

LOGISTICS COST OF BIOMASS FROM PRUNING

EUROPRUNING ASSESSMENT

For presentation at a conference on

Smart logistics for forest residues, pruning and dedicated plantations

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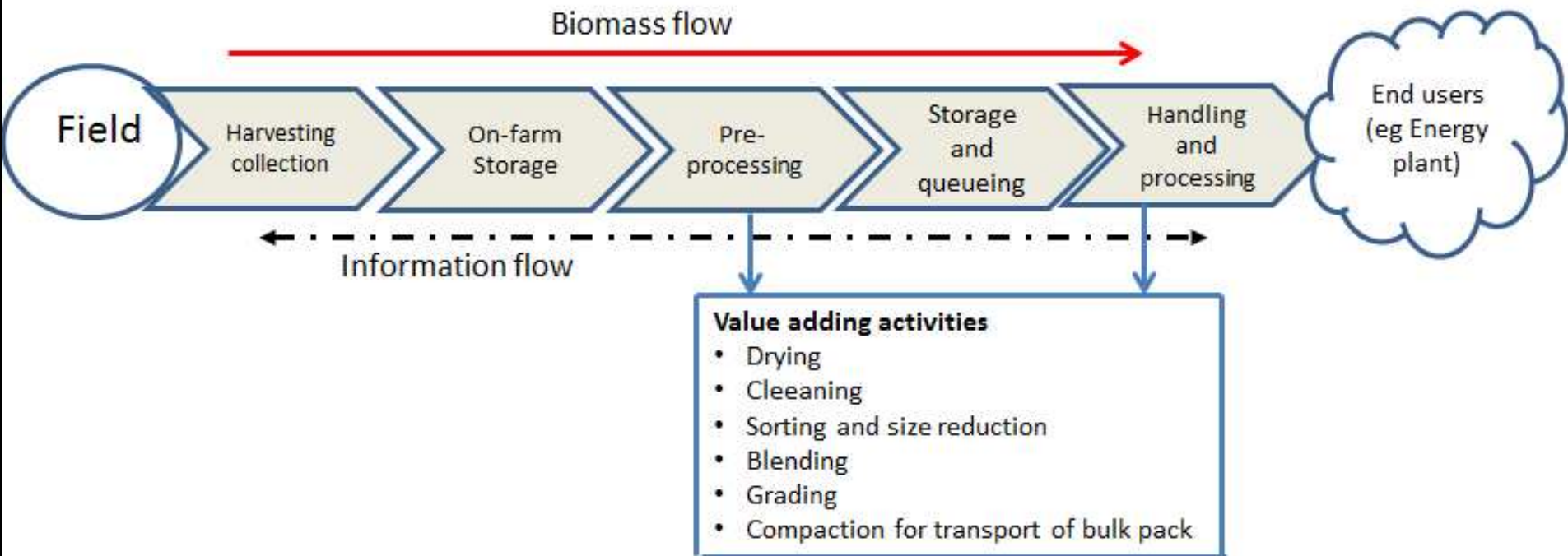
Content of the presentation

- **Logistics cost concept**
- **Preliminary results** of logistics operational costs along pruning biomass logistics chain based on Demo site in Spain

Background

- Due to the decreasing tendency of fossil-oil reserves and the increasing environmental concern, energy policy priorities promote utilization of **renewable** energy from raw materials such as pruning biomass (Lopez et al., 2009).
- For this, **cost-efficient biomass supply** is very important
- In case of Pruning biomass, the **effective logistics** system and **methods** of logistics cost analysis is lacking
- For this, clear identification of cost distribution over the useful life span of proposed pruning logistics system, tools such as **Life Cycle Cost Analysis (LCCA)** are important and need to be developed for specific case of Pruning biomass system.
- For example, the acquisition cost is often a small part of total costs associated with owning and operating the systems.

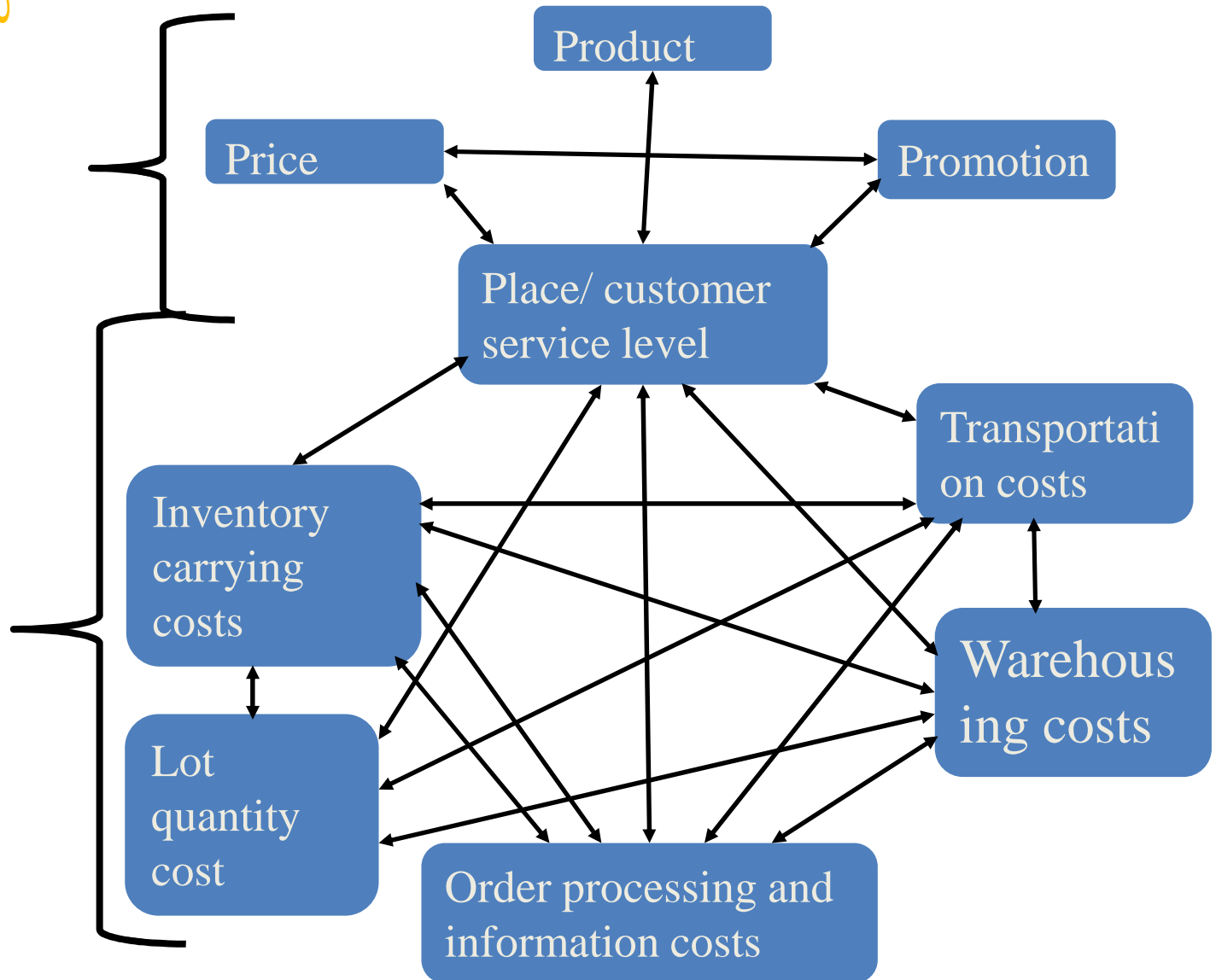
Typical Biomass Logistics Chain Linked with Energy production

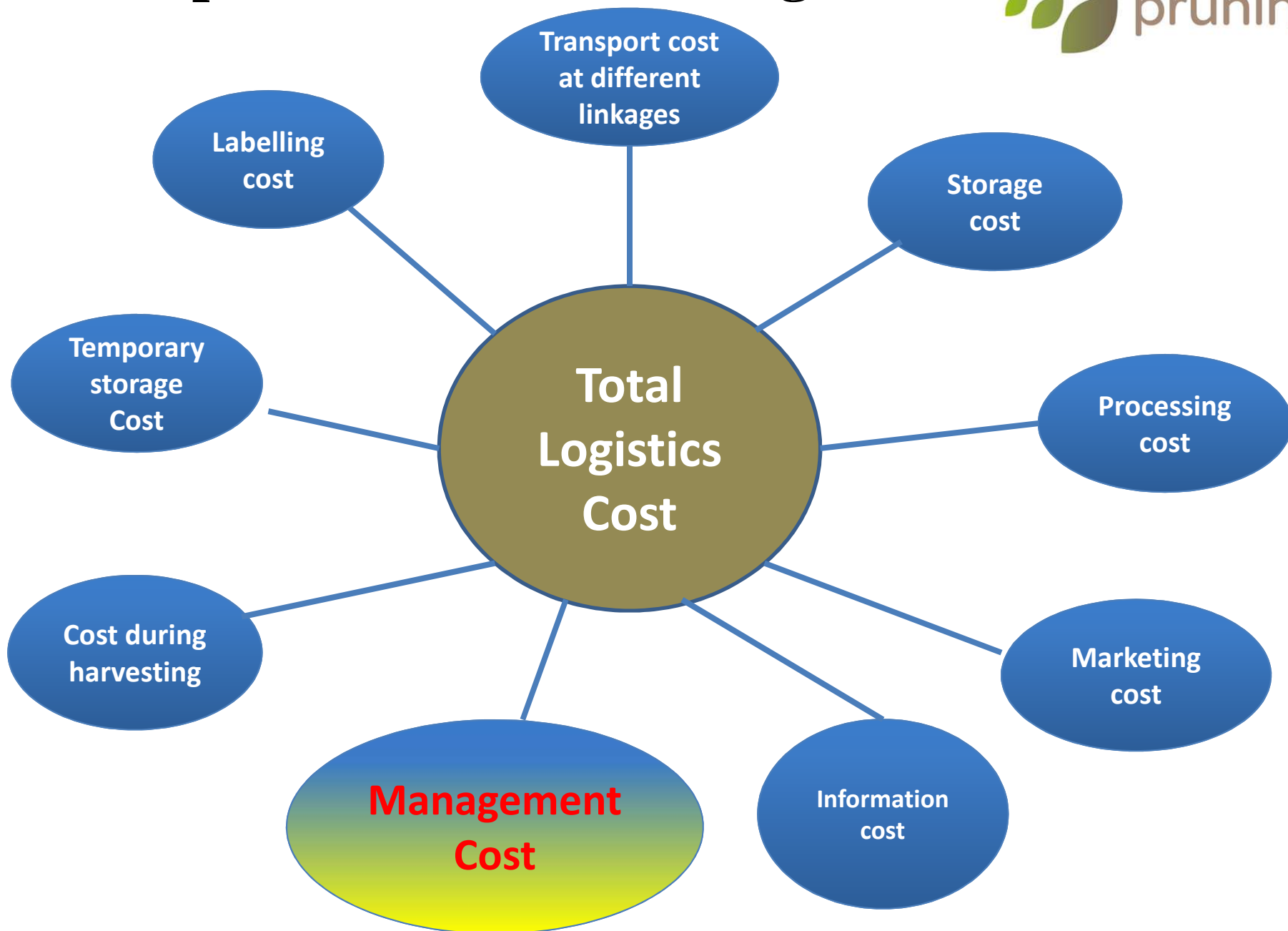


Traditional Logistics and marketing cost

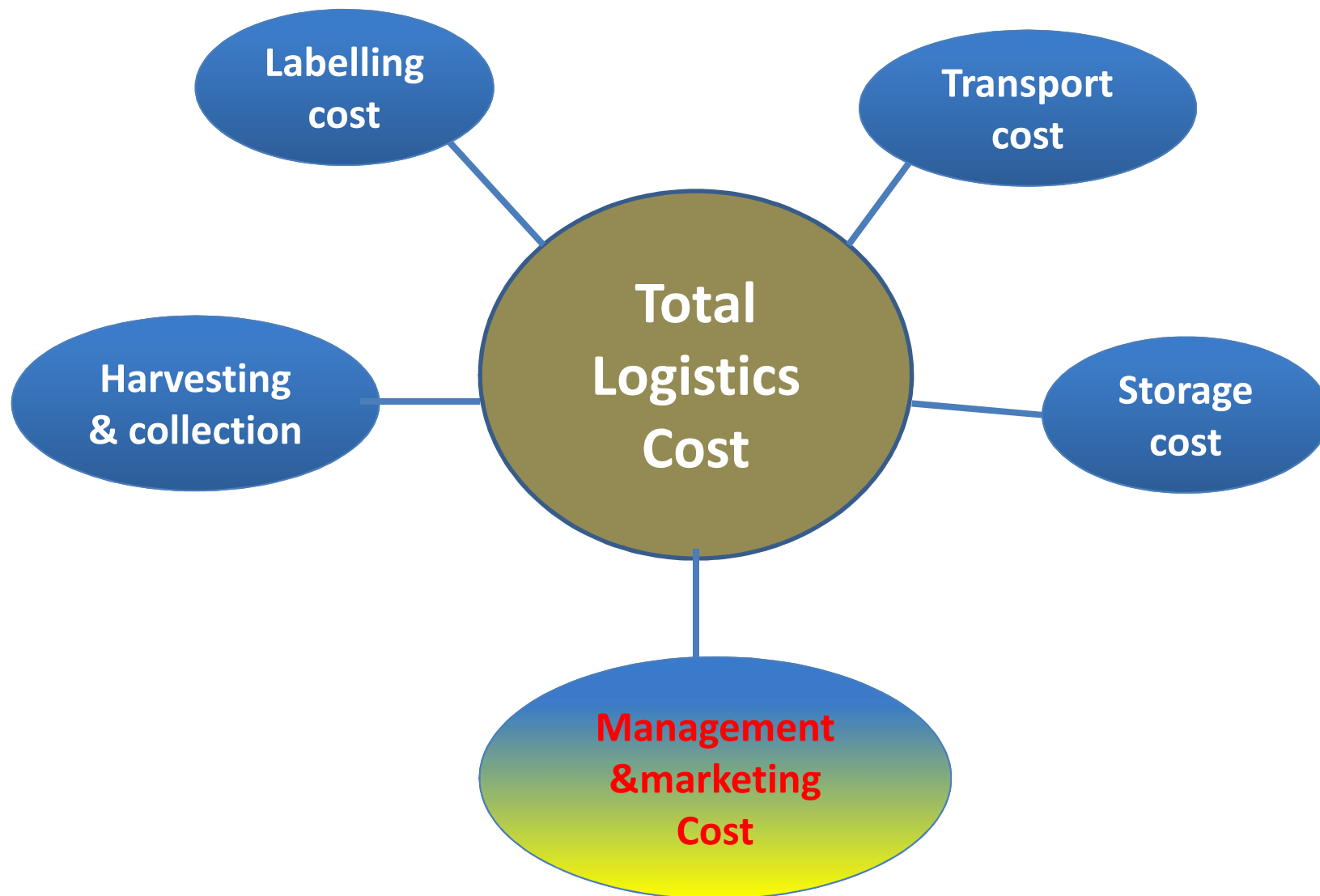
Marketing

Logistics





EUROPRUNING BIOMASS LOGISTIC COST COMPONENTS



Objectives of EuroPruning's Biomass Logistics Cost

- ❖ **Minimize** total costs including all cost components
- ❖ **Identifying** costs at all stages of the biomass logistic chain for the agricultural pruning
- ❖ **Develop** a biomass logistics cost model and performing Life-Cycle Cost Analysis (LCCA)

Methodology

- **Conducting literature review**
- **Data collection**
- **Two parts of analysis**
 - **Modeling logistics costs at all stages** of biomass logistics chain: This deals with logistics operational costs
 - **Conducting Life Cycle Cost Analysis:**
 - ❖ LCCA is a tool to determine the total cost of owning and operating a facility or a system over a given useful life span.
 - ❖ Developing **LCCA frame work** (that describes well the case of Pruning biomass logistics chain)
 - ❖ This LCCA Frame work considers **initial costs** (start up costs) and **Future costs** (Operational cost, Maintenance & Repair Cost, Replacement costs)
 - ❖ It covers over **10 years** of life span

Some Consideration & assumptions

- **Pruning cost:** The case of manual pruning is considered
- **Transport cost:** includes transport from farm-storage & storage-Power plant
 - ❖ Uniform estimated distances are used for all variety : Farm-storage =100km, storage-End user= 15km; Transport company-to-Farm=170km; Storage-to-Transport company=120km).
 - ❖ **Loading cost** at farm has been considered in Transport stage while **unloading costs** at storage site has been included in cost estimated **at storage stage**
 - ❖ It is assumed that each trip is done different day and the truck **starts from Transport Company location and return to transport Company after each trip**
- **Labeling:** Each biomass type is considered to be produced by one farmer
 - ❖ each farmer will pay a yearly label fee of 100 €
 - ❖ at storage level, it is taken into consideration that all products are stored at single site and traded by a single trader
 - ❖ Additional costs of preparing and labeling by each partner is considering.
- **Management cost:** includes marketing and management over 6 months
 - ❖ use of EuroPruning application platform is taken into consideration.
 - ❖ man power cost for managing the system is considered and it is distributed among the five items uniformly

Determining Logistics cost

- **Total Logistics Cost** could be determined as

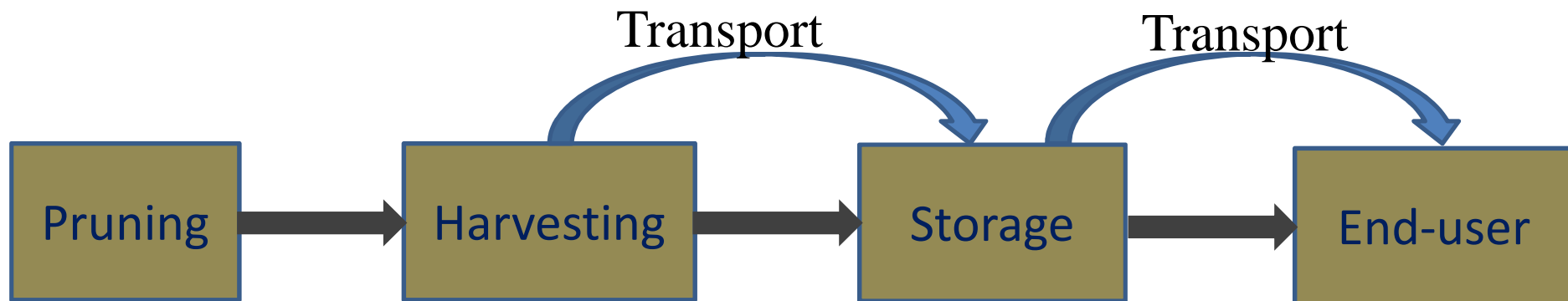
$$LC = P + H + S + T + L + M \quad (1)$$

P= pruning cost in € ; *H*=harvesting cost in €

S=storage cost in € ; *T* = transport cost in €

L=labeling cost in € ; *M*= management cost in €

LC= total cost in €



The logistics cost elements:

- ❖ Logistics **operation costs** such as fuel, man power (but not investment costs)
- ❖ **Investment costs** (if any) is included in LCCA
- ❖ Each of the logistics cost elements in the above model are modeled separately for detail cost estimation
- ❖ As an example the Model for calculating cost at **storage stage** has been presented here.

Example of modeling logistics cost

- For **storage stage**:

$$S = \sum_{v=1}^V \sum_{l=1}^L C_{sv} X_{v,l} \quad (2)$$

- $v \in (1, \dots, V)$ represents pruning varieties (example different species) stored at the site
- $X_{v,l}$ = biomass of variety v stored at storage location l , in t (i.e. ton), and
- C_{sv} = cost of storing biomass of variety v in €/t
- In the case of Spain DEMO site
 - ❖ $V=5$ since five types of prunings have been considered
 - ❖ $l=1$ since only one storage site is considered

Some characteristics of Pruning biomass considered for this preliminary logistics cost determination at [Spain DEMO site](#)

Biomass type	Traded form	Considered amount [t]	Moisture content (%)	Remark
Almond	Chips	9,4	50*	Chips in bigbags
Peach	Chips	50	33	
Up-rooted Peach	Chips	120	33	
Vineyard	Bales	12	43	
Olive	Chips	160	45*	
Total		351,4		

*-Moisture content estimated at Pruning time, while the remaining are at harvesting time (wet basis)



Prunings on Field



Harvesting Prunings



Pile of pruning chips (Spain)



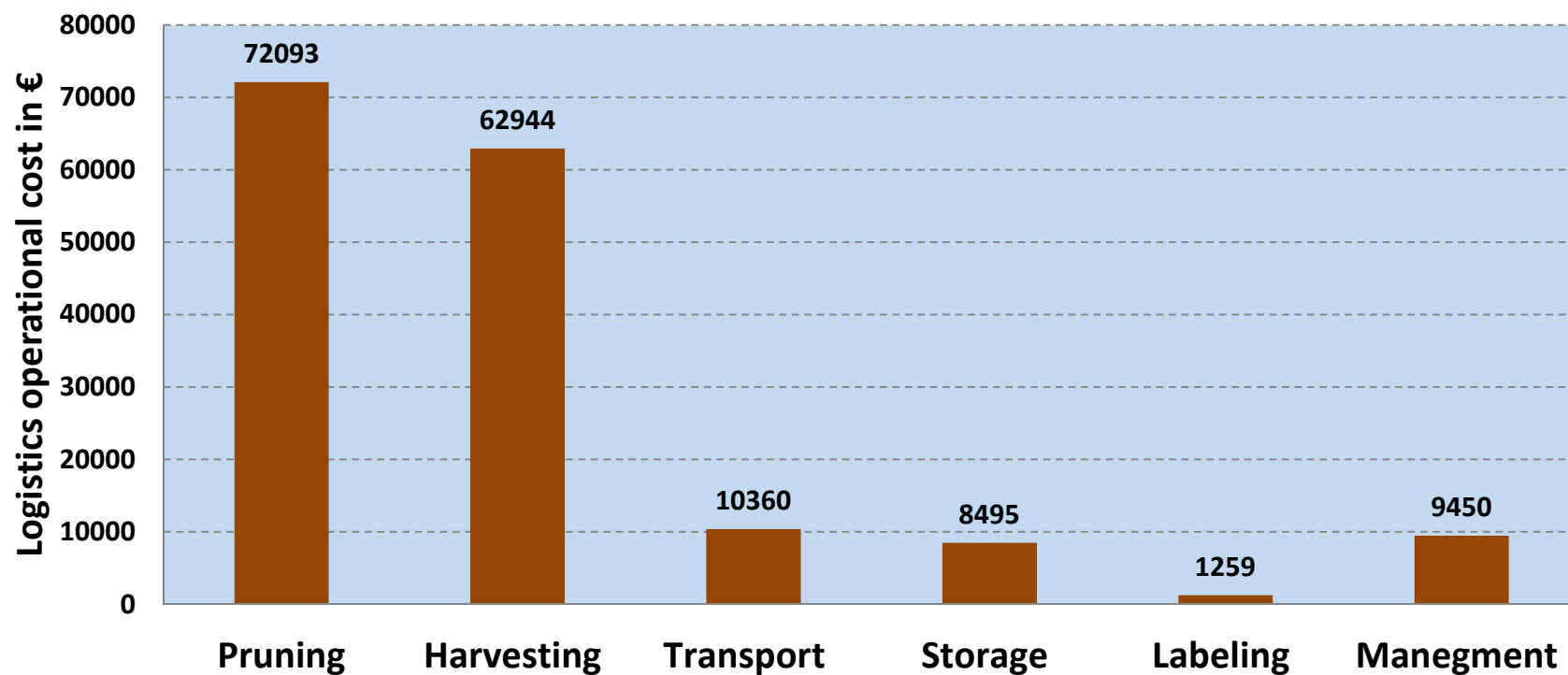
Pruning chips in big-bags (Spain storage site)



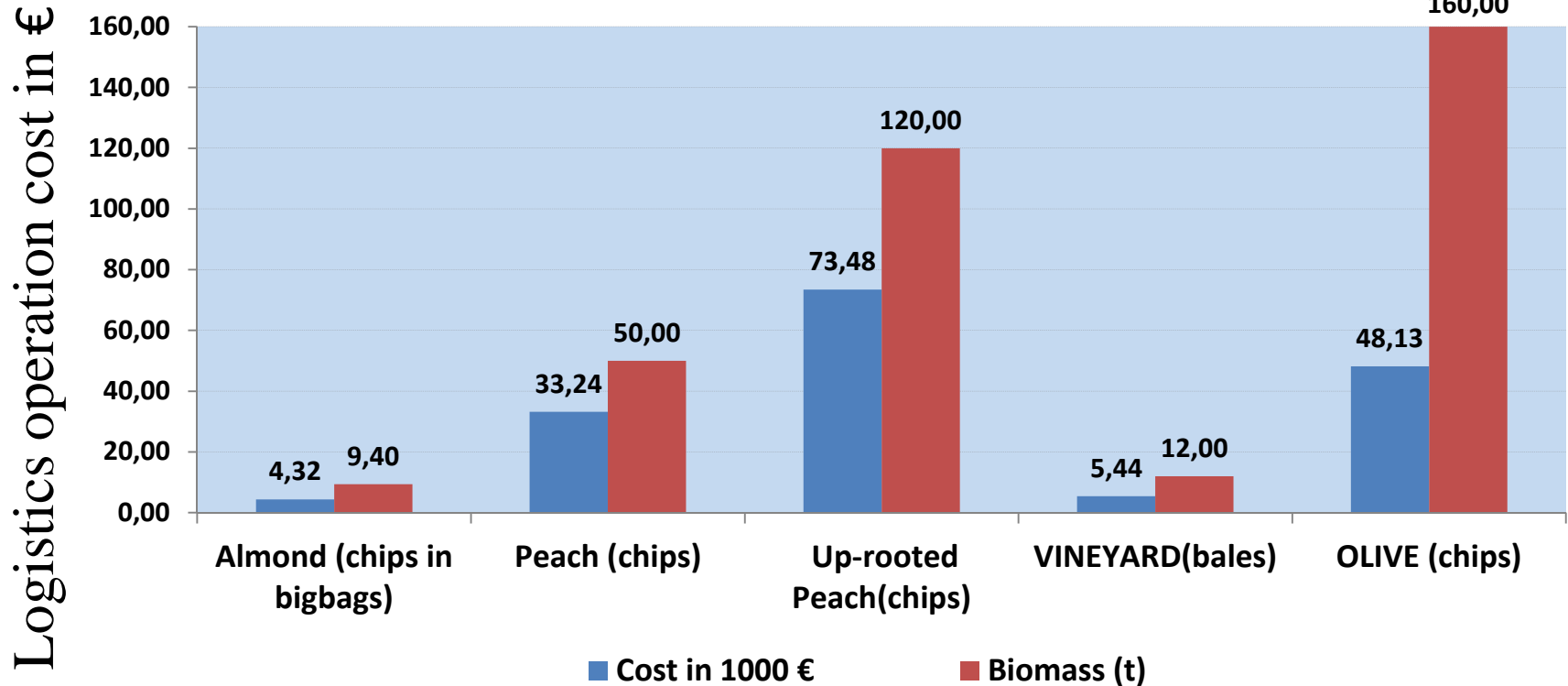
Bale stack of Vineyard

Some Results of **Preliminary** Analysis

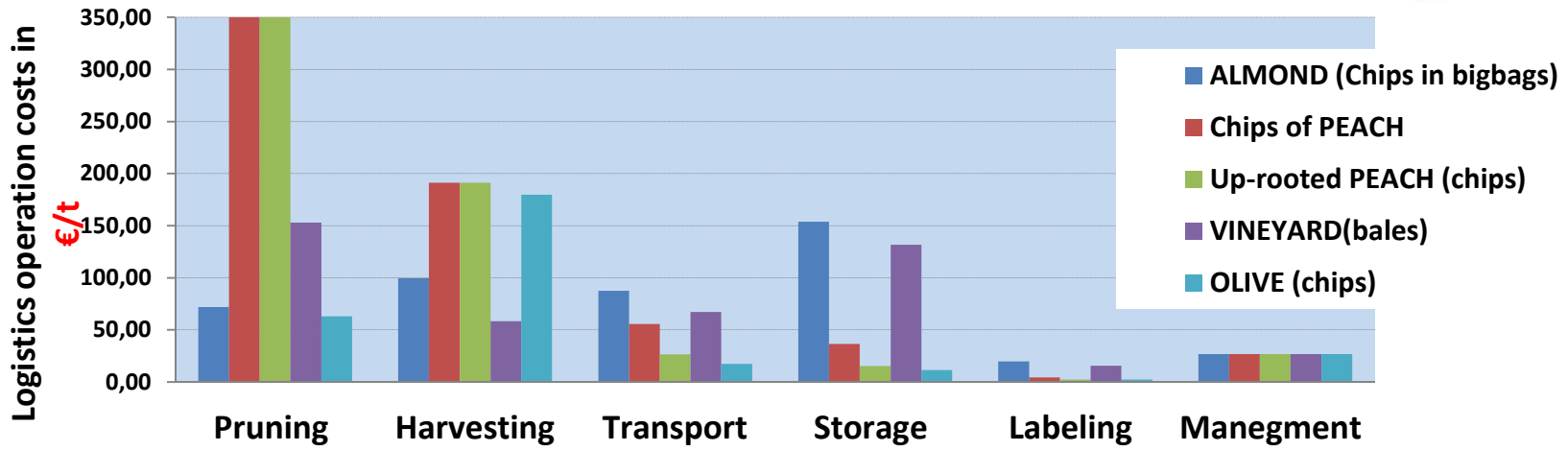
Total Logistics operational Cost estimated for **Spain DEMO site**



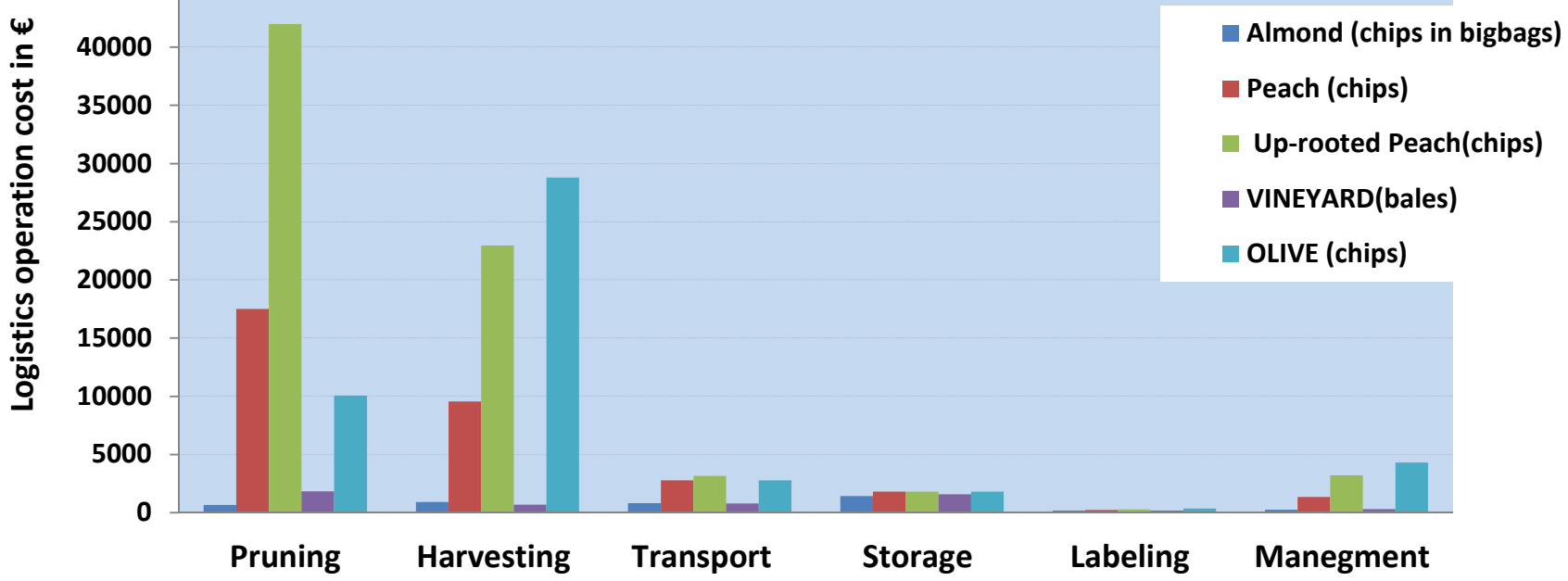
Distribution of logistics operation cost among biomass types at Spain DEMO site



Comparison of **unit costs** of each biomass types at Spain DEMO site



Comparison of **total logistics costs** along logistics chain



Comparison of costs as % share along logistics chain for each biomass species and total for the DEMO site

Stage of logistics chain	Unit	ALMOND (chips in bigbags)	Peach (chips)	Up-rooted Peach(chips)	VINEYARD (bales)	OLIVE (chips)	Total Logistics cost
Pruning	%	17	54	58	36	21	45
Harvesting	%	23	30	32	14	61	39
Transport	%	13	5	3	10	4	4
Storage	%	36	6	3	31	4	5
Labeling	%	5	1	0	4	1	1
Manegment	%	6	4	4	6	9	6
Total cost	€	4317	33237	73480	5436	48131	164601

*Loading cost at farm has been considered in Transport stage while unloading costs at storage site has been included

Concluding Remarks

From this preliminary analysis based on limited data , the following could be noted:

- ❖ **Pruning and Harvesting** have high cost share for total logistics cost of Spain DEMO site
- ❖ Storage cost is high for ALMOND and Vineyard prunings. Unloading and loading activities of bigbags (ALMOND chips) and bales of VINEYARD have contribution for this.
- ❖ The analysis doesn't include cost **incurred due to losses**
- ❖ This analysis will be revised with more data from DEMO sites and the logistics cost characteristics noted above **might change.**
- ❖ The future complete analysis (including **LCCA**) will provide insight regarding pruning biomass logistics costs and evaluation methods.

Thank you !!!

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