,138,333
Equipment total [DH]						10,146,598
total [DH]						11,611,093
TVA tax (20%)						2,322,219
Total capital costs (Tax included) [DH]						13,933,312

Compost sales estimation

Potential demand estimation

Crop calendar and compost application rates

Actual demand estimation

Actualization coefficient based on farmers WTP (comparing farmers WTP with the local compost prices to find actual demand)

Compost sales

Compost local prices and actual demand from farmers

Potential demand :Agricultural area

- Total : **agricultural area** of **68 800 ha**,
- Table: the allocation of **agricultural area** in regards of the different **crops**.

Type of agriculture	Crops	Surface (Ha)	Total
Cereals	Soft wheat	21 900	33 800 (49%)
	Durum Wheat	3 200	
	Barley	8 700	
Leguminous Crops.	Beans	980	1 600 (2.3%)
	Peas	520	
	chickpeas	100	
Forage crops	Grass, etc.	7 800	7 800 (**11.3%**)
Gardening (fruits and vegetables)		3 588	5 523 (9.6%)
		1 935	
Fruit trees	Vine fruit	1 975	4 770 (**7%**)
	Rosacea (apples pears ...)	1 155	
	Tropical crops	634	
	Citrus	328	
	Olive trees	300	
	Almond trees	38	
	Fig trees	320	
	Grenadier	20	

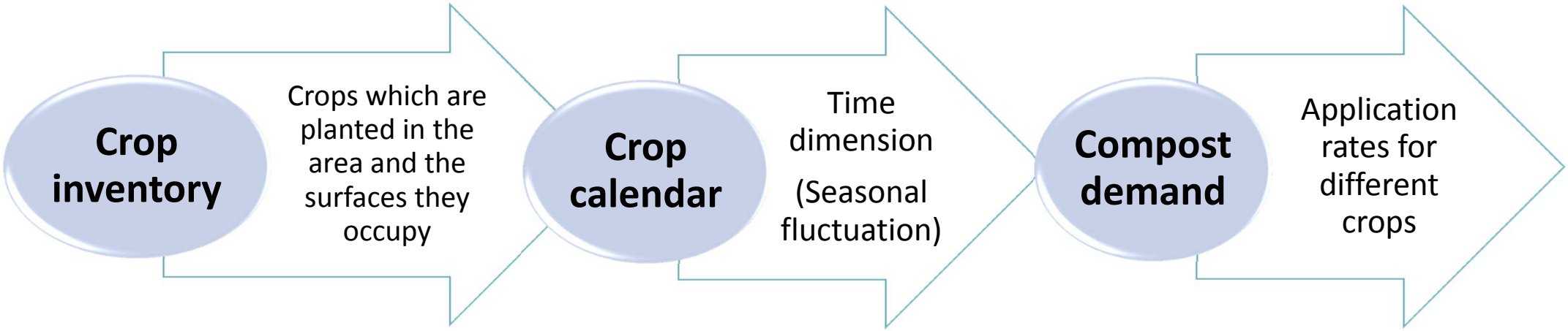
Estimation of Compost Potential Standard Demand (PSD)

PSD here refers to the quantity of compost to be used by farmers if:

- Standard application rates of compost are applied,
- **100% of the arable farmland** in the area of study is considered.

Standard application rates are defined as the amount of compost needed in [t /Ha] for every specific type of crops (ZEDDOU,2008 summarizes their values for the study area)

Flow of compost demand calculation



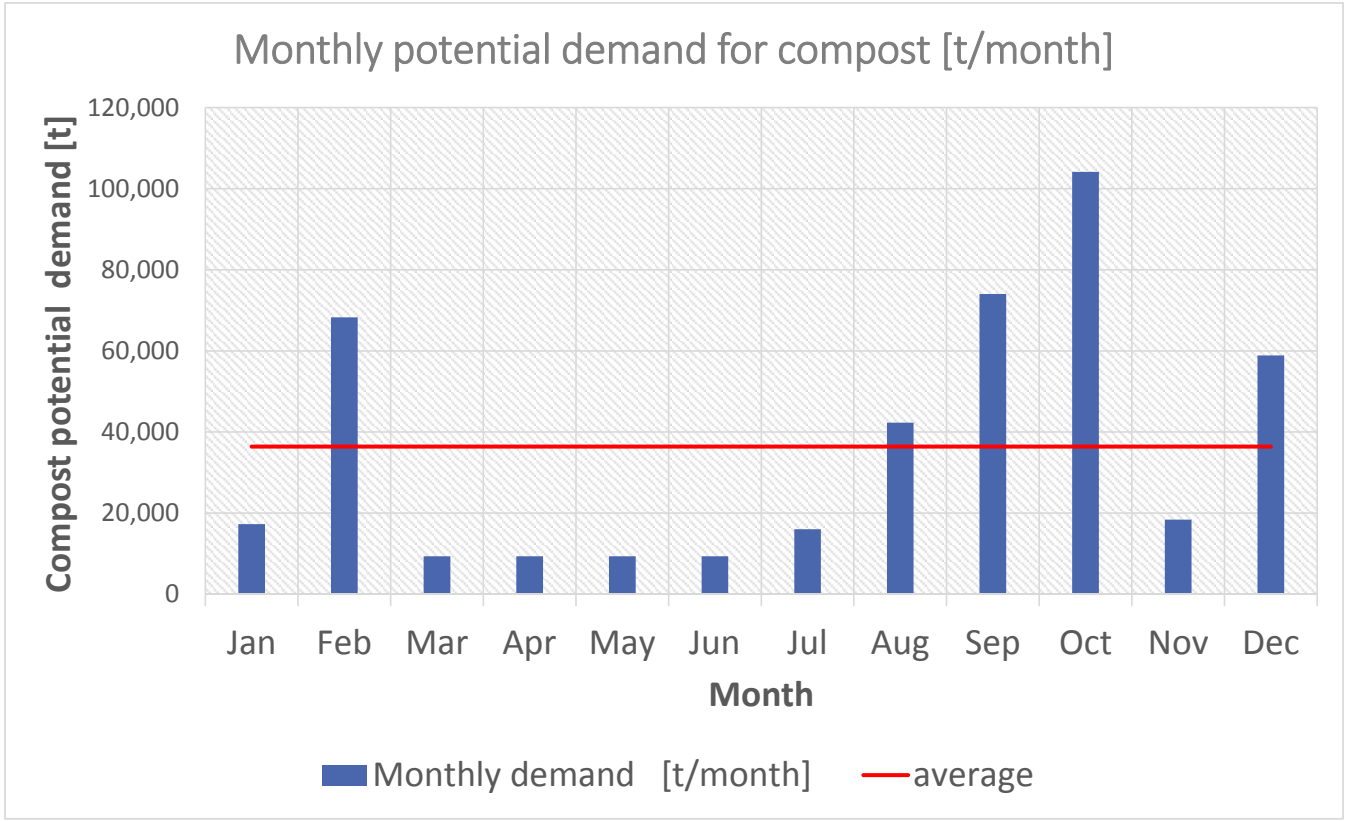
Crop calendars in the area of study.

crops	January	February	March	April	May	June	July	August	September	October	November	December
Durum wheat						3.58					4.108	
soft wheat						17.26					50.45	
Barley						9.912					68.206	
corn	0.8							6.4				0.8
Oat						0.84						5.04
Other cereals		0.48				0.08						
Beans					0.99							3.96
Chickpea					0.07							0.24
Other					0.07							0.21
Forage crops			2.05							134.2		
Tomato	0.432							233.4				
Potato			700.75						1.9			
Onion					0.017				3.5			
Other market												
Citrus	1.737											
citrus berries	0.389											
orange citrus	0.076											
lemon	0.14											
Almond							0.07474					
olives				61.220008							1.711023	
watermelon	226.3658				1.650725							
grapes raisin						0.048725			7.4415			
Table raisin						1.602			218.9243			
Rosaceae									1.986361			
Compost PSD (t/m)	17,256	68,266	9,336	9,336	9,336	9,336	15,992	42,297	74,033	104,136	18,376	58,858
	harvesting period [planted surface in 1000 Ha]				sowing / planting period [production in 100 t]						average	36,380

Compost application period

Seasonal fluctuation

- Result : **seasonal fluctuation** with a peak around **October** (wheat planting season)
- Need for storing area ➔ additional cost
- After estimation compost demand, considering local prices we can estimate compost sales



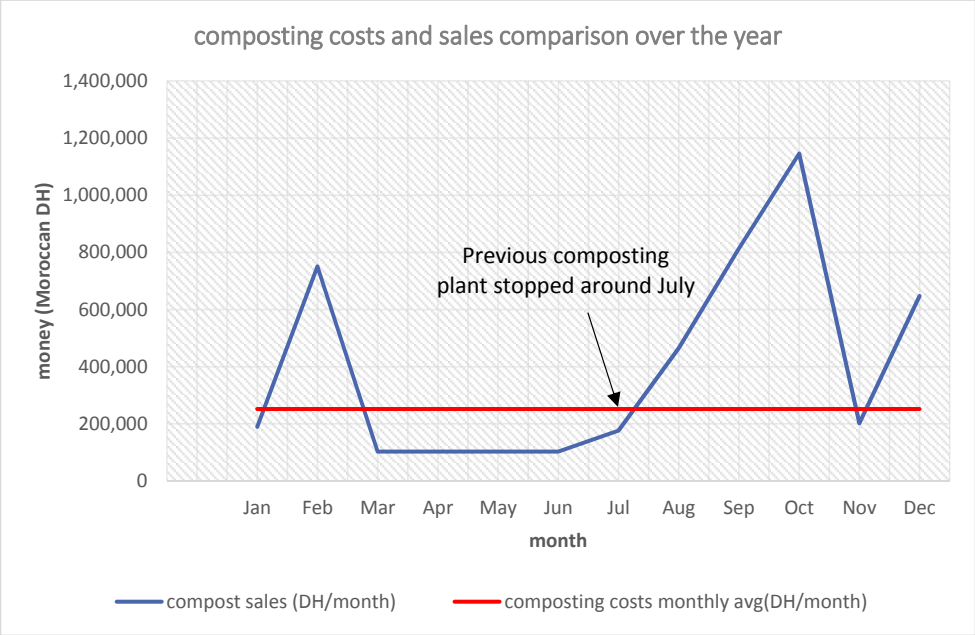
seasonal fluctuation of compost potential demand in the area of rabat based on crop calendars

Results and Conclusions

1. The **current situation** of the composting industry in the area of Rabat:
   - Weak market, low marketing efforts ➔low actual demand, farmers unfamiliarity with the product.

2. The main **inhibitors** to composting are:
   - Lack of subsidies ➔the initial costs hard to bear from the composting plant;
   - Poor marketing efforts which affects the actual demand for compost from farmers;
   - Negative effect of previous experiences.

3. Even though the total yearly sales of compost outweigh the **costs** of composting, in low demand months, costs were observed to be **higher** than the **benefits** under the current conditions;
   ➔failure of previous experiences before first 2 years.



4. **Improve the** composting plants business plan so as to have other revenue streams like introducing tipping fee for raw materials etc.

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THANK YOU FOR YOUR ATTENTION.

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