



Study of Use of Cable Cars as a Logistics Support to Mountainous Rural Area in West Java

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ABSTRACTS

Cable cars as a means of transporting goods and passengers have been applied in several countries. Cable cars can reach areas with difficult terrain to reach so as to support logistic systems for rural areas that have hard-to-reach terrain. The southern district of Garut Regency has extensive agricultural and plantation land and terrain that is quite difficult to reach so that the installation of cable cars will be able to provide the community with ease in transporting agricultural products. The existence of a cable car that has been installed in Sutenjaya Village, Lembang will facilitate development because it can be used as a pilot project.

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1. INTRODUCTION

Logistics is one of the most important aspects in industrial sector. Logistics activities cover some aspects including transportation, warehousing, routing, information system, and also law and regulation. Logistics is one of the important aspects of economic activity that affect the efficiency and growth of a country (Es et al., 2018). A country's logistics performance will greatly affect the country's economic development with increased trade activity and the growth of new markets (Ekici et al., 2016).

Indonesia is a country with a very diverse landscape ranging from coastal areas, forests, to mountains (Rudiarto, I., Handayani, W., & Sih Setyono, J, 2018). A very diverse landscape becomes a challenge in the logistics activities of transporting goods. Rural communities in mountainous areas will face difficulties in carrying out shipping or moving goods from one area to another because of road access that is difficult to reach (Siti Amanah, Anna Fachtiya, 2018). West Java has mountainous areas in the central and southern parts and lowlands in the north. West Java also has forest areas with conservation forest functions, protected forests and production forests whose proportion reaches 22.10% of the area of West Java (<http://bappeda.jabarprov.go.id/rapat-pembahasan-potensi-wilayah-di-kabupaten-dan-kota-seluruh-jawa-barat/>).

Cable cars have advantages because they can be placed to traverse complex and difficult areas. Cable cars can reach various types of terrain so that it can function as a tourist transportation or as a tool to reach places with difficult terrain (Mbereyaho, 2018). Cable cars can be a logistics support to mountainous rural area because it can reach some places with difficult terrain.

2. METHODS

The study started by reviewing some literature about cable cars and rural logistics. The literatures used in this paper can be from international source, national source, and local source. Focus of the literature review process was on the benefit of cable cars in some countries and also the characteristic of rural area on those countries.

Observation and interview were also conducted to gain the information about the use of cable cars in Indonesia. The observation and interview have the purpose to get the information about benefit, function, specification, and also the cost needed to run the cable cars system.

Information about the topography of West Java Province was obtained through literature from Statistic Indonesia (BPS and BPS Jawa Barat). The needed topography data was the lands characteristic and also the landscape of West Java. Observations were also made to see directly the landscape of some area of West Java.

3. RESULTS AND DISCUSSION

3.1. Cable Car

Cable car is one of the transportations in the form of trains that hang and run using cables. Most cable cars are operated using electricity. At first the cable car was used in tourist attractions such as forest areas, mountains, snowy areas, or in amusement parks, but currently the use of cable cars is not only to meet tourist needs but also used as a means of mass transportation (Liu H-L, Hsu W-L., et.al. 2015).

There are several types of cable car systems based on their functionality and type. Li (2004) in Liu and Hsu (2015) Describes a cable car system based on its function and type.

- (1) Functionality
 - a. General Ropeways
Used to transport passengers and goods and compartments used using doors and locks.
 - b. Special Ropeways
Used only for carrying passengers only and have an open compartment.
- (2) Type
 - a. Reversible
Reversible cable cars are divided into monocable, bicable, and multicable based on the number of cables used. Systems that are widely used in reversible types use 3 or 4 cables. The principle of a reversible cable car is a cable car with a cabin that can move forward and backward on the same cable so that when the cabin has reached its destination then the cabin will return to the original destination using the same cable.
 - b. Continuous
Cable cars in the continuous type are divided into 2 systems, namely fixed-grip and detachable-grip. Cable cars with fixed-grip systems have a cabin system that is continuously attached to the cable and runs continuously in one direction. Detachable-grip cable cars use cabin types that can be removed and reconnected on the cable if going in or out of the station. Fixed-grip systems are commonly used in small-scale transportation systems while detachable-grip is used in systems with high user density.

Some countries already use cable cars as a means of transportation either as tourist destinations or as an alternative to mass transit in addition to buses and other land transportation. The existence of a cable car in the densely populated area of La Paz-El Alto managed to cut the average travel time by 22% or by 9 minutes per day (Garsous *et al.*, 2019). In other case cable car is used to move people in the area with complex landscape. Many cable cars are built in areas with extreme natural conditions such as snowy ski areas (Mt Titlis in Switzerland and Chamonix Valley in France), close to large waterfalls in humid areas, close to the sea (Hong Kong and Singapore), in areas with high salinity, in misty areas (Huangshan), or on the edge of the desert (the Great Wall of China) (Liu & Hsu, 2015).

3.2. Rural Logistic

Rural logistics have different characteristic than urban logistic. Rural logistic tends to have lower logistics performance value when compared to urban logistics. The logistics performance includes distribution efficiency, information level, distribution cost and service level (Gani, 2017). In China there are several problems faced related to urban logistics performance, such as low distribution efficiency, low information level, high distribution cost and low service level (Xu, *et al.*, 2021). Type of goods transported also differs between urban logistic and rural logistic. In urban logistic goods transported are mostly industrial goods while in rural logistics goods are transported mostly in the form of agricultural products (Gong, 2019; Rubio, *et al.*, 2019; Suvedi, *et al.*, 2017). Agricultural products have their own characteristics and problems that are different from the characteristics of the industry in general. Fresh agricultural products are very easily damaged, have high market uncertainty, disequilibrium of market forces, and higher needs of the logistics supply chain (Tao, 2014).

There is a similarity of several solutions offered to solve rural logistics problems, namely by planning a distribution center in rural areas to transport agricultural products or other products. Rural areas can adopt the concept of joint distribution in designing distribution systems (Yandong He, et.al., 2017). Products originating from rural areas are collected first at several distribution stations and then collected to a distribution center to be marketed to the city (Chen, et al., 2019). In other cases, improvement in rural logistics performance is done by integrating government policies and the construction of distribution centers of rural area. Rural cooperative organizations play an important role as centers in the design of supply chain models for agricultural products in rural areas, in addition wholesale markets and logistic centers also play a very important role as the core of rural logistic systems (Tao, 2014). In addition to infrastructure, another thing to consider in designing a rural logistic system is the marketing process. A web-based online platform can be used to market products to trigger an increase in transactions both online and offline which will provide advantages to push agricultural products and local specialties across the country to new postal supermarkets all over the country (Gong, 2019; Hu, et al., 2020).

3.3. West Java Characteristics and Application of Cable Car in West Java

West Java Province is located between 5°50'-7°50' South Latitude and 104°48'- 108°48' East Longitude and has a land area of 35,377.76 km². West Java is an area distinguished from the steep mountainous area in the south with an altitude of more than 1,500 meters above sea level, a sloping hillside area in the middle with an altitude of 100-1,500 m above sea level, a large plain area in the north with an altitude of 0-10 m above sea level, and a river flow area (Purnamasari, et al., 2021).

West Java is administratively divided into 18 districts and 9 cities. Sukabumi Regency became the largest district with an area of 4,145.70 km² followed by Cianjur Regency with an area of 3,840.16 km² and Garut Regency with an area of 3,074.07 km². West Java has the highest area in Cimahi City with a regional height of 794.36 meters above sea level, followed by West Bandung Regency with a height of 789.56 meters above sea level and Garut Regency with a regional height of 758.92 meters above sea level (<https://jabar.bps.go.id/>).

The southern part of West Java has a lot of mountainous terrain (Suriadikusumah, 2014). Garut Regency is a region in the south of West Java that has a fairly large area and is in a fairly high area. South Garut has very large plantation and agricultural land but also complex and hard to reach terrain (Maryati, et al., 2020). Transportation used by residents in the South Garut area are mostly motorcycles and cars carrying goods and passengers.

The use of cable cars as a means of transportation of agricultural products has been applied in Sutenjaya Village, Lembang. The cable car named "Kereta Gantung Sasak Apung Padjadjaran" has provided facilities for farmers in the area but the use of cable cars is still not much of a concern of the local government as a means of transportation of agricultural products. Cable car Sasak Apung Padjadjaran has the following basic specifications.

- (1) Type of cable car: Reversible
- (2) Maximum capacity: 5 tons
- (3) Cable car mileage: 300 meters
- (4) Driving system: Motor/Dynamo
- (5) Cable diameter: 18 mm
- (6) Number of cables: 6 cables
- (7) Power source: 3-phase electricity

(8) Cabin type: Open compartment

To provide convenience to the logistics system in South Garut the use of cable cars can be an alternative solution because cable cars can reach difficult terrain in the agricultural and plantation areas of South Garut. In addition, similar terrain characteristics between South Garut and the mountains in Lembang will facilitate planning in the installation of cable cars for agricultural transport equipment. With one of the facilities supporting agricultural transportation, the construction of distribution stations and distribution centers will be able to easily connect with each other.



Figure 1 Landscape of Southern Area of Garut Regency



Figure 2 Landscape of Sutenjaya Village, Lembang



Figure 3 Cable Car Sasak Apung Padjadjaran



Figure 4 Support Poles and Drive Motors

4. CONCLUSION

Some countries have used cable cars as a means of tourism transportation or as a means of transporting goods and people in difficult areas. In some studies, it has been proven that cable cars can provide significant benefits to the surrounding community. Cable cars can be a support tool in a rural logistic system, especially in terms of transporting agricultural products and plantations in hard-to-reach terrain. Cable cars for the purposes of transporting agricultural products already exist in Sutenjaya Village, Lembang so it will be easier to build cable cars in areas that have difficult terrain in West Java, especially in the southern area of Garut Regency because it already has a pilot area.

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