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CAUSAL RELATIONSHIP MODEL OF PUBLIC DECISION- MAKING ON TRAIN TRAVEL AND RAIL FREIGHT TRANSPORT

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ABSTRACT

The purpose of this study was to verify empirical data consistency of the causal relationship model of public decision-making on train Travel and rail freight transport to guide the stakeholders to create the model to urge people increasingly use the train travel and rail freight transport services. The Thai government has initiated a construction project of new railway lines to expand the transportation network in all regions and enhance rail travel accessibility for the public. However, the limited use of passenger and rail freight services by the public may cause the problems of the development project. Therefore, the government has sought ways to encourage greater public interest in rail transport. Therefore, the researcher aimed to examine the empirical consistency of a causal relationship model regarding people's decisions to travel and transport goods by rail, in order to develop a framework that encourages increased usage of rail services. The researcher implemented a questionnaire as the data collection tool. The study population consisted of passengers who used railway freight transport services with a sample size of 500 participants. Sampling was conducted through stratified random and purposive sampling methods. The statistics used to analyze the data were frequency distribution, percentage, mean, and standard deviation. Inferential statistics were employed to test hypotheses and identify causal relationships through structural equation modeling using advanced statistical software. The results of the study revealed that service quality measured through six indicators: reliability, responsiveness, assurance, convenience (0.88), empathy, and tangibles showed nine pairs of positively correlated variables and had a significant causal influence on the decision to travel and transport goods by rail. The standardized regression weight was 0.88. Moreover, the service quality measured through these six indicators could predict 77% of the public decision to use rail transport services.

KEYWORDS: Service Quality, Travel and Freight, Railway, Quality of Life, 20-Year National Strategy.

1. INTRODUCTION

Rail transport or train tracking system is considered a mode of transportation infrastructure with low costs and high safety. In most developed countries, there is a network of railway lines spanning an entire country. However, most railway lines in Thailand are single-track and have been dilapidated in the course of time. This results in train delays when compared to other modes of transport. In the past, the Thai government prioritized the development of road transport systems which led to scattered urban growth that did not adequately support the increasing population.

Therefore, the Thai government has placed an emphasis on promoting railway transport as the core transportation and logistics system of the country in the future (Public Relations Office of Sakon Nakhon Province, 2023), and assigned the State Railway of Thailand (SRT) to implement new railway line construction projects to expand the transport network to all regions. This is in accordance with the national logistics development strategy. It is expected that if the project is completed, it will accommodate increasing volumes of freight and passenger transport in the future. This project will enhance the rail travel efficiency because it can reduce train delays caused by single-track operations, or railroad switches and support more streamlined transport (Thansettakij, 2024).

The State Railway of Thailand (SRT) has been assigned by the government to develop a major part

of the railway system to build train infrastructure, including the development of double-track railways, new railway lines, high-speed trains, and commuter trains. Today, the main railway routes in Thailand consist of four lines: the Northern Line, Southern Line, Eastern Line, and Northeastern Line. When the development projects are completed, railway coverage will extend to more provinces. This will not only improve the quality of life through better transportation and logistics, but also create opportunities for business, trade, investment, and tourism, particularly in provinces that previously had no railway access (State Railway of Thailand, 2017).

However, most people in Thailand still relies on private vehicles. In addition, the railway system supervised by the State Railway of Thailand continues to face challenges in terms of public image, operating losses, internal corruption, and service quality that fails to impress the public. Moreover, the long-term effects of COVID-19 pandemic led to reduced social interaction, decreased on-site work, and increased work from home, which significantly decreased the average daily use of rail services from pre-pandemic levels to the present (as shown in Figure 1). The decreased services have directly impacted the SRT's commercial revenue from both passenger fares and freight services (as shown in Figure 2).

Volume Of Railway Service Usage by The Public from The Pre-COVID-19 Period To 2021

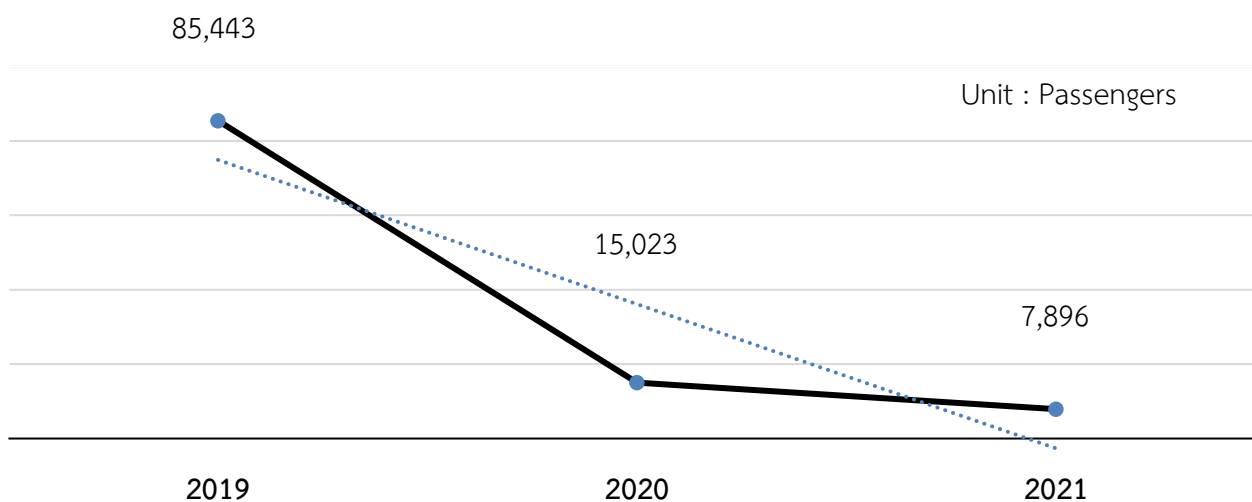


Figure 1: Volume Of Railway Service Usage by The Public from The Pre-COVID-19 Period To 2021 (Ministry of Transport, 2021).

Revenue From Railway Transport (2019–2021, In Million Baht)

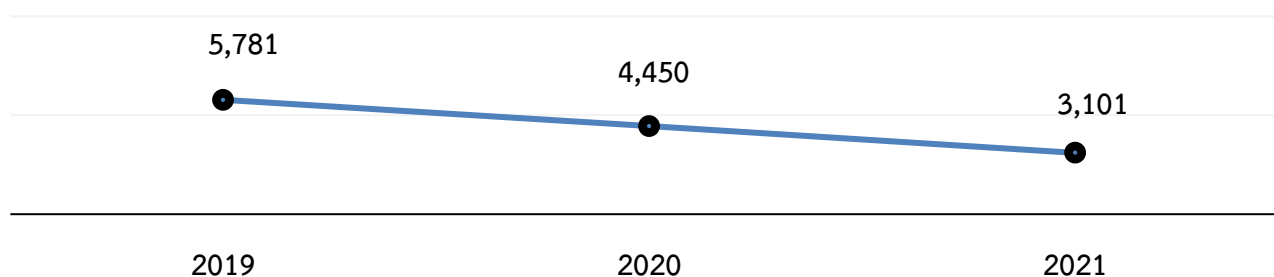


Figure 2: Revenue Of State Railway of Thailand from 2019-2021 (State Railway of Thailand, 2024).

Although almost 40 million passengers or people recently used train transport services for their travel per year, they currently do not prefer using railways for travel or freight transport. This may cause a big problem of the government's railway development, and affect the country's ability to drive economic and social development. Moreover, the most important thing is that it cannot enhance quality of life based on the achievement goals outlined in the 20-Year National Strategy (2017-2037) and Social Development Plan (2017-2021) (Office of Transport and Traffic Policy and Planning, 2016). Therefore, the Thai government must select effective ways to encourage the public to increase their use of railway transportation system.

Therefore, the researcher wanted to study the causal relationship model of passengers' decisions to travel and transport goods by rail. The results of the study will be presented to government agencies and relevant organizations to be used as a guideline to create service models and quality standards and formulate strategies that stimulate the increased use of rail travel and railway freight transport services. And these can enhance the efficiency and elevate the standard of rail transport and eventually contribute to the country's long-term development.

2. RESEARCH OBJECTIVES

The objective of this research was to examine the empirical data consistency of the causal relationship model of public decision-making on train travel and rail freight transport.

3. LITERATURE REVIEW

3.1. Service Quality

Rail transport is considered a service industry that provides convenience for the public in travel. The development of Thailand's railway transportation system should focus on enhancing service quality in a way that can be perceived by users. What the public receives from the service should exceed their

expectations to create satisfaction. The decision to continue using the service is made after comparing the actual experience with the expectations prior to using the service (Bucu, E. G. C., et al., 2023). The Improvement of service quality in an appropriate way can increase user perception and ultimately lead to satisfaction (Du, Y., & Sang, K., 2023). Therefore, improving the service efficiency through the development of five key components of service quality: Tangibility, Responsiveness, Reliability, Assurance, and Empathy should be implemented to enhance customer satisfaction with railway services (Gopal Vasanthi, M., et al., 2023). It is essential to continuously improve service quality and develop effective strategies and policies to attract and build trust among passengers to obtain better services. In addition, facilities should be developed to enhance the image of the railway transportation system in Thailand (Wisutwattanasak, P., et al., 2023).

3.2. Tangibility Of Service Quality

The concept of tangible service quality in rail transportation system refers to the physical aspects of service quality that passengers can directly perceive and evaluate. These include components, such as the passenger comfort with factors like seating arrangements, cleanliness, and noise levels, which are essential for enhancing comfort (Young, P., 2022). Moreover, railway infrastructure, such as track maintenance, plays a vital role in ensuring smooth and safe travel, which significantly contributes to the tangible aspect of service quality (Sresakoolchai, J., & Kaewunruen, S., 2023). These tangible factors have a direct impact on passenger satisfaction and perceptions of service quality that really influence the passengers' decision to use railway services.

3.3. Reliability Of Service Quality

Reliability in the train transportation system is essential for ensuring safety, operational efficiency, and passenger satisfaction. The system must be reliable for passengers in terms of effective planning

for train maintenance and conducting maintenance in accordance with service conditions (Radomir, B., Zivoslav, A., & Milan, B., 2022). And regular maintenance helps reduce unplanned downtime and enhances the safety of railway vehicles (Oky, A., & Yunendar, A. H., 2024), or reliability in well-trained personnel of railway staff who have got proper training in areas such as safety and customer service, as well as effective communication with passengers (Gonçalo, et al., 2024). The organization should place emphasis on training employees to improve communication skills and raise awareness of safety protocols (Victoria, L., Irina, M., & Natalia, K., 2019). Moreover, train time tables should be properly assigned and implemented to guarantee appropriate and timely travel services (Inna, V., Volodymyr, V., & Yuliia, B., 2019). These measures can enhance operational performance and strengthen the reliability of services, which increasingly influences passengers' decision to use rail transport.

3.4. Responsiveness Of Service Quality

Responsiveness in railway services is an essential component that influences customer satisfaction and operational performance. This service quality involves the willingness of train staff to solve problems that passengers may encounter while traveling and to provide assistance. The concept of responsiveness in railway services is vital for enhancing passenger satisfaction, such as scheduling that should meet passenger travel needs (Christoph, G., & Stephan, Z., 2022). Providing proper training for staff to improve communication skills and responsiveness is also essential, and enhancing the overall convenience and accessibility of railway services can help passengers meet their expectations and attract new users (Patrícia, S., et al., 2024).

3.5. Empathy In Service Quality

Service quality in terms of empathy is a vital component that directly influences passenger satisfaction and loyalty in train services. Studies have revealed that encouragement of staff to pay close attention and take good care of passengers can significantly enhance customer satisfaction. Therefore, it is necessary to improve service interactions (Luce, D., & Carine, L., 2024). Empathy, attentiveness, and awareness of passengers' needs have a significant positive effect on their satisfaction with railway services (Chia, S. H., & Nor, A. A. H., 2021). Moreover, it is also an essential part of fostering customer loyalty and encouraging repeat usage of railway services (Yenita, Y., 2023).

3.6. Assurance In Service Quality

Service quality in terms of assurance refers to the knowledge, courtesy, and competence of train staff in building customer trust and confidence. Passengers usually expect that service providers have a good knowledge of what they are responsible for and provide an effective communication of their expertise through various channels (Wisutwattanasak, P., et al., 2023). In addition, this includes safety assurance in railway transportation through infrastructure improvements and advanced signal systems that provide alerts during travel (Aleksey, M., et al., 2021). Besides, these advancements enhance the safety and flexibility of rail services to enhance the overall assurance of railway operations (Anusha, K., Atharva, G., & Mrs. A. A. K., 2024). And implementation of robust safety measures can enhance the reliability of rail services and play an essential role in ensuring overall service assurance (Seong, Y. C., Myeong, S. C., & Kyung, H. S., 2021).

3.7. Convenience In Service Quality

Today railway stations are not only transportation hubs where journeys begin and end but also serve as community centers for meetings and social gatherings. Therefore, various facilities should be provided, such as internet access for travelers (e.g., Wi-Fi hotspots, charging stations, etc.), as well as improved connectivity with transportation modes between towns or cities (Coppola, P., & Silvestri, F., 2020). There should be some retail shops and cafés for passengers to dine, shop, or read while waiting for departure (Otsuka, N., & Reeve, A., 2024). Moreover, all passengers including people with disabilities, the elderly, children, pregnant women and those with large luggage should be properly served when they board and disembark the train, and other ways of convenience should be provided to enable passengers to book and purchase tickets easily. These may positively influence passengers' perception and decision on traveling by train (Purnomo, F. M., & Indarwati, T. A., 2023). Therefore, service providers should continuously improve both service quality and online ticketing systems to increase customer satisfaction (Sari, M. N., & Dirbawanto, N. D., 2023).

3.8. Decision To Use Railway Services

One of important considerations for decision making in getting train services is setting competitive pricing (Jingjing, Z., Xiaoqing, Z., & Kehuai, J., 2022). Besides, there are other essential factors, such as punctuality and employee behavior. The two factors play a crucial role in influencing passengers' decisions to use railway transportation. In addition,

the COVID-19 pandemic has enhanced public awareness of health risks, and this makes passengers consider getting other safer transportation services (Xiaowen, F., et al., 2023). Therefore, the State Railway of Thailand should establish health and safety standards after the COVID-19 pandemic, and assign social distancing protocols and proper ventilation systems (Simona, S., Martin, V., & Jan, I., 2022). At the same time, service development and improvement for people with disabilities who often face physical and social barriers are also essential. This consideration extends to passengers who travel

with other disabled ones. Moreover, adjustments of train schedules with a focus on service quality and effective arrangement of routes to meet local travel needs are important components that influence passengers' decisions to get railway services (Rongyao, Z., Kan, W., & Chen, C., 2019). Based on the literature review, the researcher has identified variables and established a model representing the relationships among these variables, which has been developed into the research framework as illustrated in Figure 3.

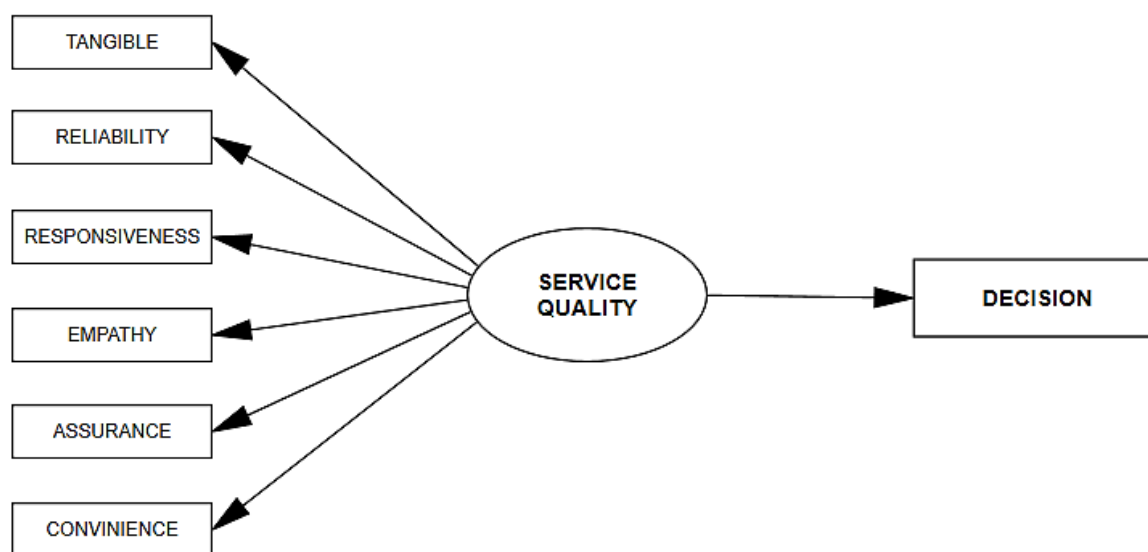


Figure 3: Conceptual Framework of The Study on Causal Relationship Model of Public Decision-Making on Train Travel and Rail Freight Transport.

4. RESEARCH METHODOLOGY

4.1. Population And Sample

The population of this study was people who travel by train. The sample size was 750 cases (Comrey, A. L., & Lee, H. B., 1992) which indicated a very good level for factor analysis. The multi-step random sampling technique including stratified random sampling and Quata sampling was applied. The first sample group was 150 cases of Northern Line users; the second group was 150 cases of Northeastern Line users; the third group was 150 cases of Eastern Line users; the fourth group was 150 cases of Central Line users; and the fifth group was 150 people who live along the Southern railway line.

4.2. Research Instrument

The research instrument used in this study was a questionnaire developed from a review of relevant literature, documents, theories, and previous studies.

The questionnaire consisted of three parts: Part 1: General information of the respondents with 4 items: gender, marital status, occupation, and the day they choose to use the rail service. The questions in this section were in checklist format. Part 2: A questionnaire used to assess the importance level of service quality indicators in railway transportation. It consisted of six indicators: tangible service quality, reliability, responsiveness, empathy, assurance, and convenience. The questions in this section were designed using a 5-point rating scale (Likert Scale, R., 1932). Part 3: A questionnaire used to assess the importance level of decision-making on train travel and rail freight transport with four indicators. This section also implemented a 5-point rating scale (Likert Scale, R., 1932). To verify content validity, the questionnaire was evaluated using the Index of Item-Objective Congruence (IOC) where five experts reviewed the items in relation to the research objectives. The resulting IOC values ranged from 0.60 to 0.80, which meets acceptable criteria (Rovinelli, R.

J., 1976). And then the questionnaire was pilot tested with 30 non-sample respondents (Burns, N., & Grove, S. K., 2001), and the data collected was used to determine reliability using Cronbach's alpha coefficient. The result was 0.99 which indicated that the questionnaire was highly reliable and suitable for data collection (Cronbach, L. J., 1951).

4.3. Data Analysis

The descriptive statistics were used to analyze personal data to get percentages calculated for each item, and to analyze the importance level of mean scores ($\bar{X}$) and standard deviations (S.D.). To analyze the causal relationship model of passenger decision on train travel and rein freight transport, goodness-of-fit indices were used to assess the consistency of the model with empirical data (Gaskin, J., & Lim, J., 2016), e.g., CMIN/DF (Chi-square/DF) was less than 5.00, CFI (Comparative Fit Index) was greater than

0.95, SRMR (Standardized Root Mean Square Residual) was less than 0.08, and RMSEA (Root Mean Square Error of Approximation) was less than 0.08. To verify construct validity, the suitability of indicators within each construct was evaluated using the following criteria: Factor Loadings between indicators and their respective constructs should be greater than 0.50 and statistically significant (Kilic, A., et al., 2020), Composite Reliability (CR) should be greater than 0.70, and Average Variance Extracted (AVE) should be greater than 0.50 (Hair, J. F., et al., 2019).

5. RESEARCH RESULTS

1. Analysis Of the Respondents' Personal Data

The results of the personal data analysis of the sample group who were the respondents are shown in Table 1.

Table 1: Personal Data of The Respondents (N = 750).

Personal Data		Quantity	Percentage
Gender	Female	400	53.30
	Male	350	46.70
Marital Status	Single	465	62.00
	Married	285	38.00
Occupation	Student	221	29.47
	Employee	190	25.33
	Civil servant/state enterprise staff	187	24.93
	Freelance	101	13.47
	Business owner	51	6.80
Day of Service Usage	Weekend (Saturday & Sunday)	263	35.10
	Long holiday/festival	256	34.10
	Weekday (Monday-Friday)	231	30.80

From Table 1, it is found that the majority of respondents were female (53.30%), single (62.00%), and students (29.47%). Most respondents used the railway service on weekends (Saturday and Sunday) (35.10%).

2. Analysis Of the Importance Level of Train

Service Quality Indicators

The results of the analysis on the importance level of train service quality indicators are presented in Table 2.

Table 2: Mean ($\bar{X}$) And Standard Deviation (S.D.) Of the Importance Level of Train Service Quality Indicators.

Service Quality Indicator	$\bar{X}$	S.D.	Important Level
1) Tangible	4.50	0.60	Highest
2) Reliability	4.44	0.60	Highest
3) Responsiveness	4.44	0.61	Highest
4) Empathy	4.49	0.63	Highest
5) Assurance	4.52	0.63	Highest
6) Convenience	4.39	0.66	Highest
Overall	4.46	0.57	Highest

From Table 2, it was found that the overall railway service quality was rated at the highest level of

importance ($\bar{X} = 4.46$). The indicators can be ranked from highest to lowest average score as follows: Assurance ($\bar{X} = 4.52$), Tangible ($\bar{X} = 4.50$), Empathy ($\bar{X} = 4.49$), Reliability ($\bar{X} = 4.44$), Responsiveness ($\bar{X} = 4.44$), Convenience ($\bar{X} = 4.39$), respectively.

3. Analysis Of the Importance Level of The

Table 3: Mean ($\bar{X}$) And Standard Deviation (S.D.) Of the Importance Level of Decision No Train Travel and Rail Freight Transport (Decision).

Decision Indicator	$\bar{X}$	S.D.	Important Level
1) DEC1	4.41	0.80	Highest
2) DEC2	4.38	0.82	Highest
3) DEC3	4.33	0.92	Highest
4) DEC4	4.43	0.74	Highest
Overall	4.39	0.66	Highest

From Table 3, it was found that the overall decision on train travel and rein freight transport was rated at the highest level of importance ($\bar{X} = 4.39$). The indicators can be ranked from highest to lowest mean score as follows: DEC4: Rail service operates in all weather conditions ($\bar{X} = 4.43$), DEC1: Lower fares and shipping costs compared to other transport modes ($\bar{X} = 4.41$), DEC2: Accessibility for passengers with disabilities or health conditions ($\bar{X} = 4.38$), and DEC3: Rail routes passing through desired destinations ($\bar{X} = 4.33$), respectively.

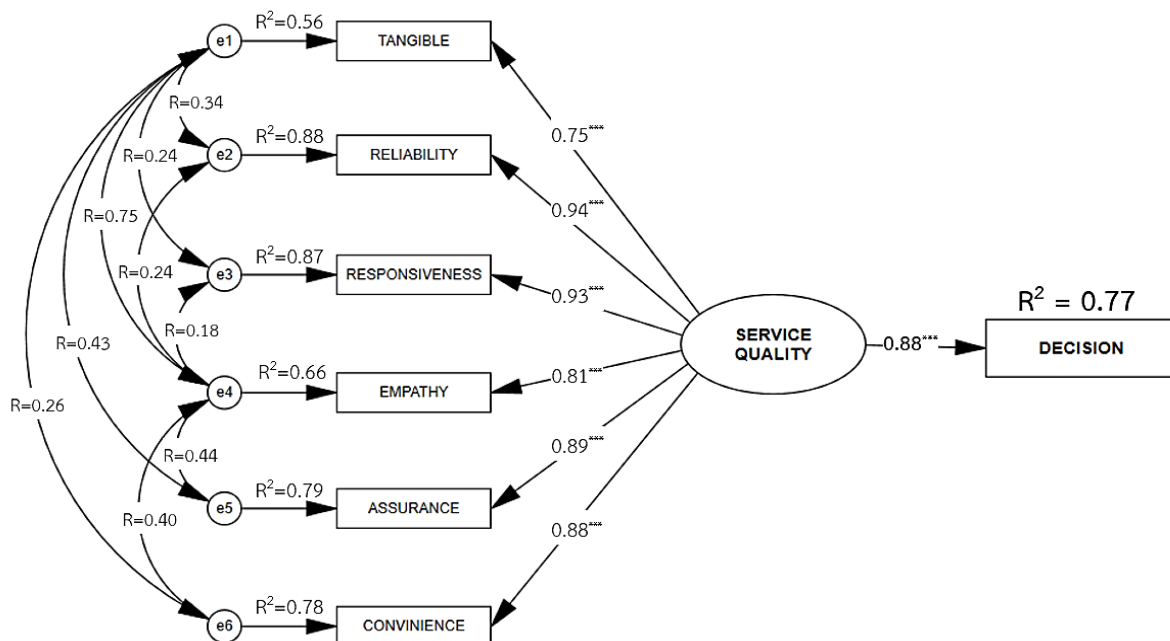
4. Analysis Of the Causal Relationship Model

Decision on Train Travel and Rail Freight Transport

The results of the analysis on the importance level of decisions related to on train travel and rail freight transport are shown in Table 3.

for The Passenger Decision on Train Travel and Rein Freight Transport

The researcher improved the causal relationship model for the public's decision on train travel and rein freight transport by analyzing Modification Indices (M.I.) of each pair of the indicators with the highest M.I. values. After that the relationships between the associated error terms were added, and the model was reanalyzed repeatedly until it achieved a good fit with the empirical data. The result of revised model provided statistical values that met the criteria as shown in Figure 4.



*** $P < 0.001$

CMIN/DF = 2.84, CFI = 0.99, SRMR = 0.00, RMSEA = 0.05

Figure 4: Final Causal Relationship Model of Passenger Decisions on Rail Travel and Rail Freight Transport (Standardized Scores).

From Figure 4, Structural validity analysis for the right service quality indicators shows a Composite

Reliability (CR) of 0.95 and an Average Variance Extracted (AVE) of 0.76 that meet the assigned criteria. This indicates that the service quality indicators are appropriate. The results of correlation analysis among the six service quality indicators with total nine pairs revealed that correlation coefficients (R) were ranged from 0.18 to 0.75 and all of them were positive and statistically significant at $p < 0.001$. The strongest correlation coefficients emerged between Tangible and Empathy ($R = 0.75$).

The development of the six service quality indicators based on the passenger decision on rail travel and rail freight transport revealed that the standardized regression weights ranked from highest to lowest were as follows: Reliability: 0.94, Responsiveness: 0.93, Assurance: 0.89, Convenience: 0.88, and Empathy: 0.81 Tangible: 0.75. The service quality measured by the six indicators influenced decision-making on rail travel and rail freight transport at statistical significance level of $p < 0.001$, with a standardized coefficient of 0.88, and 77% of the public's decisions on rail travel and freight-service could be predicted ($R^2 = 0.77$).

6. CONCLUSION

The results of this study indicate that service quality significantly influences on customer loyalty. Enhancement of service quality in terms of reliability, assurance, service delivery, empathy, tangibility plays an essential role and positively affects user satisfaction with train transportation services. If the State Railway of Thailand can improve its service quality, it may help increase passenger satisfaction with train travel or freight transport services. (Saibal, M., et al., 2024).

The development of tangible railway service quality, such as stations, services, employees, and vehicles, significantly affects overall passenger satisfaction levels, serves as a key tangible indicator of service quality, and contributes a positive experience for passengers (Nattiya, W., et al., 2023). For instance, the physical environment of railway stations, train accessibility and waiting areas must be assigned (Ahmad, N. H. I., et al., 2020). Cleanliness within service stations, on trains, and other facilities is also essential, and this is in accordance with previous studies stating that cleanliness plays a significant role in creating a positive passenger experience and is directly related to customer satisfaction with train services (T. Aditya, Sai, Srinivas, et al., 2024). And the availability of adequate seating within station premises or on the trains must be provided (Muditha, P. P., et al., 2023). Furthermore, sufficient capacity to meet demand also

contributes to satisfaction. At the same time, the employee manners and professionalism are essential factors in customer satisfaction (Aminah, D., 2023). In addition, infrastructure maintenance, such as the care of railway tracks, is an essential concern to convince passengers for their smooth and safe travel (Sresakoolchai, J., & Kaewunruen, S., 2023). All these elements are essential for evaluating the tangible aspects of train service quality, and these will enhance customer satisfaction and loyalty (Elise, A., et al., 2023), eventually attract passengers to decide to get train services.

Service quality in terms of reliability is an essential component that significantly affects customer satisfaction in train services. Enhancement of reliability, assurance, responsiveness, empathy, and tangible factors is essential for boosting overall customer satisfaction. Therefore, the State Railway of Thailand should prioritize reliability to meet customer expectations and raise overall satisfaction (Mesfin Y. Y. & Mulugeta A., 2023). Reliability encompasses trustworthy rolling stock that directly enhances customer satisfaction by reducing unexpected breakdowns and failures, and reliability in these can lead to a smoother travel experience (Okky A. & Yunendar A. H., 2024). It also involves the maintenance of railway infrastructure, such as track upkeep, to build confidence in safety of passenger journeys (Sresakoolchai J. & Kaewunruen S., 2023), and the implementation plan of condition-based maintenance for train sets (Radomir B., Zivoslav A., & Milan B., 2022), and regular maintenance to minimize unplanned downtime and increase the safety of railway vehicles (Okky A. & Yunendar A. H., 2024) to enhance customer safety, smooth travel, and on-time arrivals. This is in accordance with the findings of the study of T. Aditya, Sai, Srinivas et al. (2024), claiming that enhancing reliability especially punctuality boosts greater trust and satisfaction with railway services.

The responsiveness of railway service quality is a vital factor that influences customer satisfaction and operational efficiency. This includes providing a timetable that meets passenger travel demands (Christoph, G. & Stephan, Z., 2022), as well as additional staff training to enhance communication skills and customer responsiveness. Moreover, increasing convenience in providing services can help fulfill customer needs and attract new passengers to get the train services (Patrícia, S., et al., 2024). At the same time, installing early warning systems at stations or onboard trains can help prevent accidents or avoid dangerous situations at any time to enhance passenger safety (Anusha, K.,

Atharva, G., & Mrs. A. A. Kokate, 2024). Besides, the State Railway of Thailand should also enhance the responsiveness of railway service quality by empowering staff to resolve passenger issues promptly which can help improve passenger experience and perception (T. Aditya, Sai, Srinivas, et al., 2024). Moreover, additional staff training should be provided to improve their communication skills and emotional flexibility to better adapt to, understand, and meet passenger needs (Mathieu, L., et al., 2023). In addition, the smartphone applications should be integrally implemented for real-time issue reporting to support faster problem resolution and improve overall customer satisfaction (Kshitij, S., 2023).

Empathy in railway service is an essential component of service quality because it directly influences customer satisfaction and loyalty among passengers. This is in accordance with the study of Luce, D. & Carine, L. (2024) stating that supporting employees to take good care of passengers can positively impact customer satisfaction. Therefore, service interactions must be improved by showing empathy, care, and a genuine effort to understand passengers' needs (Chia, S. H. & Nor, A. A. H., 2021). Empathy is necessary for service staff to effectively respond to passenger emotions and reactions, and it can enhance their satisfaction (Luce, D. & Carine, L., 2024). This finding contrasts with a previous study by Rajeswari, V. & Santa, K. (2014), which claimed that empathy, as an essential component of service quality, did not significantly affect customer satisfaction. However, it is consistent with the findings of a study by Wisutwattanasak, P., et al. (2023), which explained that empathy improves perceived service quality and positively affects passengers' intentions to use train services. Moreover, it is in accordance with the findings of a previous study by Depi, G. Y. & Awan, A. (2024), who stated that empathy significantly influences passenger satisfaction with train services.

Assurance in railway service quality is an important component for enhancing passenger satisfaction. This factor includes the knowledge, politeness, and employee competency in building customer trust and confidence. Besides, passengers usually expect railway staff to have expertise in their respective roles. And effective communication with customers through various channels is also essential and should be taken into account (Wisutwattanasak, P., et al., 2023). Assurance regarding safety in railway transport can be improved through better infrastructure and onboard warning systems (Aleksey, M., et al., 2021). These can enhance safety

and flexibility of overall assurance of railway service quality (Anusha, K., Atharva, G., & Mrs. A. A. K., 2024). Moreover, railway security measures can increase reliability and are essential to service assurance (Seong, Y. C., Myeong, S. C., & Kyung, H. S., 2021). Besides, railway operators should emphasize the importance of train scheduling to guarantee timely services (Inna, V., Volodymyr, V., & Yuliia, B., 2019), which can improve operational efficiency and enhance reliability, and these can influence public decisions to use railway services.

The comfort of railway service quality is another principal factor that influences passengers' decisions to use railway services. Service providers should understand the elements that increase passenger comfort and implement them to better meet customer needs. Besides, internet technology should be provided to travelers (e.g., internet hotspots, charging stations, etc.), and there should be an effective improvement of networking integration with other urban transportation systems (Coppola, P. & Silvestri, F., 2020). In addition, there should be retail stores and coffee shops where passengers can eat, shop, or read while waiting for their train (Otsuka, N. & Reeve, A., 2024). Moreover, service providers should put an emphasis on service accessibility for all passengers, such as people with disabilities, the elderly, children, pregnant women, and those with large luggage so that they can comfortably board and disembark from trains (State Railway of Thailand, 2024). Enhancing comfort through easy ticket reservations and purchase can also be another key factor for passengers to prefer train travel (Purnomo, F. M. & Indarwati, T. A., 2023), especially by offering online ticketing systems to improve customer satisfaction (Sari, M. N. & Dirbawanto, N. D., 2023). These are consistent with previous studies indicating that comfort is a key component significantly influences perceived service quality and passengers' decisions to use State Railway of Thailand services (Nuttawut, R., 2023). It is also in accordance with the findings of a study by Nattiya, W., et al. (2021) stating that the quality of comfort boosts customer satisfaction and significantly impacts passenger loyalty to make a decision to use railway services. Moreover, expanding the railway network to cover more areas also enhances accessibility and encourages more passengers to use the service (Kestsirin, T., et al., 2023).

Besides the service quality mentioned above, passengers' decisions on train travel and rail freight transport are also influenced by train schedules and adjustments to local routes that enhance convenience

and meet passenger needs (Rongyao, Z., Kan, W., & Chen, C., 2019). One of the most important factors is pricing, and it inevitably influences passengers' decisions on train travel and rail freight transport because railway fares are generally cheaper than other transportation modes (Kumphol, W., Harutairat, J., Somkuan, S., & Niwatchai, J., 2024). Therefore, railway fares should not be increased or if necessary, it should not be too high. At the same time, the development and improvement of railway services are necessary to better accommodate passengers with disabilities who often face physical and social barriers. This also benefits passengers who are close to someone with a disability. The scheduling of trains and local route adjustments are also essential because it can enhance convenience for passengers and influence passengers' decisions to use railway services (Rongyao, Z., Kan, W., & Chen, C., 2019).

Therefore, improvement of service quality of train travel and rail freight services may help improve operational efficiency. This can increase public confidence in service quality, and build stronger trust in railway organizations. Eventually, once people

perceive high-quality service, it may enhance passenger satisfaction so much that they decide to get rail transport services. This, in turn, can improve quality of life by reducing private vehicle usage and promoting rail travel services instead. As a result, travel expenses are reduced, and people can manage their activities across different regions due to the expanding reach of railway networks.

7. RECOMMENDATIONS

The development of basic transportation infrastructure is significantly important and essential to the improvement of the public quality of life. Based on the findings of this study, the government should assign policies or strategies grounded in the research results and assign the relevant agencies to integrate and implement them to meet the public needs. In addition, the responsible agencies should monitor and evaluate the outcomes to identify deficiencies or necessary improvements to ensure that the quality of railway services can effectively meet public demands and the national goals that have been assigned.

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REFERENCES

- Ahmad, N, H, I., Muhamad, N, B., Nur, I, M, Y., & Amiruddin, I. (2020). Rail-based Public Transport Service Quality and User Satisfaction – A Literature Review. *Promet-traffic & Transportation*, doi: 10.7307/PTT.V32I3.3270
- Aleksey, M., Andrey, A., Andrey, I., Aleksey, I., & Sergey, K. (2021). Result Assessment of the Quality Railway Track Padding. doi: 10.1007/978-981-33-6208-6_20
- Aminah, D. (2023). 22. The effect of service quality in enhancing consumer satisfaction. *Jurnal Penelitian Ilmu Manajemen*, doi: 10.30736/jpim.v8i2.1622
- Anusha, K., Atharva, G., & Mrs., A., A., Kokate. (2024). Enhancing Railway Resilience: Real-time Monitoring and Early Warning Systems. *International journal of innovative research in electrical, electronics, instrumentation and control engineering*, doi: 10.17148/ijireeice.2024.12430
- Bucu, EGC, Araos, XK, Balbin, RE, Dequito, AP, & Pineda, MJ. (2023). A SERVQUAL Approach to Improving the Railway Experience Amidst Pandemic using Multi-Criteria Decision Making. *Proceedings of the International Conference on Industrial Engineering and Operations Management Manila, Philippines*, March 7-9
- Burns, N., & Grove, S. K. (2001). *The Practice of Nursing Research: Conduct, Critique, & Utilization*. (4th ed.). Philadelphia: W. B. Saunders.
- Chia, S, H., & Nor, A, A, H. (2021). The Influence of Service Quality and Train Comfort towards Passengers' Satisfaction: A Case Study of KTMB ETS.
- Christoph, G., & Stephan, Z. (2022). Demand-responsive Scheduling in Railway Transportation. doi: 10.5220/0011018700003191
- Comrey, A. L., & Lee, H. B. (1992). *A First Course in Factor Analysis* (2nd ed.). Hillsdale, NJ: Lawrence Erlbaum. Cited in Lingard, Helen & Rowlinson, Steve. (2006). Sample size in factor analysis: why size matters.
- Coppola, P., & Silvestri, F. (2020). Assessing travelers' safety and security perception in railway stations. *Case studies on transport policy*, 8(4), 1127-1136.
- Cronbach, L. J. (1951). Coefficient alpha and the internal structure of tests. *psychometrika*, 16(3), 297-334.

- Department of Highways. (2021). Rail and Electric Train Ridership Drops by 10 Times, from an Average of 1.22 million People per Day to 134,000. [Retrieved 1 Nov 2024], from <https://www.prachachat.net/property/news-732583>
- Depi, G. Y., & Awan, A. (2024). The Influence of Service Quality on Train Passenger Satisfaction at Rantau Prapat Station PT KAI Persero Divre I North Sumatra. doi: 10.47134/railway.v1i1.2340
- Du, Y., & Sang, K. (2023). Evaluating Users' Satisfaction on Urban Railway Based on Service Quality Model: The Study on KLIA Express in Malaysia. In International Conference on "Health & Environmental Resilience and Livability in Cities-The challenge of climate change (pp. 267-275). Cham: Springer Nature Switzerland.
- Elise, A., Markos, A., Guillaume, C., & Alice, C. (2023). On applying artificial intelligence techniques to maximise passengers' comfort and infrastructure reliability in urban railway systems. doi: 10.1109/mt-its56129.2023.10241648
- Gaskin, J. & Lim, J. (2016). "Model Fit Measures", AMOS Plugin. Gaskination's StatWiki.
- Gonçalo, N., Guilherme, R., Miguel, G., Virgínia, I., António, R., A. (2024). Human reliability and Organizational factors—How do Human Factors contribute to Signals Passed at Danger?. Safety Science, doi: 10.1016/j.ssci.2023.106395
- Gopal Vasanthi, M., Soundrarajan, V., Nawaz, N., Gajendran, V., & Parayitam, S. (2023). Passenger satisfaction with cleanliness and other service quality dimensions and gender as a moderator: Evidence from Indian Railways. Cogent Business & Management, 10(1). <https://doi.org/10.1080/23311975.2023.2183568>
- Hair, J. F., Black, W. C., Babin, B. J., & Anderson, R. E. (2019). Multivariate Data Analysis (8th ed. Annalbel Ainscow.
- Inna, V., Volodymyr, V., & Yuliia, B. (2019). System of logistics management in ensuring the efficiency of railway enterprise activities. doi: 10.32840/2522-4263/2019-4-13
- Jingjing, Z., Xiaoqing, Z., & Kehuai, J. (2022). Research on Differential Pricing and Train Operation Decisions for Railway Cargo Transportation Under Competitive Conditions. Transportation Research Record, doi: 10.1177/03611981221102147
- Kestsirin, T., Panuwat, W., Chamroeun, S., Manlika, S., Sajjakaj, J., Thanapong, C., Vatanavongs, R., & Rattanaporn, K. (2023). Assessment of Disparity in Accessing Railway Stations in Thailand: an Application Geographic Information System Network Analysis. Journal of geovisualization and spatial analysis, doi: 10.1007/s41651-023-00168-8
- Kilic, A., et al. (2020). Comparison of Confirmatory Factor Analysis Estimation Methods on Binary Data. International Journal of Assessment Tools in Education, 7 (3) , 451-487.
- Kshitij, S. (2023). Ensuring Customer Satisfaction on Long Distance Train Journeys: An Indian Railways Case Study. doi: 10.1109/vppc60535.2023.10403169
- Kumphol, W., Harutairat, J., Somkuan, S., & Niwatchai, J. (2024). Analyzing Factors Influencing the Development of Railway Freight Transportation Service through the Fuzzy Analytic Hierarchy Process Technique. Engineering and technology horizons, doi: 10.55003/eth.410203
- Luce, D., & Carine, L. (2024). Empathy in Service Design: Prompting Employees' Empathy with Users through Love and Breakup Declarations. doi: 10.1145/3663384.3663388
- M, Chanin. & Z, Ulrich. (2017). The Future of Thai Railways. [Retrieved 25 August 2023]. From <https://blogs.worldbank.org/th/eastasiapacific/future-of-thai-railways-5-fundamental-questions>
- Mathieu, L., Marzia, D, P., Beatrice, S., Geneviève, R., Marie-Pierre, G., & Normand, P. (2023). Empathy training for service employees: A mixed-methods systematic review. PLOS ONE, doi: 10.1371/journal.pone.0289793
- Mesfin, Y, Y., & Mulugeta, A. (2023). The effect of service quality on customer satisfaction in railway transport service in Ethio-Djibouti. doi: 10.18844/gjbem.v13i2.8096
- Muditha, P, P., F. S., Nazeer., A.M.L., & De, Alwis. (2023). The Customer satisfaction on the railway infrastructure in Sri Lanka: a study on railway stations. doi: 10.31705/wcs.2023.83
- Nattiya, W., Anon, C., Cherdsak, S., Karn, N, S., Warunee, A., Nattida, N., & Wilasinee, K. (2023). The Development of Service Metrics Indicators of a Public Transportation Service Case Study: Intercity Trains in Nakhon Ratchasima Province, Thailand. Sustainability, doi: 10.3390/su151511739
- Nattiya, W., Vatanavongs, R., Ampol, K., & Sajjakaj, J. (2021). Exploring Passenger Loyalty and Related Factors for Urban Railways in Thailand. Sustainability, doi: 10.3390/SU13105517
- Nuttawut, R. (2023). Factors affecting state railway of Thailand (SRT) passenger train service use decision: A

- structural equation model. *Heliyon*, doi: 10.1016/j.heliyon. 2023.e15660
- Office of Transport and Traffic Policy and Planning. (2017). Plans for Key Missions of the Ministry of Transport under the (Draft) 20-Year Transportation Development Strategy of Thailand (2017-2036). Department of Highways.
- Okuy, A., & Yunendar, A. H. (2024). Reliability improvement of railway vehicles: a review. *Jurnal Nasional Aplikasi Mekatronika, Otomasi dan Robot Industri*, doi: 10.12962/j27213560.v3i1.18994
- Otsuka, N., & Reeve, A. (2024). Railway stations as public space: how to promote rail journeys via multi-functional railway stations. *European Planning Studies*, 32(5), 973-1009.
- Patrícia, S., Joaquim, M., Eurico, S., & Pedro, P. (2024). Railways Passenger Comfort/Discomfort: Objective Evaluation. doi: 10.5772/intechopen.111704
- Purnomo, F. M., & Indarwati, T. A. (2023). Consumer preference analysis in online purchase of inter-city railway tickets at Surabaya Pasar Turi station. *International Management Conference and Progressive Papers*, 1, 352-364.
- Radomir, B., Zivoslav, A., & Milan, B. (2022). Modeling of reliability and availability of data transmission in railway system. *Advanced Engineering Letters*, doi: 10.46793/adeletters.2022.1.4.3
- Rajeswari, V., & Santa, K. (2014). 6. Satisfaction and Service Quality in Indian Railways - A Study on Passenger Perspective. *IOSR Journal of Economics and Finance*, doi: 10.9790/5933-0415866
- Rongyao, Z., Kan, W., & Chen, C. (2019). Service Supplier Selection Decision Based on Dempster-Shafer Synthesis Rule. doi: 10.1142/S2424862219500040
- Rovinelli, R. J. (1976). Methods for Validating Criterion-Referenced Test Items. Unpublished Doctoral Dissertation. University of Massachusetts Amherst. [cited 5 Apr, 2024, from https://scholarworks.umass.edu/cgi/viewcontent.cgi?referer=https://www.google.co.th/&httpsredir=1&article=4661&context=dissertations_1 “
- Saibal, M., Aarti, S., Anupama, S., Mykola, K., Hareesh, K. S., & Somnath, M. (2024). On the analytical study of the service quality of indian railways under soft-computing paradigm. *Transport*, doi: 10.3846/transport.2024.21385
- Sakhon Nakhon Provincial Public Relations Office. (2023). Developing the logistics system with double-track railways and spreading prosperity through high-speed rail. Retrieved 20 December 2023], from <https://sakonnakhon.prd.go.th/th/content/category/detail/id/9/iid/161305>
- Sari, M. N., & Dirbawanto, N. D. (2023). The Influence of Service Quality and Online Ticket Purchase System on Customer Satisfaction of Train Service Users: (A Study at Pt. Ka Sribilah for the Medan-Rantauprapat Route). *Journal of Humanities, Social Sciences and Business*, 3(1), 142-152.
- Seong, Y. C., Myeong, S. C., & Kyung, H. S. (2021). Reliability Analysis of the Integrated Navigation System Based on Real Trajectory and Calculation of Safety Margin Between Trains. *IEEE Access*, doi: 10.1109/ACCESS.2021.3061070
- Simona, S., Martin, V., & Jan, I. (2022). Travel behaviour changes during the pandemic: Prague-Pilsen rail case study. *Review of Economic Perspectives*, doi: 10.2478/revecp-2022-0015
- Sresakoolchai, J., & Kaewunruen, S. (2023) Railway infrastructure maintenance efficiency improvement using deep reinforcement learning integrated with digital twin based on track geometry and component defects. *Sci Rep*, 13(1):2439. <https://doi.org/10.1038/s41598-023-29526-8>
- State Railway of Thailand. (2020). The Business Plan of the State Railway of Thailand (2017-2021). *Journal of Railway Development*.
- State Railway of Thailand. (2024). Auditor Report. Annual Report 2020 - 2022.
- T., Aditya, Sai, Srinivas., Kamasani, Teja, Sri., M., Bharathi. (2024). Railway Service Dynamics: Factors Shaping Customer Satisfaction in Indian Railways. doi: 10.48001/jomas.2024.126-12
- Thansettakij. (2024). "Double-Track Railways and 28 New Railway Routes to Boost the Rail Network to 6,900 Kilometers". [Retrieved 10 June 2024], from <https://www.thansettakij.com/business/economy/598229>
- Victoria, L., Irina, M., & Natalia, K. (2019). Issues of transport security and human factor. doi: 10.1051/E3SCONF/20199108062
- Wisutwattanasak, P., Champahom, T., Jomnonkwao, S., Aryuyo, F., Se, C., & Ratanavaraha, V. (2023). Examining the impact of service quality on passengers' intentions to utilize rail transport in the post-pandemic era: an integrated approach of SERVQUAL and health belief model. *Behavioral Sciences*, 13(10), 789.

- Xiaowen, F., David, A., Hensher., Zhi-Chun, Li., N.N., Sze. (2023) Effects of proactive and reactive health control measures on public transport preferences of passengers – A stated preference study during the COVID-19 pandemic. *Transport Policy*, doi: 10.1016/j.tranpol.2023.11.011
- Yenita, Y. (2023). Analysis of the Effect of Service Quality on Passenger Satisfaction and the Impact on Passenger Loyalty of Users of Merak Port Railroad Transportation Services - Rangkasbitung. *Jurnal Perkeretaapian Indonesia (Indonesian Railway Journal)*, doi: 10.37367/jpi.v7i1.275
- Yong, P., Jiahao, Z., Chaojie, F., Zhifa, W., Wenjun, Z., Dayan, S., Yating, L., Diya, X., Qian, X. (2022). A review of passenger ride comfort in railway: assessment and improvement method. *Transportation safety and environment*, doi: 10.1093/tse/tdac016