

# Optimization of raw wood supply chain

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## 1 Introduction

The real costs of logistic services are important determinants of a country's ability to participate fully in the world economy (Limao and Venables, 2001). Regarding the situation in Switzerland, raw wood transport costs are up to 50% higher compared to the neighboring countries such as Germany (Gautschi et al., 2017).

This study investigates two types of logistic services: Raw wood transports services from trucks and combined rail and truck traffic for raw wood (CT), which is the raw wood transport from the wood supplier in the forest to the customer through combining both trucks and trains.

The main aim of this study is to quantify cost saving potentials of raw wood transports in Switzerland in consideration of different transport systems.

## 2 Method overview

This study includes four main methods:

- Literature study
- Expert interviews and expert reports
- Time studies and GPS- localisation
- Statistical analysis

All practical tests found place in Switzerland from low land to mountain area. For the raw wood transports given by trucks we conducted in total 25 truck transports.

For the combined rail and truck traffic we are still measuring 12 truck transports and 9 train transports.

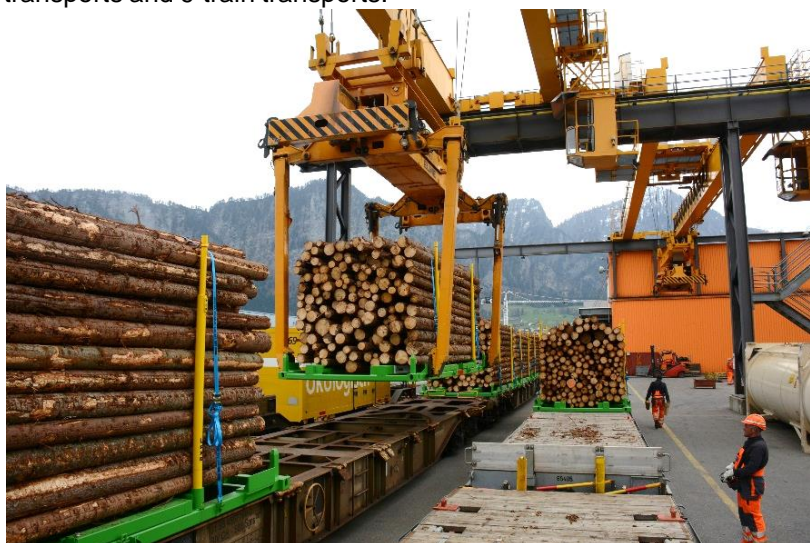


Fig. 1. Train transfer point in Landquart Switzerland. The transport system called "flatrack" is moving from narrow-gauge railway to commercial railway (Rhaetian Railway, 2016).

## 3 Materials

In this study we used mainly four different materials to measure and identify system relevant parameters;

- Tracker-application (Runkeeper) to record truck movement
- ArcGIS from ESRI (Version 10.6.1)
- Rstudio (Version 0.99.896)
- Questionnaires to report practical test events through partners
- Six different truck types with different properties
- Two different train transport systems

## 4 Results and discussion

This study have authored tree major findings for raw wood transport realised by trucks:

1. Loading capacity of the trucks is not the primary criteria for lower transport costs (see Fig.2, left).
2. The proportion of costs of total transport costs per ton wood for loading and unloading processes range between 8.5% and 46%.
3. Total transport costs per ton kilometer can be described approximately with the function  $f(x) = 0.085x + 13.210$  ( $R^2=0.696$ ) (see Fig.2, right).

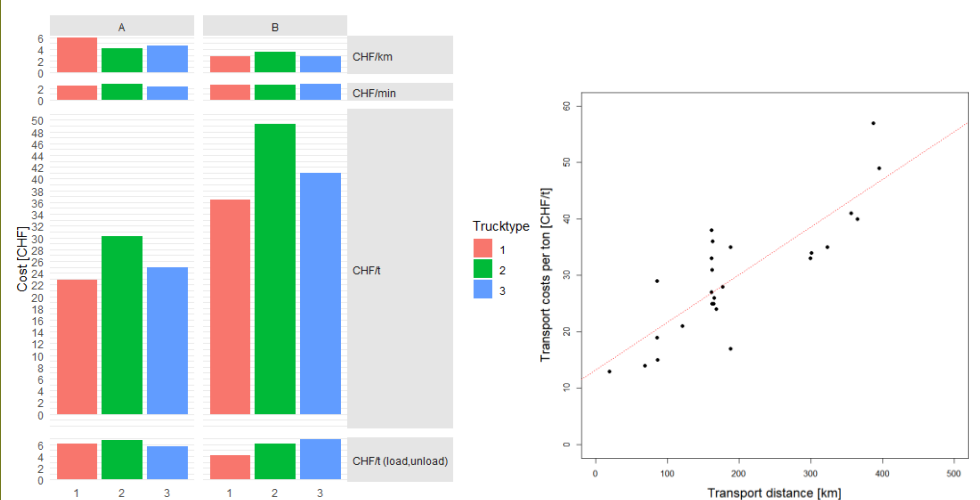


Fig. 2. (left side) Transport costs from practical tests of two truck logistic entrepreneurs (A/B) in Swiss francs (CHF). A and B used in each case tree different truck types (1,2 and 3). (right side) Correlation between total transport costs per ton and transport distance

## 5 Conclusion

Considering the current wood market prices (WaldSchweiz, 2019), the share of raw wood transport costs realised by trucks lies between 25% to 50% of total wood value. According to this we found high loading and unloading times for trucks caused on different factors such as small wood piles. At least we identified costs for taxes between 2.40 CHF to 12.05 CHF per ton wood.

However, to optimize raw wood transport processes first the effect of organizational adaption should be verified.

To do this we have to (i) strengthen the cooperations with entrepreneurs from wood logistic, (ii) to demonstrate the importance of cooperations for all players in the raw wood logistic sector, (iii) to improve the detail level of data collecting and (iv) to enlarge datasets.

For combined rail and truck traffic for raw wood processes we are still collecting data and first cost saving potential results are expected soon.

## 6 References

1. Gautschi M., Hagenbuch M., Taverna R. (2017). Transporte in der Schweizer Wald- und Holzwirtschaft: Situationsanalyse und Optimierungsmöglichkeiten
2. Limao, N., & Venables, A. J. (2001). Infrastructure, geographical disadvantage, transport costs, and trade. The World Bank Economic Review, 15(3), 451-479
3. WaldSchweiz (2019). Holzmarkt. <https://www.waldschweiz.ch/schweizerwald/holzmarkt/holzpreise/nadelstammholzleitsortimente/>. Release date: 25.09.2019. Update date: June 2019
4. Rhaetian Railway (2016). Rundholztransporte. <https://www.rhb.ch/de/buendnerqueterbahn/angebote/rundholztransporte>. Release date:25.09.2019. Update date: August 2016