Efficiency Enhancement in Rail Freight Service in Thailand Using Servqual Model

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***Abstract*—Rail freight service in Thailand is increasing its importance as it is considered as the second cheapest mode of transportation after the maritime service. Moreover, the current major mode of transportation which is the road transportation has created a lot of problems including high energy consumption, increased number of accidents and pollution problems. Therefore, Thai government has launched its policy to expand the rail track networks and promote the use of rail freight services. However, there is no clear avenue to enhance the efficiency of the rail freight service. The purpose of this study is to identify a set of performance indicators for measuring rail freight transportation service. The indicators were developed based on SERVQUAL Model and prioritized by the Analytic Hierarchy Process (AHP). Finally, the result from this research shows where the providers should focus for improvement as they are the major concerns for customers and providers themselves. The punctuality and better services are the most important concerns while the tangible assets are the least significant attributes. A set of performance indicators for rail freight service is recommended.**

Keywords-rail freight service; servqual model; analytic hierarchy process; performance indicator; service quality

I. INTRODUCTION

Rail transportation in Thailand has been established more than one hundred twenty years ago. The State Railway of Thailand has been the only service provider for both rail freight and passenger transport. Even though the rail transportation has been in effect for a long time, it is not a popular mode of transportation. The percent shares of rail transportation are approximately 1.89, 1.90, and 1.99 percent in 2014, 2015, and 2016, respectively [1]. According to [2] the main problems for unsuccessful rail transportation in Thailand include (1) delays, (2) continuous loss of property, (3) cargo distribution problems, (4) shortage of equipment, (5) shortage of staff and (6) other problems such as hygiene, safety, and frequent accidents [2].

From the above problems, it showed that rail freight transportation service in Thailand is lack of service quality. This means that the quality of the services in terms of punctuality is poor, the security is not good, storage and distribution have problems, infrastructure is insufficient, staff on duty is not enough, and a lot of accidents occur. However, there is no clear definition of service quality specifically for rail freight or a clear guideline on how to measure service performance. Without pre-defined measures, there is no way to know the current performance of rail freight services. Hence, the operators cannot make any improvement. This research is interested to enhance the efficiency of rail freight service in Thailand focusing on the service quality. Before going that far, it is necessary to identify the right performance indicators for rail freight service as the first step. Then, data collection will be made and followed by the analysis of results. The final step of research methodology will be the recommendations for improvement.

To measure service quality, one of the most popular tools used by many researchers and industries is called SERVQUAL model. It is a multi-dimensional research instrument, designed to capture consumer expectations and perceptions of service along the five dimensions that are believed to represent service quality. The common five dimensions include tangibles, reliability, responsiveness, assurance, and empathy and applied the Analytic hierarchy process (AHP) to analyze the data. The AHP established by [3] and there found in many researches using AHP and combination with other methodology in widespread industries such as [4], and [5]. However, there is limited literature on the application of SERVQUAL in measuring quality of rail freight services.

Therefore, this research aims to investigate the application of SERVQUAL model and its dimensions/sub-dimensions in measuring the quality of rail freight transport. The important weight of each dimension/sub-dimension will be identified and the performance of the rail freight service in Thailand will be measure. Lastly, the low performance sub-dimensions will get recommendations for improvement.

II. SERVICE QUALITY

The service quality has been applied in many previous studies. The application of service quality concept in transportation service have showed in [1], [3], [6], [7], [8], [9], [10], [11], and [12] which were done in the maritime freight service, air cargo service, and passenger rail service. There is a limited literature on the application of service quality in rail freight service.

A. Definition of Service Quality

Service quality is a concept of significant interest in many industries. Researchers defined Service quality differently. [13] defined service quality as "the degree and direction of discrepancy between customers' perceptions and

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expectations". [14] defined customers‟ service quality as the difference between the actual service performance and their expectations. [15] that “service quality has been variously defined as focusing on meeting needs and requirements, and how well the service delivered matches customers' expectations." Service quality is the distinction between consumers' expectations for service performance and their perceptions of the service received. In this research, service quality means the quality of service which are reflected from the customer‟s perception of each service attribute.

Customer satisfaction is the overall level of service success as per customer expectations. [16] studied service quality and customer satisfaction in retailing in India and concluded that customers have highest expectations on promptness of service, accuracy and security. The study of relationship between service quality and customer satisfaction found that all five dimensions of SERVQUAL were significantly related to customer satisfaction, these studies were consistent with [17] who came to the same conclusion in the study on the communication industry. [17] found that there was a positive relationship between service quality and library user satisfaction among universities in Kenya. Service Quality, therefore, has a direct and strong effect on customer satisfaction and loyalty.

Great service quality is important for companies to satisfy their customers. In the rail freight service, it is important for the State Railway of Thailand (SRT) as the sole rail freight service provider to know how their customers perceived their service. Hence, this research will provide specific service quality measures for the rail freight service measurement.

B. Measuring Service Quality using SERVQUAL Model

TABLE I. DEFINITION OF FIVE DIMENSIONS OF SERVQUAL

Dimensions	Definition
Tangible	Appearance of physical facilities, appearance, and communication of the personnel in the service process and type of equipment provided in the service process
Reliability	The ability of an organization to do a task or service as promised is called as reliability
Responsiveness	The willingness of service provider to help the customers. Making an effort sincerely to provide prompt service to customers
Assurance	Ability of the service provider to give a sense of trust and security to the customers
Empathy	Ability of service providers to communicate with customers and provide individualized attention to them.

In the beginning SERVQUAL established by [13] and had identified ten dimensions of service quality (SERVQUAL) which include credibility, security, accessibility, communication, understanding the consumer, tangibles, reliability, responsiveness, competence and courtesy. Subsequent research of [13] consolidated the ten dimensions into five dimensions which are tangible, responsiveness, reliability, assurance, and empathy. The definition of each dimension is shown above in Table I.

III. RESEARCH METHODOLOY

The step of research methodology contains 5 steps as shown in Fig. 1

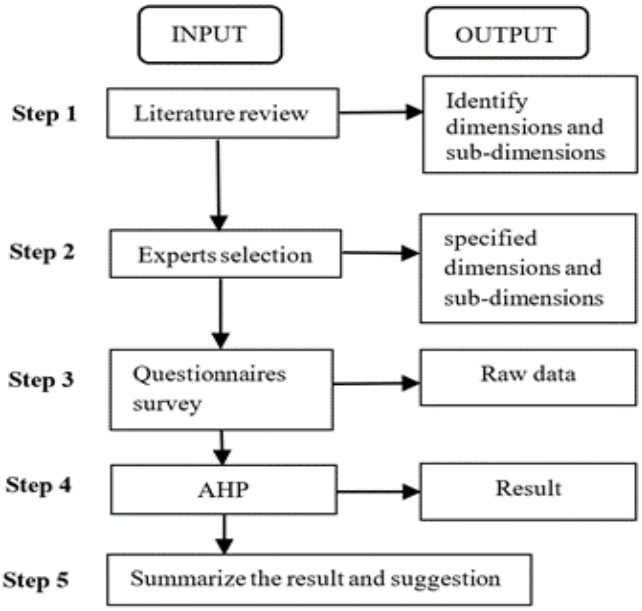

Figure 1. Steps of research methodology.

Step 1 Identify dimensions and sub-dimensions from literature review

This step concerns the summary of dimensions and sub-dimensions of service quality derived from previous literatures.

Step 2 Specify dimensions and sub-dimensions for rail freight services

The dimensions and sub-dimensions from Step 1 were selected by rail-related experts so that the chosen dimensions and sub-dimensions were for rail freight service. At this step, three experts were asked to choose the specific dimensions and sub-dimensions as shown in Table II.

Step 3 Survey using questionnaires for two target groups

This step is the data collection using questionnaires survey. The questionnaires were asked two target groups. One is the customers who have used the rail freight service and the other is the provider or the SRT who provide the freight service. In total, there were five respondents from each group who were asked to rate the weight of importance indicators and fill the pairwise service quality dimensions. The respondents will indicate which indicators were "equally important", "more important than" or "less important than" another dimension in the pairwise comparison matrix and rating scale as shown in Table III.

TABLE II. SPECIFIC DIMENSIONS AND SUB-DIMENSIONS FOR RAIL FREIGHT SERVICE

Dimension	Sub-dimension
Tangible	T1 Modern equipment and facilities T2 Clean and comfortable service T3 Ability to communicate T4 Accurate and reasonable cost

	T5 Real-time tracking
Responsiveness	R1 Preparedness to help R2 Respond to customer need R3 Ability to solve problem R4 Variety of service R5 Sufficient locomotive and containers
Reliability	RE1 Error prevention RE2 Customers‟ confidence RE3 Customers satisfaction RE4 Punctuality
Assurance	A1 Customer loyalty A2 Polite staff A3 Knowledgeable staff A4 Compensation policy
Empathy	E1 Customer care E2 Keep confidential E3 Suitable service E4 Service improvement

TABLE III. RATING SCALE FOR AHP QUESTIONNAIRES

Option	Numerical value(s)
Equal	1
Marginally strong	3
Strong	5
Very strong	7
Extremely strong	9
Intermediate values to reflect fuzzy inputs	2, 4, 6, 8
Reflecting dominance of second alternative compared with the first	Reciprocals

Selection of respondents are from experts who have direct experience in rail freight transportation including the customers and the providers. The list of respondents is shown in Table IV.

TABLE IV. LIST OF RESPONDENTS

Number of Respondents	Years of experience	
	Customers	*Providers*
1	8	35
2	12	41
3	29	40
4	16	15
5	20	36

Step 4 Apply AHP to prioritize the dimensions and sub-dimensions

The Analytical Hierarchy Process (AHP) tool was used to prioritize the dimensions and sub-dimensions of service quality identified in Step 3. The AHP concept is one of the most popular methods for decision making in the service quality assessment. AHP can be used to select priorities, allocate resources, compare and manage quality. AHP is a quantifiable technique that helps to organize problems that are complex structured multiple attributes. It is an approach that aims at deciding on a set of problem-solving strategies The AHP provides a means of decomposing the problem into a hierarchy of sub-problems which can more easily be comprehended and subjectively evaluated. The subjective evaluations are converted into numerical values and processed to rank each alternative on a numerical scale.

Step 5 Summarize the result and suggest means for improvement

The result from Step 4 was analyzed and the results were summarized. The weight of each measure was determined and the performance of each attributes was shown.

A. Finding

The findings from following the steps of methodology are the importance of each dimension and sub-dimension for the customers‟ and the providers‟ perspectives. It is noted that the customers gave priority to the „Assurance‟ attribute (30.8 percent) followed by „Reliability‟ attribute (28.6 percent) and „Responsiveness‟ attribute (23.0 percent). For providers, the „Responsiveness‟ is the most important attribute (35.4 percent) followed by „Empathy‟ (23.0 percent) and „Reliability‟ (20.9 percent) attributes. The percentage of each dimension (attribute) and the consistency ratio (CR) are shown in Table V.

TABLE V. AHP WEIGHT PERCENTAGE FOR EACH DIMENSION IN CUSTOMERS‟ AND PROVIDERS‟ PERSPECTIVES

Five Dimensions		CR	Customer Weight	CR	Provider Weight
1	TANGIBLE	1.1%	7.5%	1.7%	5.2%
2	RESPONSIVENESS	1.4%	23.0%	1.2%	35.4%
3	RELIABILITY	1.4%	28.6%	0.5%	20.9%
4	ASSURANCE	0.5%	30.8%	1.5%	15.5%
5	EMPATHY	1.7%	10.1%	1.7%	23.0%
FIVE-DIMENSIONS CONSISTENCY RATIO (CR)		2.4%		0.3%	

The importance of each sub-dimension comparing between customers and providers‟ perspectives for Tangible, Responsiveness, Reliability, Assurance, and Empathy are shown in Figs. 2-6, respectively.

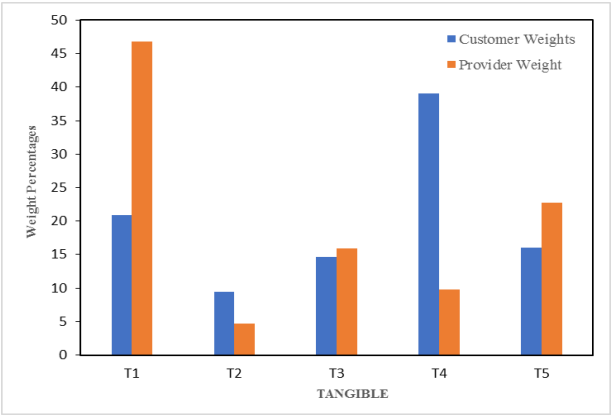

Figure 2. Comparison between customers and providers inputs for „Tangible‟ dimension.

From Fig. 2, the customers agreed that T4: Accurate and reasonable cost is the most important attribute for rail freight service while the providers thought that T1: Modern equipment and facilities is the most important one. The

others sub-dimensions including T2: Clean and comfortable service, T3: Ability to communicate, and T5 Real-time tracking the customers and providers had the same opinion because T1 and T4 are an important basis and should be improved first.

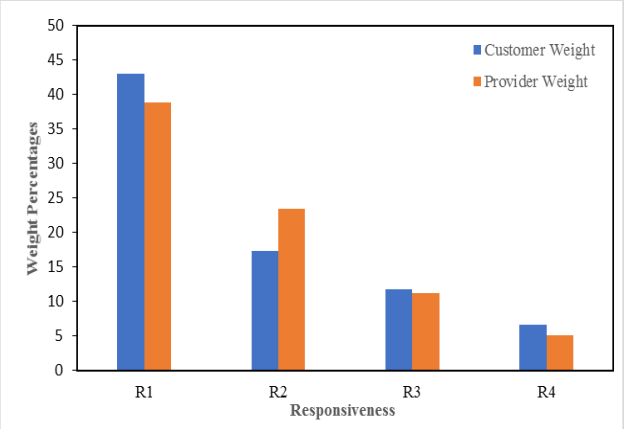

Figure 3. Comparison between customers and providers inputs for „Responsiveness" dimension.

From Fig. 3, the customers and the providers had the same opinion in term of the importance of each sub-dimension of „Responsiveness". For rail freight service, they agreed that R1: Preparedness to help is the most important attribute, followed by R2: Respond to customer need, R3: Ability to solve problem, and the R4: Variety of service is the least important one.

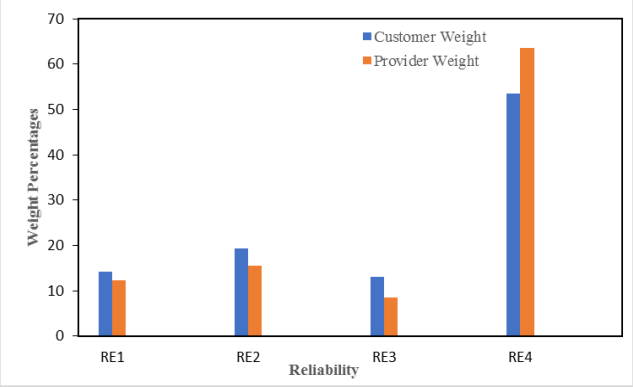

Figure 4. Comparison between customers and providers inputs for „Reliability" dimension.

From Fig. 4, the customers and the providers had the same opinion in term of the importance of each sub-dimension of „Reliability" dimension. For rail freight service, they agreed that RE4: Punctuality is the most important attribute, followed by RE2: Customers" confidence, RE1: Error prevention, and RE3: Customers satisfaction, respectively.

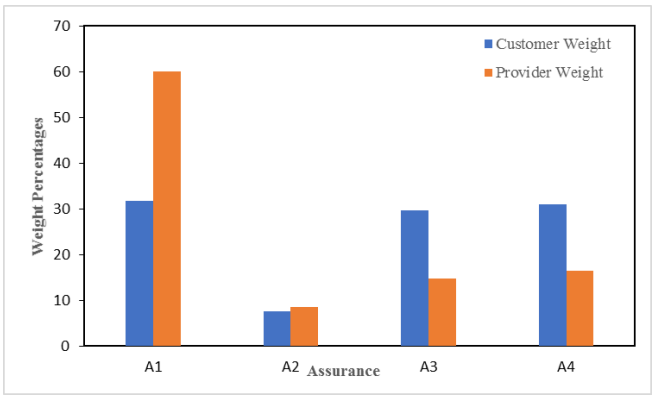

Figure 5. Comparison between customers and providers inputs for „Assurance" dimension.

From Fig. 5, the providers gave priority on the A1 while the customers gave the same scores for A1: Customer loyalty, A3: Knowledgeable staff, and A4: Compensation policy because maintaining a customer base is important in the growth of the company. The knowledge and ability of employees to respond to work are also important, and another important thing is to keep the customer's company information confidential, that able to create satisfaction for customers and make customer trust in the company

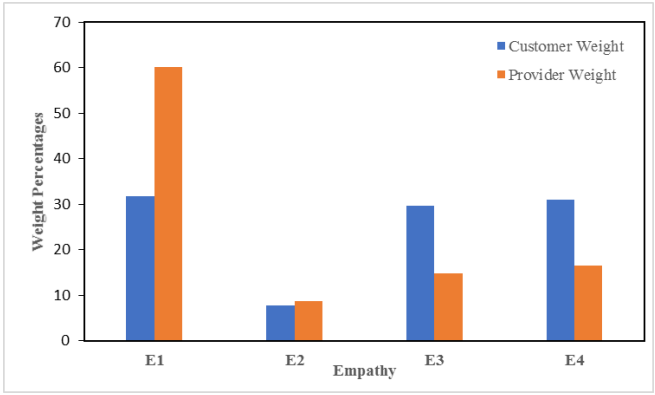

Figure 6. Comparison between customers and providers inputs for „Empathy" dimension.

From Fig. 6, the providers gave priority on the E1: Customer care, while the customers gave the same scores for E1: Customer care, E3: Suitable service and E4: Service improvement. The customer opinion that there is a lack of facilitation in the loading and unloading of goods and should be improving urgently. The provider is well aware that is a lack of customer care and should be urgently improving.

The results of the global weights calculated by dimension weights multiplies by sub-dimension weights for the customers and the providers are shown in Table VI. – VII. For the customers, the top three ranks are RE4: 'Punctuality', R1: 'Preparedness to help', and A1: 'Customer loyalty' while the lowest three are T2: 'Clean and comfortable service', T3: 'Ability to communicate', and T5: 'Real-time tracking'. This reveals that the customers focus on punctuality and services offered to them, not pay attention on the Tangible dimension.

TABLE. VI. THE RESULT OF THE CUSTOMER GLOBAL WEIGHTS

Dimensions (Weight)	Sub-dimensions	Local Weight	Global Weight	Rank
TANGIBLE (0.075)	T1	0.209	0.015675	17
	T2	0.094	0.00705	22
	T3	0.146	0.01095	21
	T4	0.391	0.029325	12
	T5	0.16	0.012	20
RESPONSIVENESS (0.23)	R1	0.43	0.0989	2
	R2	0.174	0.04002	9
	R3	0.118	0.02714	14
	R4	0.067	0.01541	18
	R5	0.211	0.04853	7
RELIABILITY (0.286)	RE1	0.141	0.040326	8
	RE2	0.193	0.055198	6
	RE3	0.13	0.03718	10
	RE4	0.536	0.153296	1
ASSURANCE (0.308)	A1	0.317	0.097636	3
	A2	0.077	0.023716	15
	A3	0.296	0.091168	5
	A4	0.31	0.09548	4
EMPATHY (0.101)	E1	0.209	0.021109	16
	E2	0.35	0.03535	11
	E3	0.152	0.015352	19
	E4	0.289	0.029189	13

TABLE VII. THE RESULT OF THE PROVIDER GLOBAL WEIGHTS

Dimensions (Weight)	Sub-dimensions	Local Weight	Global Weight	Rank
TANGIBLE (0.052)	T1	0.468	0.024336	14
	T2	0.047	0.002444	22
	T3	0.159	0.008268	20
	T4	0.098	0.005096	21
	T5	0.228	0.011856	19
RESPONSIVENESS (0.354)	R1	0.388	0.137352	1
	R2	0.235	0.08319	5
	R3	0.113	0.040002	8
	R4	0.051	0.018054	16
	R5	0.213	0.075402	6
RELIABILITY (0.209)	RE1	0.123	0.025707	12
	RE2	0.156	0.032604	9
	RE3	0.085	0.017765	17
	RE4	0.636	0.132924	2
ASSURANCE (0.155)	A1	0.601	0.093155	4
	A2	0.086	0.01333	18
	A3	0.148	0.02294	15
	A4	0.165	0.025575	13
EMPATHY (0.23)	E1	0.264	0.06072	7
	E2	0.125	0.02875	11
	E3	0.135	0.03105	10
	E4	0.476	0.10948	3

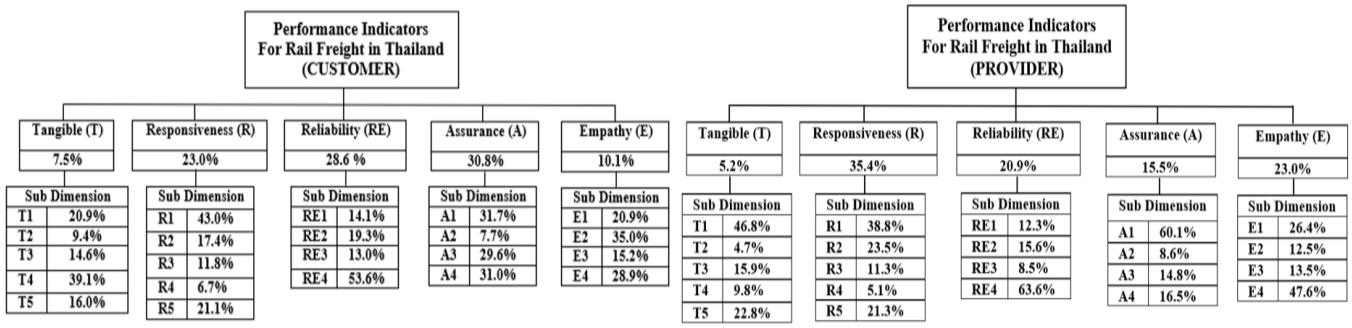

Figure 7. The AHP result for service quality measurement of rail freight service in Thailand.

As shown in Table VII above, for the providers, the most important attributes are R1: 'Error prevention', RE4:'Punctuality', and E4:'Service improvement,' while the least important ones are T1:'Modern equipment and facilities', T4:'Accurate and reasonable cost', and T3:'Ability to communicate'. This reveals that the providers focused on preventing errors and provide punctuality and better services. This is in line with the customers‟ perspective as in Thailand, the major problem is the delay of services which impact the processes after the receipt of the merchandizes transported by rail which has no threshold for the delay. The tangible dimension does not get much attention as it will take a lot of effort for improvement.

From Fig. 7, the five general dimensions of service quality have been applied in the assessment of rail freight service quality. The „Responsibility‟ is considered as the most important attribute for providers while the „Assurance‟ is considered as the most important attribute for customers. Both customers and providers agreed that the „Tangible‟ attribute is the least important attribute for rail freight service. It may be because the rail track and facilities have been constructed for more than 120 years and the facilities do not change much. So, they are more concern on the real services such as responsiveness to customers‟ need, reliability of the service, assurance, and the empathy issues.

IV. CONCLUSION AND SUGGESTION FOR THE FUTURE RESEACH

The finding from this research shows the significant difference between the main parties, namely the customers and the providers. The customers and the providers have different duties, roles, responsibilities, and concerns; therefore, they have different expectations and give different scores for each dimension or sub-dimensions. Overall, the rank of important dimensions starts from Responsiveness, Reliability, Assurance, Empathy, and Tangible.

For customers‟ perspectives, the attributes related to service improvement and loyalty should be major concerns for the providers. This is in line with the providers‟ perspectives themselves which focus is on the attributes related to service improvement and error prevention. Therefore, to be competitive with other mode of transportation, the SRT as the sole service provider should

improve the quality of the services to respond to the customers" need.

Considering both customers and providers in total, the weights of each dimension and sub-dimension are shown in Fig.8. Responsiveness, Reliability, and Assurance are considered as the major concerns while Empathy and Tangible are considered as the less important ones. For sub-dimensions, Punctuality is set as a priority for improvement which reflects the actual situation of long delay nowadays.

Further, with proper data collection, the performance of SRT based on each sub-dimension will be measured. In case of the result of low scores, then appropriate suggestions for improvement can be made. In addition, the result from AHP for measuring rail freight service may be extended to other services of the SRT or in other industries.

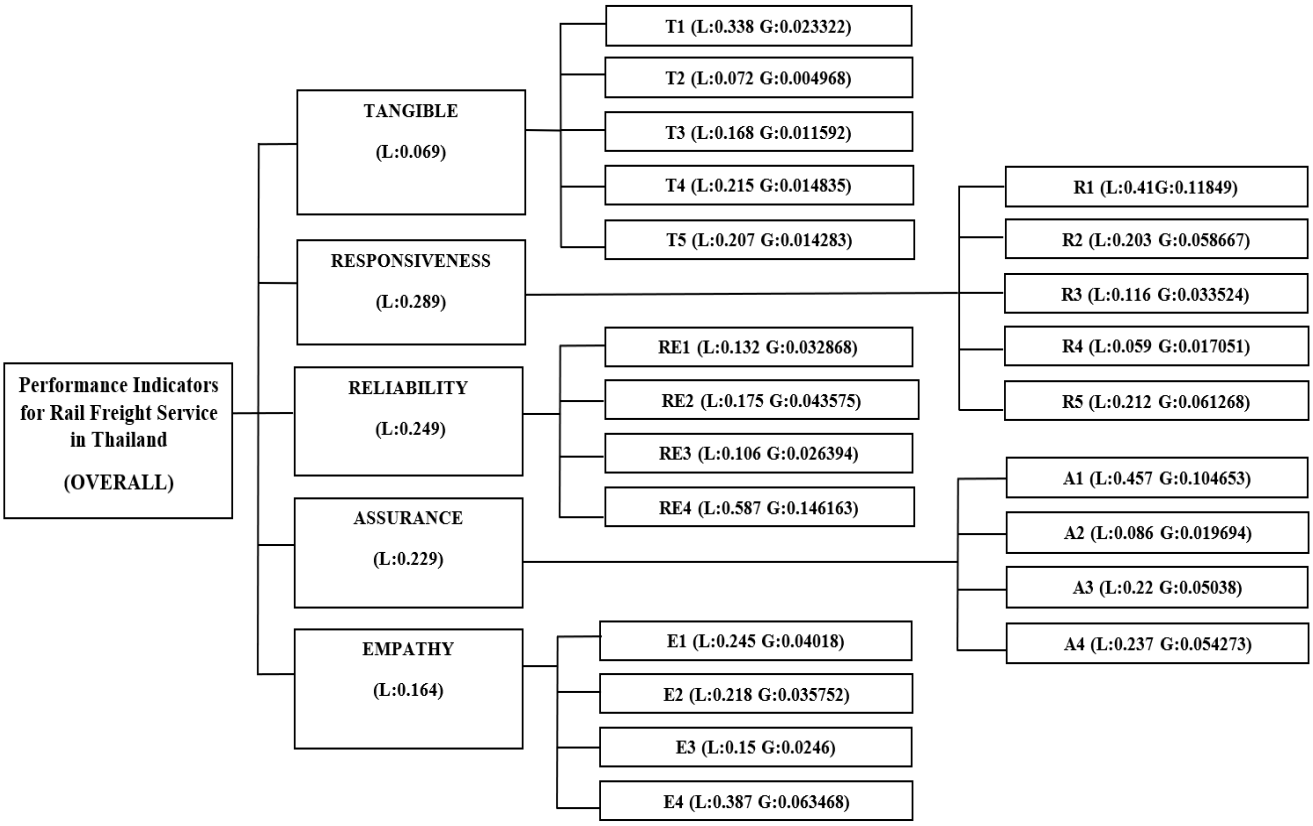

Figure 8. The overall weight of performance indicators in hierarchy structure.

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