

AN ANALYSIS OF CONTAINER TRAIN SYSTEMS FROM DHAKA TO CHITTAGONG IN BANGLADESH

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1. Introduction

An efficient transport system is a prerequisite for both initiating and sustaining economic development in Bangladesh. Investment in improving transport efficiency is the key to expanding and integrating markets, as well as achieving an average GDP growth rate of over 7% per annum. The transport sector growth rate is expected to increase at a considerable 8-9% per annum as a result of the transformation from a subsistence-based to a market-based economy. This high growth in transport volume would be a substantial improvement in the system, ensuring smooth transport. The transport system of Bangladesh consists of roads, railways, inland water transports, maritime shipping and civil aviation catering to both domestic and international traffic. The public sector is involved alongside the private sector in road transport, Inland Water Transport (IWT) and ocean shipping. Recently the private sector has also become involved in domestic air transport and railway on a very limited scale. Since gaining its independence in 1971, Bangladesh has witnessed rapid growth in transportation. The overall annual growth rate was nearly 8.2% for freight transport. The transportation systems of Bangladesh still lag behind other sectors, and their contribution to the economy is considerably lower than that of many developing countries.

Because of the growth of goods and population within the two major cities of Dhaka and Chittagong, a universally accepted means of transporting goods is needed. One possibility is to use logistics. Logistics can encompass the manufacturing function as well as goods procurement and distribution. The rationale is that production should not be planned alone, but should take into account distribution and other corporate activities. This process has been encouraged by the creation of logistics operation and physical distribution within the Dhaka-Chittagong region in Bangladesh. This paper reviews the current logistics in Bangladesh and identifies the problems of container train movement from Dhaka to Chittagong and proposes a better logistics policy for Bangladesh. In the present study, the Extended Contributive Rule (ECR) method is used to clarify the problem in freight container trains of these two major cities in Bangladesh. No analysis using the ECR method has been performed regarding goods transportation. This is also the first time using this method in analyzing the container train service of Bangladesh. By applying this method, we can obtain a high evaluation of the container train services in Dhaka-Chittagong.

2. Populations and Geography

(1) Population of Dhaka-Chittagong Areas

Table 1 lists the four censuses that have been conducted in Bangladesh. The population of Bangladesh was 71.4 million in 1974; the population of Dhaka City was 1.67 million and that of Chittagong City was 0.94

Table 1. Population information (Million)

Year	Bangladesh	Dhaka City	Chittagong City
1974	71.4	1.67	0.94
1981	89.9	3.44	1.38
1991	111.4	3.69	1.40
2001	129.3	6.84	2.34

*Key words: Dhaka-Chittagong container train, Logistics, ECR method

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million. The total population of Bangladesh was 129.3 million in 2001, at which time, the populations of Dhaka and Chittagong were 6.84 and 2.34 million, respectively. The area of Dhaka City is 1353 sq. km and that of Chittagong is 986 sq. km. The annual population growth rate of Bangladesh is 1.5 percent. The proportion of the population in urban areas is nearly 23.5 percent, while that in rural areas is 76.5 percent.

(2) Map of Bangladesh and its Transportation Network

Bangladesh appeared on the world map as an independent and sovereign state in December 1971. The gross area of the country is about 148,393 sq. km. With rapid growth and development, sustainability has emerged as a critical issue for all sectors, especially transportation. Figure 1 shows Bangladesh's various modes of transportation: highways, railways, waterways, airports and seaports.

This paper focuses on the freight container train services in the Dhaka-Chittagong area. Dhaka is the capital of Bangladesh; Chittagong, the second largest city, is known as the commercial capital of Bangladesh. Bangladesh needs to develop its transportation system in order for the economy and the goods distribution system to improve.

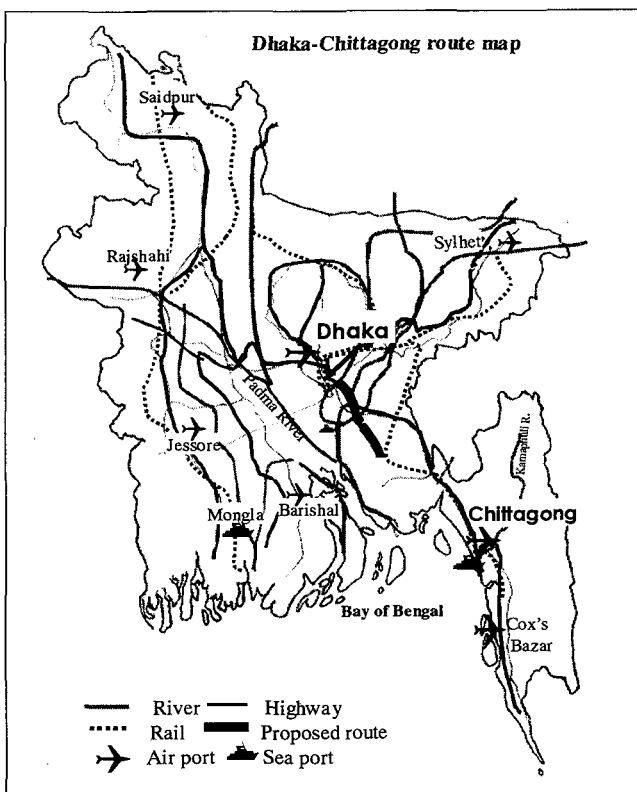


Figure 1. Map of Bangladesh

3. Data Analysis of Goods in Bangladesh by Logistics

(1) Availability of Goods

Availability of goods and their respective rates of increase are compiled in Table 2. In 1986-87, the total crops produced in Bangladesh equaled 15,818,000 metric tons, which comprised 31.8% of the total goods produced. In 1996-97, crop production rose to 20,178,000 metric tons and comprised 25.5% of the total goods produced. For the period 1986-87, domestic products in the forestry, livestock, and fisheries sectors represented 6.1%, 0.8% and 1.0% of total goods, respectively. In 1996-97, these figures rose to 8.0%, 1.1% and 1.1% of the total goods. Minerals, industrials and imported goods in the same period represented 22.7%, 22.7% and 14.9% of the total goods respectively. The grand total was 49,753,000 metric tons. For the period 1996-97, the same three categories of goods represented 28.0%, 22.1% and 14.2% of total goods produced respectively, with a grand total of 79,036,000 metric tons. Table 2 also shows that, in the period 1986-97, the quantity of crops increased by 1.28% and the rate of increase of total goods was 1.59 percent.

Table 2. Availability of goods in Bangladesh (Metric ton)

Goods	1986-87 (%)	1996-97 (%)	Increasing rate
Crops	15,818,000 (31.8%)	20,178,000 (25.5%)	1.28
Forestry	3,018,000 (6.1%)	6,305,000 (8.0%)	2.09
Live-stock	422,000 (0.8%)	871,000 (1.1%)	2.06
Fishery	517,000 (1.0%)	834,000 (1.1%)	1.61
Mineral Products	11,283,000 (22.7%)	22,135,000 (28.0%)	1.96
Industrial Goods	11,302,000 (22.7%)	17,476,000 (22.1%)	1.55
Imported Goods	7,393,000 (14.9%)	11,237,000 (14.2%)	1.52
Total	49,753,000 (100.0%)	79,036,000 (100.0%)	1.59

In Table 2 it can be seen that forestry, livestock and mineral products showed rapid rates of increase of 2.09%, 2.06% and 1.96%, respectively.

(2) Distribution of Goods

The volume of goods transported by air in 1986-87 was 2,000 metric tons, or 0.01% of the total goods distributed; in 1996-97, it was 1,000 metric tons, which was 0.002% of the total. Transportation by other means like rail, water and road for the period 1986-87 were 5.41%, 15.37% and 79.21% of the total goods distributed, respectively, with a grand total of 36,641,000 metric tons. Likewise in the year 1996-97, the figures were 4.953%, 18.678% and 76.367% of the total goods distributed respectively, with a grand total of 59,278,000 metric tons. Table 3 indicates that the distribution of goods in the years 1986-97 via roads increased by 1.56 percent and the total distribution of goods increased by 1.62 percent. It is reflected here that the shipment of goods in Bangladesh takes place mainly on roads, which formed 76.37% of total distribution, while railways handled around 5% of total distribution.

Table 3. Distribution of goods in Bangladesh (Metric ton)

Transport	1986-87 (%)	1996-97 (%)	Increasing rate
Air Transport	2,000 (0.01%)	1,000 (0.002%)	0.50
Bangladesh Railway	1,984,000 (5.41%)	2,936,000 (4.953%)	1.48
Water Transport	5,633,000 (15.37%)	11,072,000 (18.678%)	1.97
Road Transport	29,022,000 (79.21%)	45,269,000 (76.367%)	1.56
Total	36,641,000 (100.0%)	59,278,000 (100.0%)	1.62

The present analysis indicates that, in the period of 1986-97, at least 25% of distributed goods were not moved by conventional modes but, most likely, by non-motorized vehicles.

(3) Existing Situation of the Dhaka- Chittagong Freight Container Train Services

Railway container service in Bangladesh started in 1987, with the debut of the Dhaka-Chittagong parcel express train. The exclusive container train was introduced in 1991. The Inland Container Depot (ICD), Dhaka, is near Kamalapur Railway Station. The Dhaka-Chittagong train lines have a meter gauge system. The distance between the two cities is 346 km. The rail route is 68 km longer than the road route, and involves detours. Three container trains (container express, tank special, and express goods) operate in these regions. Chittagong (Ctg.) yard is near Chittagong port.



Figure 2. Container train in Bangladesh

Table 4. Container train in Dhaka-Chittagong

Container Services in Dhaka-Chittagong Railway					
No	Name	Number of train	From	To	Revenue per ton. (Tk.)
1	Container Express	2	Dhaka ICD	Ctg. Yard	353.74
2	Tank Special	1	Dhaka Cantonment	Ctg. Yard	Revenue per Km.(Poisha)
3	Express Goods	1	Tejgoan, Dhaka	Ctg. Yard	123.6

Logistics analysis finds that the distribution of goods is lower than the availability of goods. Goods production is increasing, and 25% of all goods rely solely on non-conventional, haphazard transport modes. The distribution of goods by railways decreased from 5.41% to 4.95% from 1986 to 1997. In these days of globalization, Chittagong port plays an important role and is the major commercial area of Bangladesh. The Dhaka-Chittagong freight container train is in high demand for the transport of goods. Container freight trains are well suited for moving goods. Their exhaust emissions are low and, compared with other modes of transportation, their revenue generation is satisfactory. For these reasons, it is clear that the Dhaka-Chittagong container service should be developed using modern technology, establishing a new route that promises to be of great importance to Bangladesh.

4. Problems of Logistics in the Dhaka-Chittagong Freight Container Train

There are serious problems regarding the Dhaka-Chittagong container train service. We interviewed experts at the Japan International Cooperation Agency (JICA), in the Japanese government, and various groups of Bangladeshis who are closely involved in distribution / transport-oriented organizations. Based on these consultations, we compiled a list of the 10 major problems that these two cities face. These problems are briefly described below.

① Fares

In Bangladesh, freight container train fares are an important concern. Presently there are tariff rules in maintaining the physical distribution policy. In practice, authorities do not follow these rules. Customers negotiate the price to destination, and sometimes improper bribes are offered for reduced fares. Logistically, this fare policy is very important for goods distribution. The fare is the key item in the distribution of goods.

② Number of Trains

The number of container trains is insufficient on the Dhaka-Chittagong route. Bangladesh needs more container trains in order to increase the mobility of goods. Goods in the Dhaka-Chittagong area suffer greatly from the infrequency of railway departures. There is a high demand for goods transport by seaport freight container, and this mode is of great importance to Bangladesh.

③ The Diagram of Train Service

The railway system configuration is very important for logistics. The present Dhaka-Chittagong train line was established when this region was part of British India, and no steps have been taken to change the system, except in minor ways. The railway lines are less direct than the roads. At present, container trains are not maintaining their schedules.

④ Expert Hands

Expert hands are important for logistics. Loading and unloading take considerable time, and goods often end up damaged. Here the public suffers substantial harm, and the railway authority should consider training for efficient container train service. It is difficult to achieve logistical efficiency with untrained, inefficient workers.

⑤ Information Technology

Information technology in Bangladesh is very poor across all sectors. Information is vital; the combined lack of information technology across many sectors further hampers the use of the Dhaka-Chittagong container train information system for logistics.

⑥ Container Services

Container train service in Bangladesh is inadequate for cargo transportation and does not currently satisfy the demand on the Dhaka-Chittagong route. Railway authorities are not allotted the funds needed to build new containers. Sometimes containers are unavailable for use in the Dhaka-Chittagong area. Goods distribution requires a strong policy of maintaining logistical readiness.

⑦ Transportation Time

Time is an important factor in distributing goods. The rapid urbanization of Bangladesh requires a dependable physical distribution system, in which on time delivery is provided.

⑧ Environmental Pollution

Pollution has emerged as a threat throughout the world, and current systems harm the environment. Smooth running logistics provide a number of positive effects, including recycling. Presently, the freight containers train service in Dhaka-Chittagong operates in a very outmoded way. A proper logistical operation protects the environment and

minimizes pollution.

⑨ Responsible Workers

Responsible workers are a very important part of the physical distribution. In terms of logistics, these people are involved in distributing, loading and unloading, and the wrapping or packing of goods. These people also play an important role in the information network. All these items are important for transportation. Responsible workers can promote logistics efficiently.

⑩ Warehouse

In Bangladesh, the biggest gap lies between the storing and transporting of goods. The volume and range of goods is increasing, and there is no coordination between storage facilities and the distribution of goods. This is a major logistical problem. Especially in the case of freight container trains, there is no convenient warehousing, and for logistics, this is a basic requirement for the physical distribution of goods.

According to the above discussion, the most important problem to be solved is the route configuration of the Dhaka-Chittagong container train service. The other problems according to importance are; fare policy, skilled workers, transportation time, responsible worker, environmental pollution, warehouse, number of trains, information technology and container services.

5. Observation of Goods Mobility Situation by the ECR Method

(1) Dhaka-Chittagong Freight Container Service in Train

We have chosen 10 problems which need to be improved to upgrade the freight container service in the Dhaka-Chittagong area for analysis in Section 4. These ten problems are listed in Table 5 according to rank. Securing these would be favorable for logistics in Bangladesh. Container trains are maintained by the public sector Bangladesh Railway. We evaluate container service on the Dhaka-Chittagong route by Extended Contributive Rule (ECR).

Table 5. Evaluation object of ECR method

①	The fare is cheap
②	The number of trains are too many
③	The diagram of train services is on time and straight
④	For shipment expert hands are available
⑤	In this freight transportation information technology is available
⑥	Container services is enough for goods shipment in train
⑦	Transportation time is very short for shipment
⑧	Reduce the environmental pollution and taking care policy is good
⑨	Attitude of the responsible workers are very sincere and safety
⑩	Warehouse is enough for shipment in the both cities

Here it is important to note that opinions and evaluations come from willing participants who rank the various problems. For example, some participants rate certain items as very important, while on the other hand, some will deem the same items as relatively unimportant. ECR can easily determine their importance. Moreover, it can take into account the opposing opinions in the analysis of the problem.

(2) The Basic Theory of the ECR Method

Sawaragi *et al.* (1980) proposed the ECR method, which has been developed from the Simple Contributive Rule (SCR) method (Saposnik, 1975). There are examples of application of ECR for evaluating the items with the maintenance of an existent airport, for road maintenance policy, and for traffic planning. A theoretical description of SCR and ECR follows:

$$a_i R^l a_j \text{ iff } c^l(a_i, a_j) \geq 0 \quad (1)$$

Here, Equation (1) is the quantity of decision-makers l . The decision-maker's preference between two certain choices of a_i and a_j is expressed as c^l (contribution function). For the decision-maker l , $a_i R^l a_j$, shows a_i is more or equally preferable to a_j (in weak order relation). $c^l(a_i, a_j)$ is written to be c_{ij}^l . c_{ij}^l shows decision maker l 's preference between a_i and a_j . Assuming that the number of decision makers is m , then,

$$a_i R a_j \text{ iff } g(c_{ij}^1, \dots, c_{ij}^m) \geq 0 \quad (2)$$

When the real function c^l that is defined by Equation (2) and g exist, mapping the individual preference to group preference is called a Contributive Rule (CR). Here, R is the preference of the group. Especially when g is sum of individual preferences c_{ij}^l ,

$$g(c_{ij}^1, \dots, c_{ij}^m) = \sum_{l=1}^m c_{ij}^l \quad (3)$$

Equation (3) is called SCR (Simple Contributive Rule). The value of cardinal utility of a decision maker l for selecting option a_i is expressed as $u^l(a_i)$. Assuming that the difference of utilities between option a_i and a_j is c_{ij}^l

$$c_{ij}^l = u^l(a_i) - u^l(a_j) \quad (4)$$

In the SCR method, it becomes;

$$g(c_{ij}^1, \dots, c_{ij}^m) = \sum_{l=1}^m u^l(a_i) - \sum_{l=1}^m u^l(a_j) \quad (5)$$

The order of preference given by g in Equation (5) is from weak to strong. Although the SCR method can give the preference order of a group, the scale of the opposing opinions cannot be indicated. In such cases an intensive method of preference that gives more information for valuable discussion is a powerful tool. For this end the Extended Contributive Rule (ECR) method was developed. ECR is the extension of SCR and the function g for c_{ij}^l in Equation (4) is given as

$$g(c_{ij}^1, \dots, c_{ij}^m) = \sum_{l=1}^m w^l c_{ij}^l + \lambda \sum_{l=1}^m w^l \text{Min}(0, c_{ij}^l) - m\theta \quad (6)$$

This ECR method can clarify the preference group in detail. Here,

g : Collective the degree of preference

c_{ij}^l : Preference the item j from the decision-making person's l item i .

w^l : The dignity of decision-making person's l (this research, all the opinion of respondents is treated equally, and it is $w^l=1$)

$\lambda (\geq 0)$: Value of high degree of coincidence from the opinion

$\theta (\geq 0)$: A threshold for eliminating the weak relation

The second term of Equation (6), introduces the big volume (λ) of opposing opinions, and a_i and a_j are of equal importance. The desirable preference group is $c_{ij}^l < 0$, even (the value of first term) when λ is increased but the whole strength of the preference group is the same.

In the third term of Equation (6), θ describes the threshold to cut the preference relation of the respondents averages with the opposing opinion (λ). This eliminates the weak relation. Transitivity, ECR is able to set up the preference relationship structure, but its principals of combination consist of complex situations. In the Dhaka-Chittagong container train service case, ECR ranked the problems clearly. In some cases, the preference relations of groups are too complex. As a result, the preference line cannot always be identified.

In this method, the structure set up is by most important to least important preference group, using the Interpretive Structural Modeling (ISM) method to calculate the results. This method solves the problem by priority basis and relates the items through preference lines.

(3) Data Collection

a) Data Results

Fifty people in Dhaka were surveyed, with some persons living in Chittagong. In this survey 44 were male (88%) and 6 female (12%). All were younger than 50 years old. Of the sample set, 64% (or 32 people) were aged 30-39, and 36% (or 18 people) were 40-49.

The survey was conducted from 21 December 2001 to 20 January 2002, in Dhaka, Bangladesh. All 50 of the respondents were involved in freight container train service, or were knowledgeable about transportation. Of these, 30 were businessman and 20 were civil servants; of the latter 20, three persons were teachers. The businessmen were owners of a goods company employing 19 people, 11 of whom were involved in the transport of goods.

Table 6. Survey Times and Characteristics of Respondents

Time and place:	21st December 2001 to 20th January 2002, Total 31 Days, Dhaka, Bangladesh
Sex:	Male 44 (88%), Female 6 (12%), Total 50 (100%)
Age Group:	30-39 Age Group 32 (64%), 40-49 Age Group 18 (36%), Total 50 (100%)
Profession:	Goods Businessmen 19 (38%), Transport Businessmen 11 (22%), Civil Servants 17 (34%), Teachers 3 (6%)

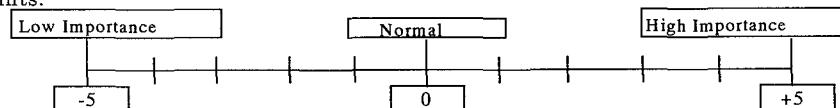
Results show that of the 50 respondents, 47 (94%) think the Dhaka-Chittagong container train does not satisfy public demand. Two respondents thought it satisfies demand and one respondent had no comment. In the remarks section of the survey, every person had a complaint about the Dhaka-Chittagong container train, all wanted better service. Some people suggested making the service safer and others suggested privatization or service improvement. It is clear that the Dhaka-Chittagong container train is very important and needs further development.

b) Survey Methodology and Design

Questionnaire Survey Sample:

Q. Asking the Public consciousness of Dhaka-Chittagong freight container services in train.

Dhaka-Chittagong freight container services are the most important transportation in Bangladesh train. In this questionnaire I am requesting you to fixing the better route of freight services at present public transport in the twenty-first century. Please read below questionnaire carefully and fill up the blanks is given. Please mark the item 1 to 10 following the instruction. The '+5' point at the item is the high important value and, the '-5' point at the item is the lowest value of my questionnaire method. Which thinks that the point '+4' - '0' and '-4' - '0' is given to the gradual marking. However, please add your point or mark and make the sum of total point of all items may become 0 points.



1. The fare is cheap.
2. The frequency number of train is too many.
3. The diagram of train services is on time and straight.
4. For shipment expert hands is enough for works.
5. In this freight transportation information technology is available.
6. Container services are enough for goods shipment in train.
7. Transportation time is very short for shipment.
8. Reduce the environmental pollution and taking care policy is good.
9. Attitudes of the responsible workers are very sincere and safety.
10. Warehouse is enough for shipment in the both cities.

Sum of the point is : 0

Figure 3. ECR method questionnaire survey sample in Dhaka-Chittagong freight-container train services

ECR was employed in the survey. This type of survey asks respondents to choose from hypothetical scenarios. In the first part of the survey, respondents were asked to state a preference solely regarding the individual's perception of the impact of the freight container train. In the second part, options were presented by ECR. In view of the complexity of this experiment, only 10 items were given. Respondents were asked to choose a number on a 10-point scale where 「+5」 points indicated most important, and 「-5」 points indicated least important. For other items, point values ranging from 「+4」 to 「-4」 are assigned. However, the sum of values assigned to all items must equal 0. In other words, it is called a plus minus 5-point method. The third part of the survey asked how well freight container rail service in the Dhaka-Chittagong region fulfilled public demand. Finally, there was a section for general remarks. The surveys done by ECR are shown in Figure 3.

(4) Dhaka-Chittagong Freight Container Service Evaluation by the ECR Method

Among the 10 problems, it is easy to clarify the results of evaluation by ECR, which showed in the figure. First we evaluate the value for $\lambda=0$, $\theta=0$, and then the result of this evaluation can make important structure of problems. Here, the result shows ranking of problems, as shown below: ① "The fare is cheap", ③ "The diagram of train services is on time and straight", ④ "For shipment expert hands are available", ⑥ "Container service is enough for goods shipment in train", ② "The number of trains is too many", ⑩ "Warehouse is enough for shipment in the both cities", ⑧ "Reduce the environmental pollution and taking care policy is good", ⑨ "Attitude of the responsible workers are very sincere and safety", ⑦ "Transportation time is very short for shipment", ⑤ "Freight transportation information technology is available". Figure 4 shows the problem ranking of preference in Dhaka-Chittagong container train (from most important to least important).

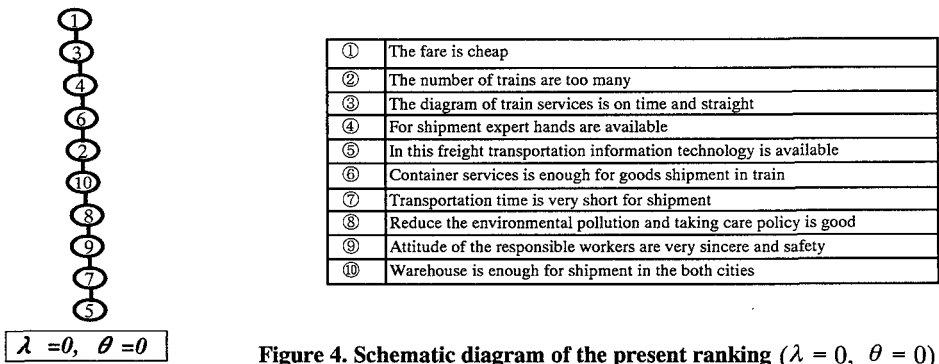


Figure 4. Schematic diagram of the present ranking ($\lambda = 0$, $\theta = 0$)

By changing the preference-relationship (by means of changing values of λ , θ) ECR method can analyze the degree of contrary opinions and weak relations. In this research, because we especially focused on opposing opinions for general ranking of importance, λ was varied. $\lambda=1$ value is twice the opposing opinions in Equation (6). Figure 5 shows the ranking of importance when $\lambda=1, \theta=0$. In that case, items ①, ③ and ④ are still ranked most important. That means few people have opposing opinions on the importance of ①, ③ and ④. According to the ranking, 10 items are divided into the three parts: 1st important group is ① "The fare is cheap", ③ "The diagram of train services is on time and straight", ④ "For shipment expert hands are available", the 2nd group is ⑥ "Container service is enough for goods shipment in train", ⑦ "Transportation time is very short for shipment", ⑧ "Reduce the environment pollution

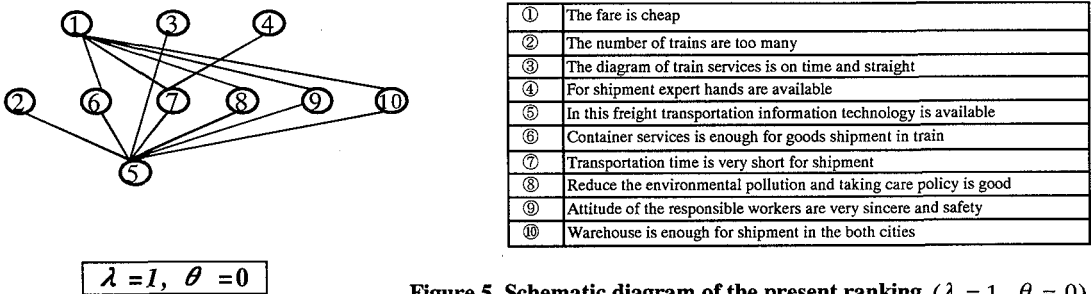


Figure 5. Schematic diagram of the present ranking ($\lambda = 1$, $\theta = 0$)

and taking care policy is good", ⑨ "Attitude of the responsible workers are very sincere and safety", ⑩ "Warehouse is enough for shipment in the both cities", ② "The number of trains is too many" and finally third group is the less important item of this number which is ⑤ "Freight transportation information technology is available".

6. Considering the Ranking of Importance for Dhaka-Chittagong Container Train Service

The ECR provided the category of services in the Dhaka-Chittagong container freight train. This analysis is based on the opinions of people who are closely related with the Dhaka-Chittagong container train system. Here, the most important items are ① "The fare is cheap", ③ "The diagram of train services is on time and straight" and ④ "For shipment expert hands are available". These three items are highly valued in the ECR evaluation, which means there is no group that contradicts their importance. These three have high value in the Dhaka-Chittagong container train.

The items ⑥ "Container service is enough for goods shipment in train", ② "The number of trains is too many", ⑩ "Warehouse is enough for shipment in the both cities", ⑧ "Reduce the environmental pollution and taking care policy is good", ⑨ "Attitude of the responsible workers are very sincere and safety", ⑦ "Transportation time is very short for shipment" are also important but less important than ①, ③ and ④. Item ⑤ "Freight transportation information technology is available" was least important in this evaluation. For a developing country like Bangladesh, this evaluation is very important for future transportation planning.

Transport policy decisions depend on the policies of the government. Although the government recognizes the gravity of the present freight container trains in the Dhaka-Chittagong route, its policies do not seem well coordinated. A lack of coordination among parties concerned made freight container related policies insufficient in this region. At all levels of decision-making, their decisions are not comprehensive thus creating conflicts in the physical distribution. This should be improved. The current deteriorating container train situation needs to be improved by ranking. In light of the above analysis, the following solutions are recommended:

- (1) New freight train container service is required, one that follows the rules of fare policy. Setting up a tariff rule is also needed for physical distribution. The train route configuration is important for setting fares: if we can shorten the route then we can reduce the fares as well as the transport time, consequently the container train service can satisfy demand. For this end, a new, shorter container train route between Dhaka and Chittagong is useful.
- (2) This paper found the preference of important items for making the short diagram or configuration route. A new route is proposed (Figure 1 proposed route) which is 68 km shorter than the current train line. Because the new route will be shorter, it reduces both the time and fare; therefore, it is essential that such a route be developed for the Dhaka-Chittagong. The Evaluation of public opinion by ECR identified the relative seriousness of problems regarding Dhaka-Chittagong container train service. ECR can be used to properly evaluate public opinion and, thereby, to support sustained development.

7. Conclusion

This paper focused on three items ① "The fare is cheap", ③ "The diagram of train services is on time and straight" and ④ "For shipment expert hands are available". The importance of the ECR ranking was noted as well. We proposed improved freight container train service on the Dhaka-Chittagong route by considering certain objectives. ECR analysis revealed the relative importance of the 10 items. We proposed a new train route in the Dhaka-Chittagong region that will save money and time. ECR is effective for developing countries to analyze problems in various sectors. Our next plan is to analyze the highway transport in the Dhaka-Chittagong area.

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An Analysis of Container Train Systems from Dhaka to Chittagong in Bangladesh

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Dhaka-Chittagong container train service is evaluated toward improving physical distribution. The Extended Contributive Rule (ECR) is used to clarify problems, based on public opinion. The ECR analysis confirmed the importance of Dhaka-Chittagong container train service for goods distribution. From the ECR evaluation, three items were found to be very important: "fare", "straightness of train route configuration and on-time performance", and "utilization of skilled goods handlers." Based on the above analysis, this paper recommends a new container service for the Dhaka-Chittagong train, and a new route to reduce the transport distance.

バングラデシュにおけるダッカ～チッタゴン間のコンテナ輸送の分析

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本研究では、ダッカーチッタゴン間における鉄道コンテナ輸送における問題点について、物流関係者を対象として意識調査を行い、ECR法を用いて評価を行った。物流においてECR法を用いた分析は今まで行われておらず、バングラデシュにおいても同様である。ECR法を用いることによって集団の重要度を分析することができる。データの分析結果から、「料金を安くする」、「定時運行と直線ルートであること」、「出荷のためのエキスパート」の3つがコンテナ輸送において重要であることがわかった。そして、ダッカーチッタゴン間における今後の鉄道コンテナ輸送の整備について、新しいコンテナサービスと新しい短絡ルートを作ることが必要であることを提言した。