

Larger loads and decreased damage – the potentials of a new forwarding concept

Ola Lindroos & Iwan Wästerlund



*Austro2011/FORMEC '11, Graz, Austria,
9 -12 October 2011.*



Swedish University of Agricultural Sciences
Dep of Forest Resource Management



The dilemma in ground based hauling:

Large loads and no soil impact



Current development



Current development




SVEASKOG



Objective

What are the potentials with forwarder trailers in final fellings with and without ground pressure restrictions?



Machines

Forwarder	Full payload (tonnes)	Ground pressure (kPa)	Payload / laden mass
Large (L)	18	95	0.8
Large reduced (LR)	13	70	0.65
Medium (M)	14	78	0.69
M reduced (MR)	11.9	70	0.58
MR + trailer	21.4 (11.9 + 9.5)	70	1.26

8 wheeled forwarders with 4 bogie tracks
Trailer with 2 bogie tracks



Scenarios

Time consumption

- Fast: 5% slower in all work elements
- Slow: 10 % slower + 1 min extra per load

Trailer costs

- Cheap: trailer cost 30 000€ (10% of Medium forwarder)
- Expensive: trailer cost 70 000€ (23.3% of M forwarder)

Fuel consumptions

Constant fuel consumption / PMh, correlated to engine effect

Trailer increase consumption with 5% / PMh



Stand characteristics

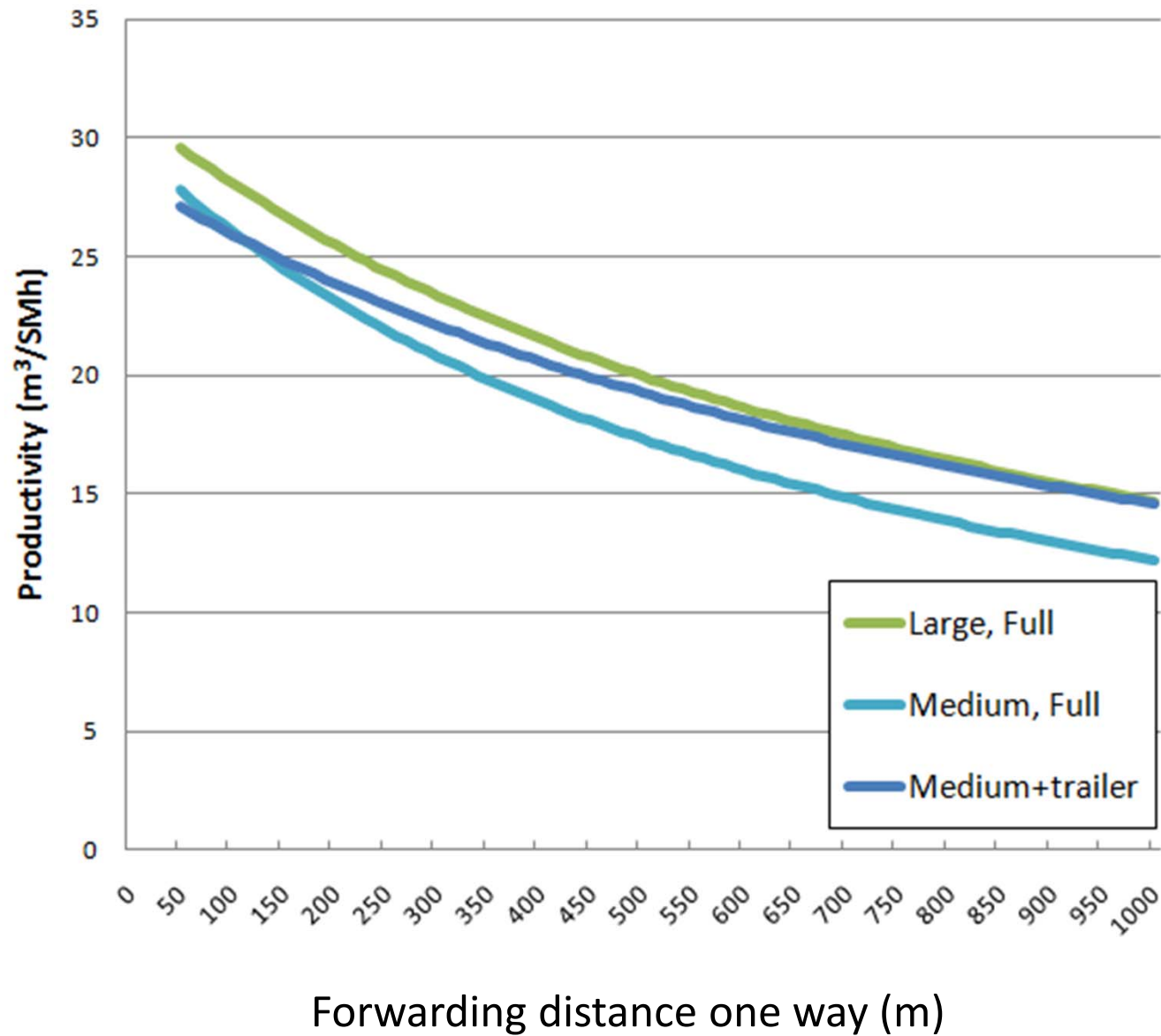
1 129 Swedish final felling stands, containing 1.6 million m³

	Volume-weighted mean	Range
Forwarding distance one way (m)	389	20 – 1 500
Stand density (m ³ /ha)	250	100 - 952



Results

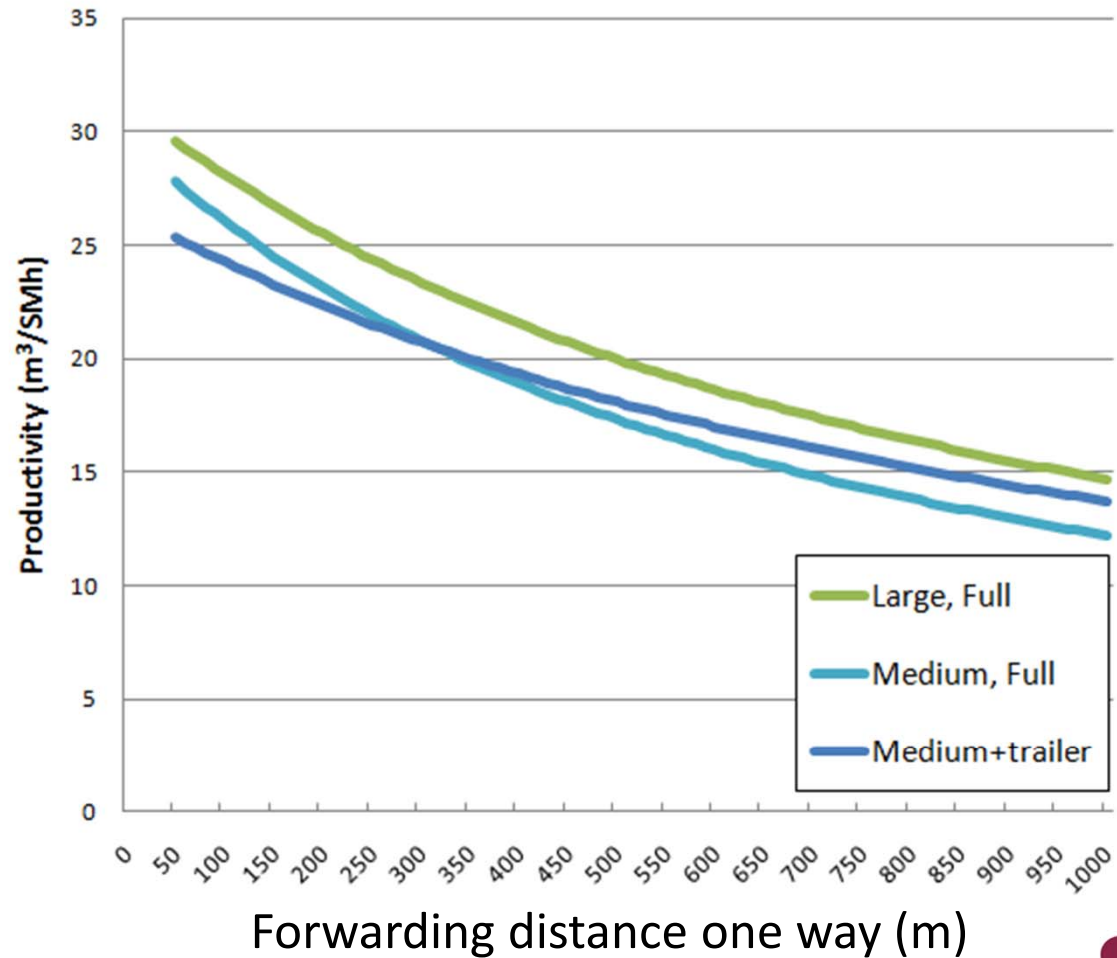
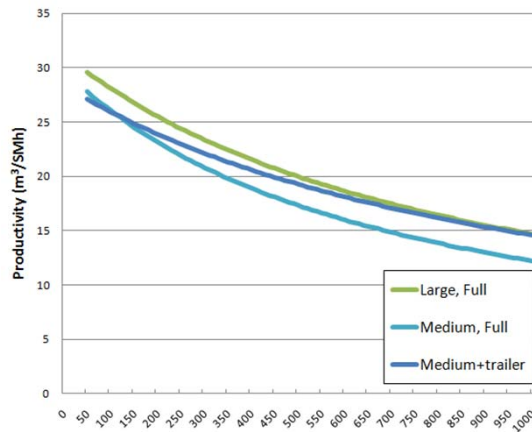
Full payloads + fast trailer



Results

Full payloads + slow trailer

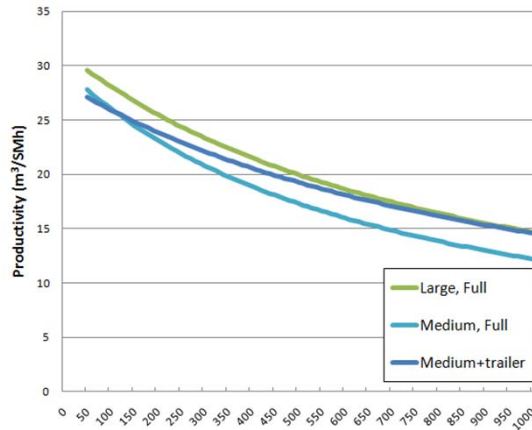
Full+fast trailer



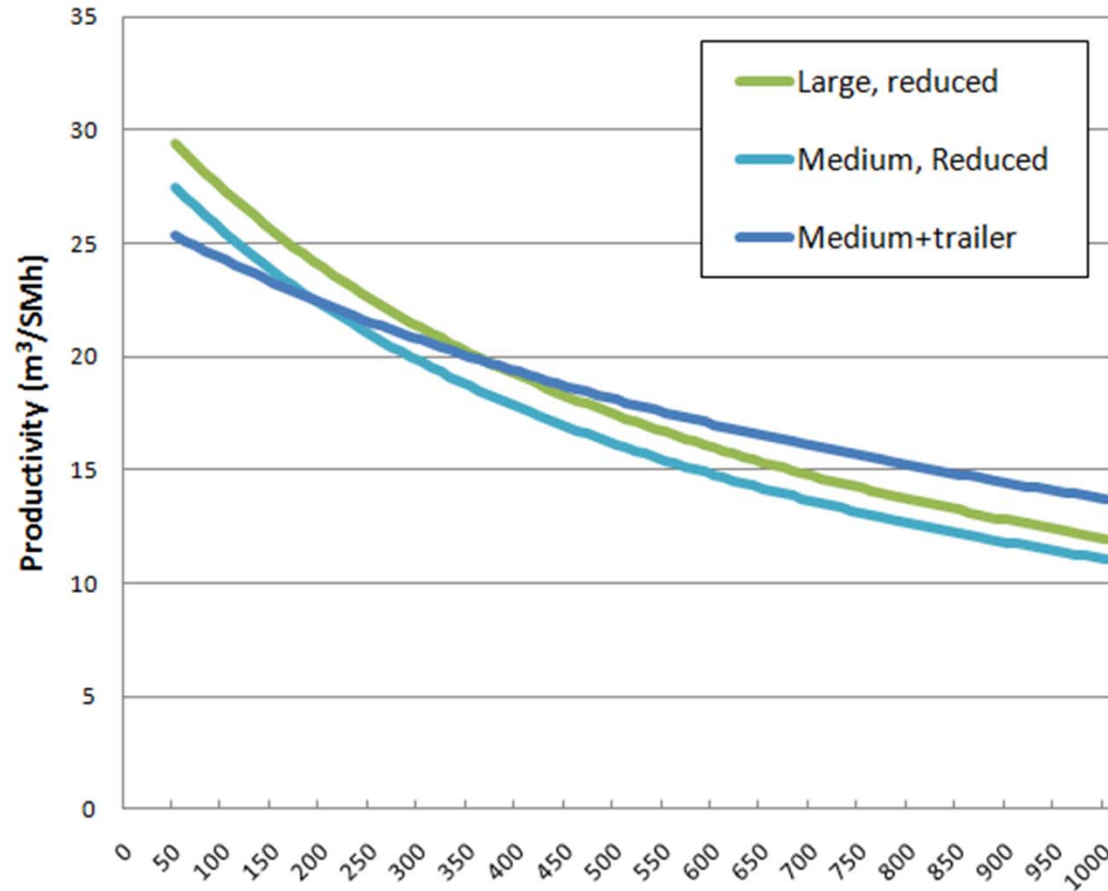
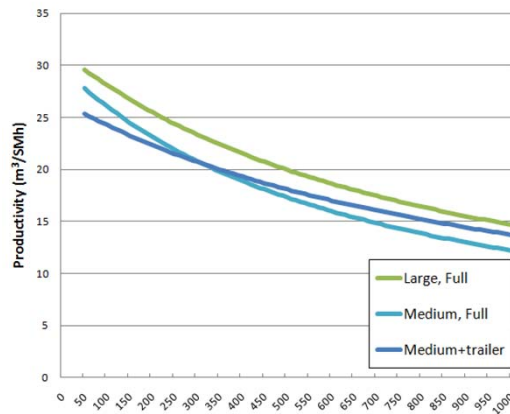
Results

Reduced payloads + slow trailer

Full+fast trailer



Full+slow trailer

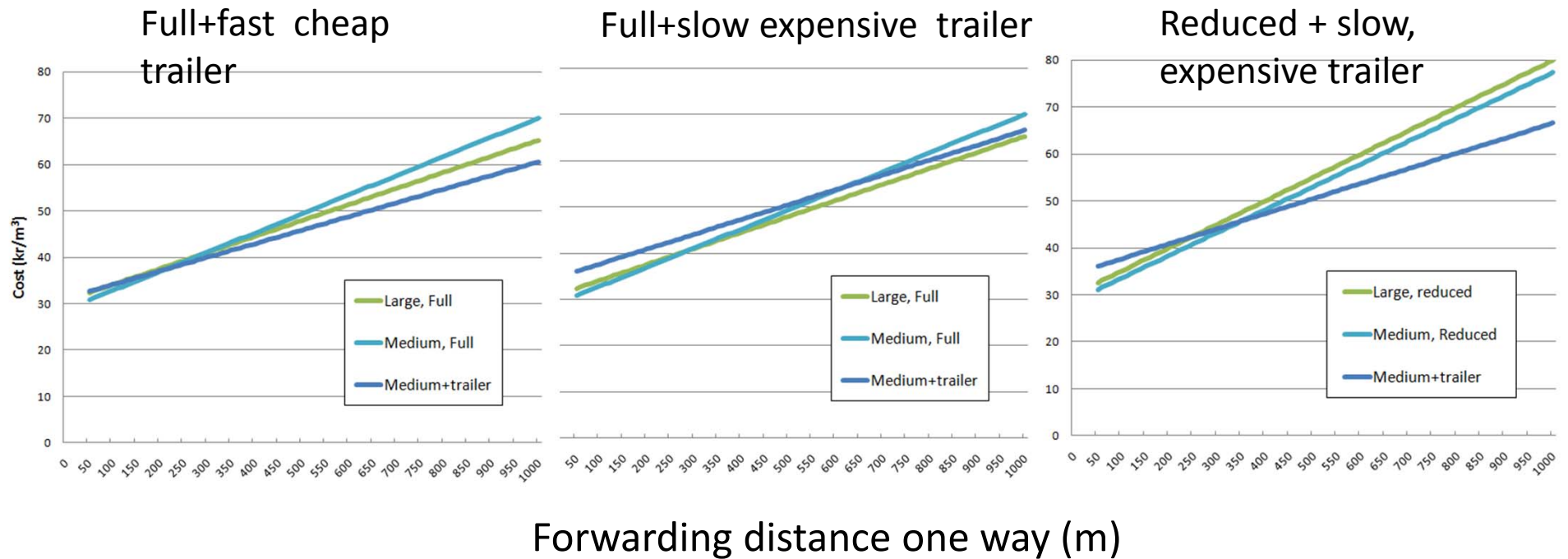


Forwarding distance one way (m)



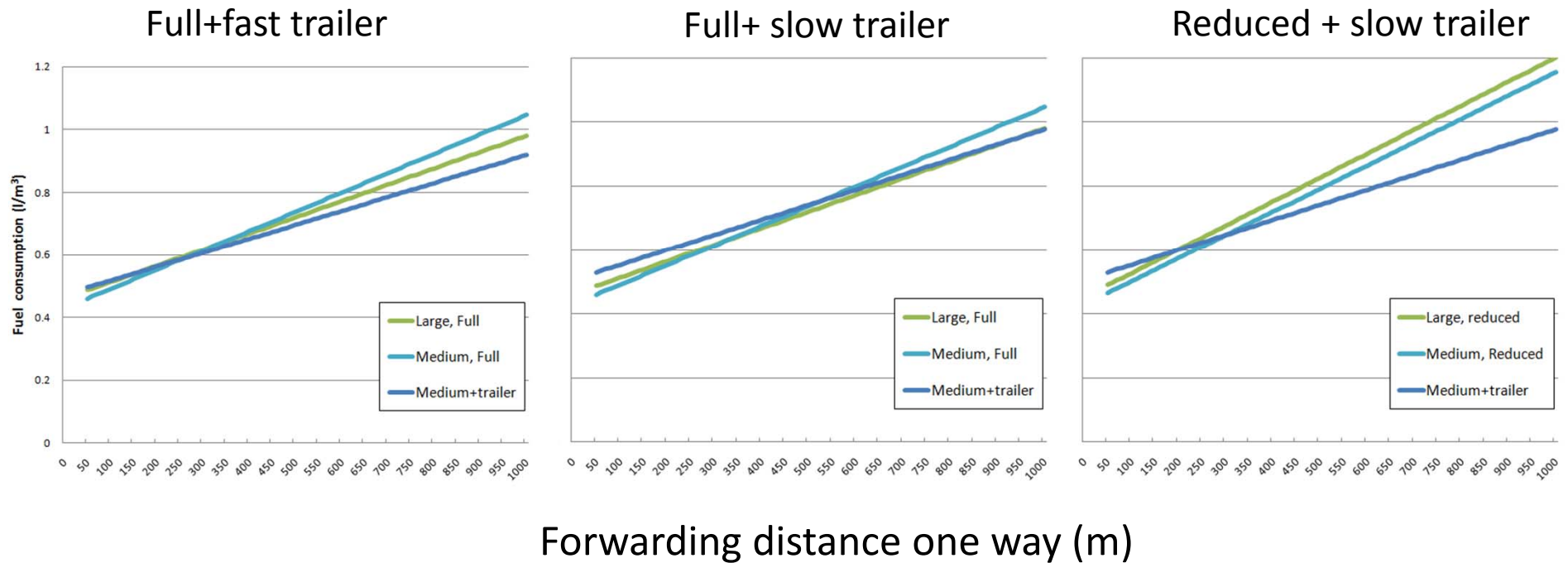
Results

Costs



Results

Fuel consumption



Stand volume potentials *(slow trailer)*

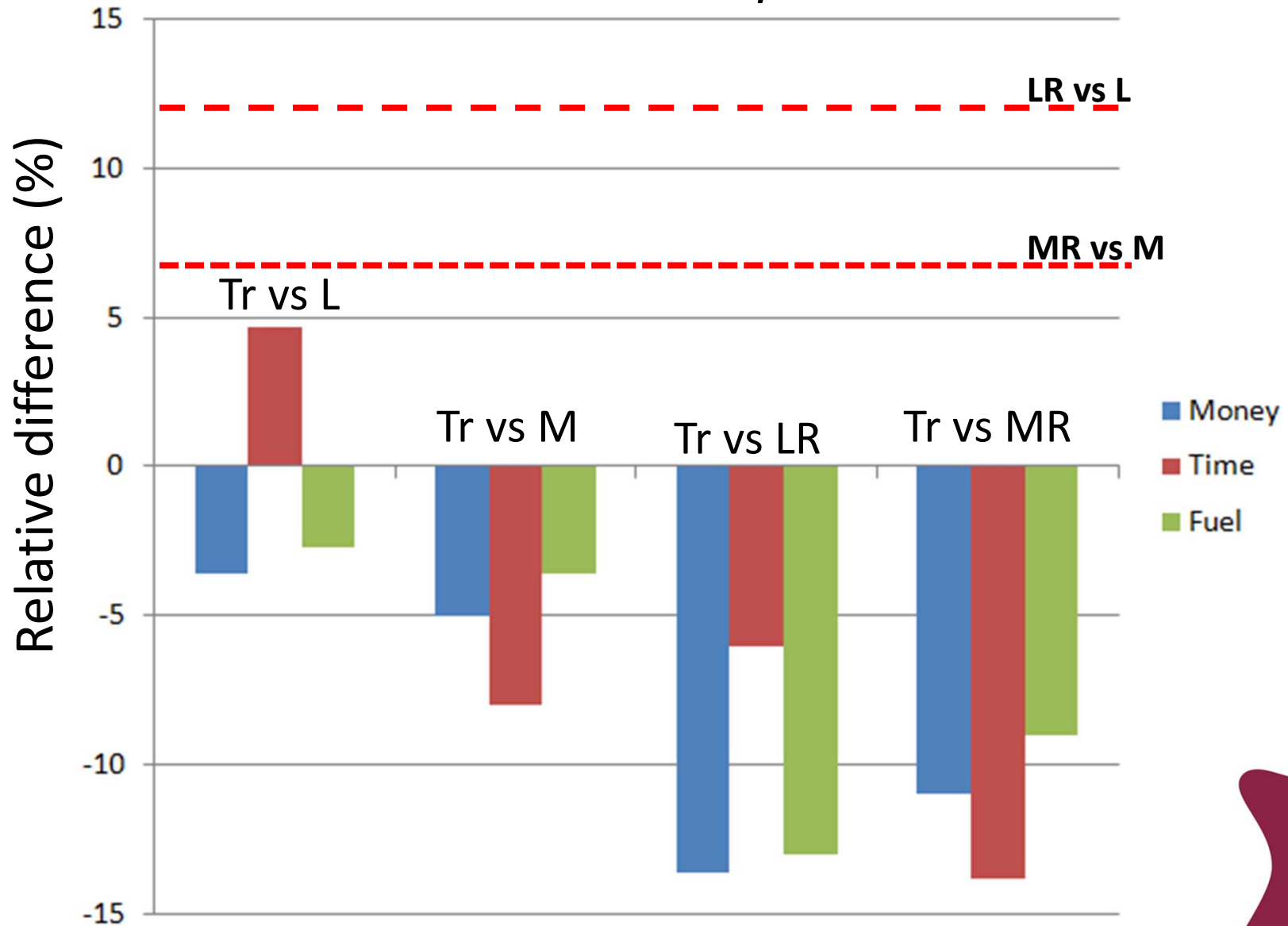
	Trailer vs L	Trailer vs M	Trailer vs LR	Trailer vs MR
North	0%	8%	30%	30%
Central	0%	12%	37%	47%
South	0%	4%	52%	51%



Results

Stand level costs/benefits

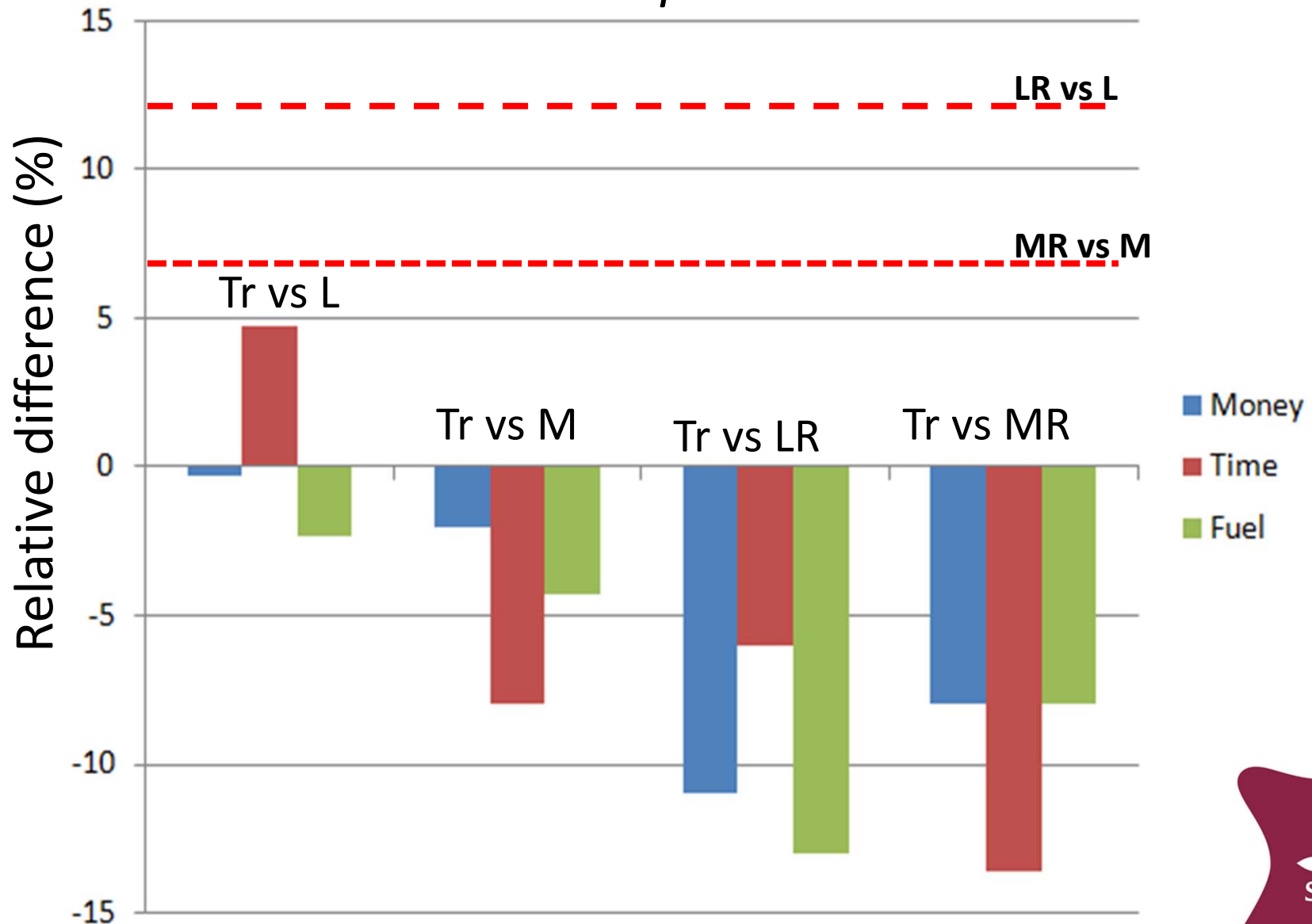
Fast and cheap trailer



Results

Stand level costs/benefits

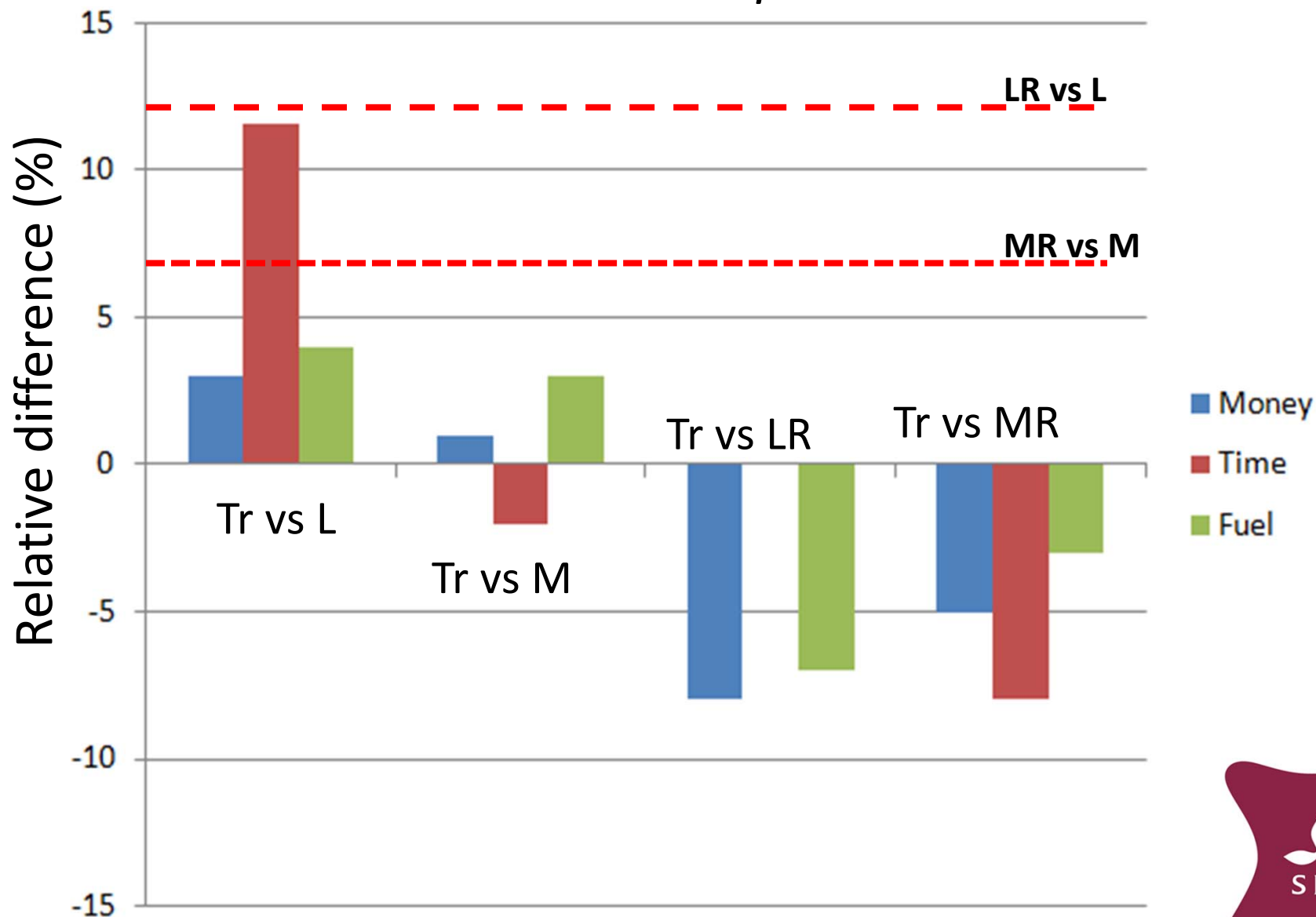
Fast and expensive trailer



Results

Stand level costs/benefits

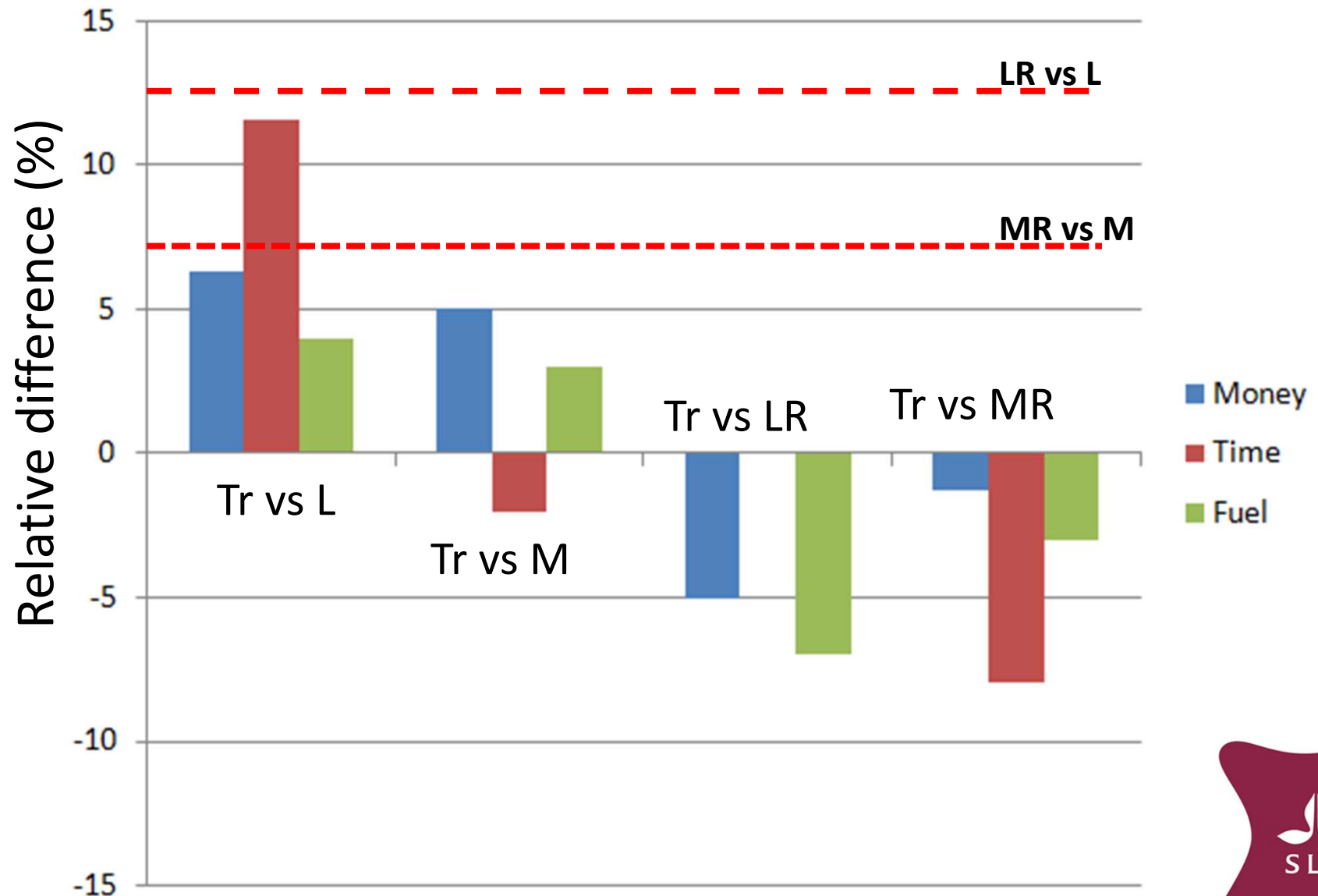
Slow and cheap trailer



Results

Stand level costs/benefits

Slow and expensive trailer



Conclusions

- Reduced ground pressure with conventional forwarders -> decreased payloads -> expensive
- High potential for forwarder trailers
- Cheap and fast trailers = competitive with conventional forwarders -> decreased ground pressure + increased profitability
- Expensive and slow trailers can be competitive under ground pressure restrictions
- Find the balance between work speed and costs



ola.lindroos@slu.se



Thank you

ola.lindroos@srh.slu.se

