Study the Nature of the Need for a Passenger Information Management System for the Department of Railways in Sri Lanka: In Passengers' Perspective

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Abstract

Sri Lanka South Asian country has a high demand for railway services as public passenger transportation. Although more than 3.7 million passengers use the railways daily, the lack of a Passenger Information Management System (PIMS) for the Sri Lanka Railways (SLR) is still a problem. Therefore, this study's main objective is to identify the need for a PIMS in SLR. A cluster sampling technique was applied to select a sample of 327 passengers serviced from the Colombo Fort Railway Station, the premier central railway station in Sri Lanka. An interviewer-administered questionnaire was used to collect data. Descriptive Statistics, one-way ANOVA, and multiple regression were used as analytical techniques. According to the analysis, the average value of the index related to the need for a PIMS is 39.18. Most passengers need a PIMS index value higher than the average value. It reveals the majority need for a PIMS. Computer knowledge, online knowledge level, knowledge of electronic card usage, the primary purpose of using the train service, train service usage frequency, and satisfaction with the M-ticketing service were identified as the factors affecting the need for a PIMS for the SLR using one-way ANOVA. Regression analysis proves that the attitude towards an online ticketing procedure, the service at the ticket counter, and the ease of knowing about the train schedule have a significant effect on the need for a PIMS. It implies that the need for a PIMS will decrease if the service at the ticket counter is more efficient and if there is an easy way for train passengers to get information about the train schedule quickly. It is suggested that the SLR should establish an easy-to-use, secure PIMS covering all sectors, using a simple interface that is tailored to the individual at all levels and further demonstrated that the government and the SLR should pay special attention to the issue.

Keywords: Passenger Information Management System (PIMS), Public transport, Railway Service, Sri Lanka

INTRODUCTION

Transportation facilities are an important factor that plays a crucial role in the development process of the economic growth of a country. Especially, the transportation facilities of industrialized countries are like the backbones of those countries. Sri Lanka is also a developing country and hence with a huge demand for public transportation. The public service sector in Sri Lanka has failed to gain any competitive advantages due to its inability to provide quality services to its customers. These institutes have incurred capital losses due to a lack of profitability. According to reports by the Central Bank, state-owned institutions like Sri Lankan Airlines, Mihin Lanka, the Sri Lanka Railways, and the Sri Lanka Transport Board (SLTB) have reported continuous losses over the past few years. The Department of Railways of Sri Lanka is a government department that is under the purview of the Ministry of Transport. It is one of the transport service providers and is the only train transportation institution in the country (Sri Lanka Railway, 2016).

Railway services are available in many countries around the world and there is a continuous demand for fast, reliable, and passenger-friendly services. Therefore, there is a need to make railway services more efficient for the increased transportation of passengers and goods. This cannot be done by human power alone. Smart computerization is the latest technology that can be used in railway systems. Manipulation of passenger data in railway services is a major task where a huge amount of passenger data is required to provide fast and efficient service. Also, the data should be stored systematically and accessible quickly upon demand. With the use of inter-database connectivity, smart computerization provides a more efficient service for passenger authentication and other related services.

At a time when the world is moving forward with information technology, a newspaper report in the Daily News of August 13, 2019, stated that Dilantha Fernando, the General Manager of Sri Lanka Railways had said that the Sri Lanka Railways (SLR) was planning to introduce an electronic ticketing system for passengers. It was also stated that the

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e-ticketing service is expected to be activated using QR code systems, smart cards, and automation machines. However, further discussions with SLR staff revealed that Sri Lanka Railways does not possess such an electronic ticketing facility at present. They confirmed further that the SLR, which was established in 1858, did not possess its own passenger management information system either, though the SLR has an information management system called M-ticketing, which is conducted in partnership with Mobitel. This system is used for booking train seats, but there are issues with the booking process in the system. Online services are not available through the M-ticketing Information Management System (Department of Railway, 2018).

There is a relationship between service quality and customer satisfaction, and customer satisfaction increases when service quality is high (Choocharukui et al, 2013). SLR has formulated plans to improve the quality of services through the renovation of railway stations, the improvement of sanitary facilities, and the widening and upgrading of platforms (Sri Lanka Railways, 2018). At a time when technology is highly advanced in the 21st century, Sri Lanka Railways, which handles over 3.72 million passengers daily (Sri Lanka Railways, 2016), needs to focus only on the above aspects to improve the quality of passenger transport services at a time when day-to-day operations are highly efficient. However, there is an issue, where from the point of view of the Sri Lanka Railways Department, which is somewhat satisfied with the services provided by them to local and foreign passengers, while according to World Bank reports, the train services provided by the Sri Lankan government has a negative image (Perera & Bandara, 2016).

The passenger information management and service system are a hallmark of a modern rail network. It is one of the high-quality service offerings provided by a train system. Internationally recognized rail transport service is an approach to service efficiency through the use of information technology for ticket issuance, seating, train operations, land management, property and asset management, procedural formulation, and inventory control. Exploratory factor analysis has been conducted to identify the customer satisfaction criteria for rail transport (Yaparathna & Ratnajeewa, 2018).

Passengers have to deal with train ticket issuing officers at the Railway Department, having to spend time in queues to buy their tickets, as well as in the distributing of train tickets, which is a huge exercise and a daily waste of money to maintain a stock of tickets. And even the expended effort has become a problematic situation. Furthermore, the government of Sri Lanka has to bear the additional cost of importing the paper used to print railway tickets. The wrong attitudes among the employees and the lack of physical resources to adhere to IT procedures and encourage their use have also become a challenge to the Department of Railways (Sri Lanka Railways, 2018). Also, railway employees have train commuters as railway employees use the train services. Because of these circumstances, it is timely to evaluate the need for a Passenger Information Management System (PIMS) for Sri Lanka Railways from a customer perspective, which has been done through this study.

According to way, the use of information systems has become more common in organizations with the advancement of information and communication technology. This has made daily tasks much easier. Information systems for public transport in Sri Lanka are

presently used only by Sri Lankan Airlines. This is also limited only to the airport. An information system has not yet been used for the bus and rail services, which are widely used by passengers. More than 3.7 million passengers use the trains daily. The lack of a Passenger Information Management System (PIMS) for the Sri Lanka Railways, which is in such high demand, is also a problem. Accordingly, the research problem of this study is the nature of the need for a Passenger Information Management System (PIMS) for the Sri Lanka Railways Department.

Hence the main objective of this study is to identify the nature of the need for a Passenger Information Management System (PIMS) for the Sri Lanka Railways Department. There are a few specific objectives of the study, which are; to identify the distribution of the need for a Passenger Information Management System (PIMS) for the Department of Railways and to identify factors affecting the need for a Passenger Information Management System (PIMS) for train passengers.

LITERATURE REVIEW

A study has been conducted by Bachok (2007) to identify the need for an information system for passengers using public transport in Malaysia. The purpose of this study is to determine the effectiveness of a passenger information system provided by the Rail Passenger Service in the Klang Valley in Malaysia. It is proposed to develop a long-term and real-time information medium for integrated public transport information and private messaging. It has been identified that the delay in the delivery of information to train commuters should be done within a period of eight to ten minutes. In providing effective public transport information, its content should be accurate, timely, and prescribed (Bachok, 2007). Improving the use of public transport and intelligent transportation systems will not only increase migration access but also help reduce traffic congestion and air pollution in urban areas. In general, a major problem with public transportation is the lack of accurate information for passengers. For that reason, the team has introduced an easy-to-use information tool for passengers. The city of Milan has introduced a real-time information system for public transport based on the management of public events, delays, and service disruptions. Here, the structure of the system distinguishes physical locations and uses different types of nodes. Most interestingly, this system has the ability to express various interpretations (Bruglieri et al., 2015).

In view of the 150th anniversary of Sri Lanka Railways, its service has been evaluated from an employee and customer perspective. An analysis revealed that there were two main reasons for the deterioration of the railway service and that these two factors were interrelated. These reasons are human resource relations and poor administration of technology. While 47% of the passengers responded positively to the online ticketing procedure, 6% did not agree with it. The reason given was that the procedure was not suitable for purchasing all types of tickets, especially for the third-class category. It has been stated that it is assumed by the public request that the ticketing process should be developed in a way that is applicable to all (Kesavan et al., 2015).

Currently, a project has been launched to establish the first automated train ticketing system in Sri Lanka, but it has been suspended due to a lack of funds. It is intended to implement the automatic ticketing system at 50 selected

major railway stations as the first phase. After the automatic train ticketing system is activated, passengers are expected to be relieved from long queues. Tickets can be purchased in four different ways. That is, through mobile applications, vending machines, electronic cards at the gates, or over the counter. The ticketing system seeks to revolutionize the outdated railway network in Sri Lanka with world-class imported machines to facilitate the long-suffering commuters. According to the Railway Department's Annual Report 2017, 136.5 million passengers traveled by train in 2016, with an increase of 0.5% to 136.6 million in 2017. But so far it is clear that there is no proper plan for the implementation of this project (Thavapalakumar, 2020). A study by Bachok (2007) selected user socio-demographic profiles to study the effectiveness of a passenger information system. In addition to that, the researcher shows that there are three stages for accessing information related to training services, namely pre-tour, train terminal, and in-train.

A study has been conducted to identify the impact of management information systems on the performance of government organizations. Demographic information is also used to measure performance Shehadeh & Nazem, (2013). Saputra (2010) analyzed the responses of train passengers in Indonesia's rail service, using ethnography, age, occupational status, level of education, and income as demographic factors. The variables used to measure passenger satisfaction are station access, ticket price, ticket queue, the accuracy of the information, response, and employee behavior. Studies have been carried out by Chandrakumara & Pathmini)2015) and Perera & Bandara)2016) to study the quality of railway services in Sri Lanka. In order to measure the quality, the service received from the railway ticket window has also been studied through the five variables of tangibility, reliability, response, sensitivity, and assurance. Kesavan et al.,)2015) used the online ticketing procedure as one of the variables to study the quality of Sri Lanka Railways.

During discussions with senior officials of the Sri Lanka Railway Department, the officials stated that if there was a passenger information management system for the department, it would be convenient for passengers as well as railway employees. According to further inquiries, officials at the ticket counters at the Colombo Fort Railway Station were of the view that the main reason for the loss of Sri Lanka Railways was the failure to modernize the Railway Department. According to them, although information management systems have been introduced to the railways at various times, the Railway Department has not been able to establish them due to political pressures and trade union actions. They further stated that no study has been conducted so far by the Railway Department or any other department on the extent to which railway employees and passengers are prepared to work with the information management system and the level of need for such a system.

Although its effectiveness and performance have been measured in relation to information management systems, no method has yet been used to measure its needs. Studies on the quality of Sri Lanka Railways, factors related to automated ticketing machines, and ticket counters, and factors related to train to the ticket, to measure the need for a passenger information management system based on the findings of discussions with railway officials, factors related
Table 01: List of Variables used for the Analysis

to train information, factors related to train passengers and goods being transported could be understood and be utilized.

Accordingly, while considering previous studies, ethnography, age, occupational status, level of education and income can be used as demographic factors for this study. Domestic and foreign researchers have not measured the need for a Passenger Information Management System (PIMS), and this research will measure this need. It can be pointed out that this would greatly assist not only the fields of information and communication but also any researchers conducting new studies.

RESEARCH METHODOLOGY

Research Design: This section describes the methodology used to identify the need for a Passenger Information Management System (PIMS) for the Sri Lanka Railway Department. Empirical research is a method of research that uses verified evidence to obtain research results. Accordingly, this study is also empirical research. This study used quantitative data. The objectives of this study are primarily to identify the need for a Passenger Information Management System (PIMS) for Sri Lanka Railways. Accordingly, there are 338 railway stations in Sri Lanka and 175 of them are major railway stations. Among them, the Colombo Fort Railway Station is the hub of the railway system and is also the main transit point. Therefore, the basis for this study is the Colombo Fort Railway Station. Accordingly, the population of the study includes all passengers arriving at the Colombo Fort Railway Station. This is an infinite population as we do not know the exact size of the population here.

Sampling Procedure and Sample Size: This study was done during the COVID-19 pandemic period. There were some difficulties related to the data collection process. The cluster Sampling technique was used to determine the sample size due to unawareness of population size or sampling frame. According to information from the passengers and officers of the railway department, used three WhatsApp groups as clusters including travelers from Colombo Fort. There were three hundred and twenty-seven passengers in all three groups and it became impossible to approach the passengers to obtain data.

Data collection method: The questionnaire method to obtain primary data was used in the fieldwork related to social science research. The Questionnaire method was used in this study to collect primary data as quantitative data, as well as case study method, was applied to gather qualitative data. Here, the questionnaire was prepared using a Google form and released to the respondents. The questionnaire consists of five parts. The first part includes ethnographic information, the second part with technical information, the third part with information on the use of railways, the fourth part with the train ticket counter and other information related to the train service, and the last one with the Likert scale used to measure variables.

Variables: This study was directed as a survey study. The data were collected from a sample of railway passengers. The following Table 01 indicates the variables with scales and levels which are used to collect data and analyses the data.

Variable Name	Scales of measurement	Categories
Gender	Nominal	Male Female
Age group	Nominal	Below 20 years 21-30 Years 31-40 years 41-50 years 51-60 years Over 40 years
Living area	Nominal	Rural Semi-Urban Urban
Level of education	Nominal	Never go to school Grade 1-5 Grade 6 – 10 Up to G.C.E O/L Up to G.C.E A/L Up to Diploma Graduate or above
Professional status	Nominal	Government sector Private sector Business Retired Student Unemployed Self-employment Others
Technical capability	Ordinal (Likert scale)	Likert statements
Technical factors	Ordinal (Likert scale)	Likert statements
Need to know passenger and freight information	Ordinal (Likert scale)	Likert statements
Ease of knowing train schedule information	Ordinal (Likert scale)	Likert statements
Ticket counter service	Ordinal (Likert scale)	Likert statements
Attitude to the Online Ticketing Procedure	Ordinal (Likert scale)	Likert statements

Source: Compiled by the researcher using literature review, 2017

Data analysis: Software such as Eviews, SPSS, and Minitab was used to analyze the data for the purpose of this study. Here, descriptive statistical techniques were used under the univariate analysis method. Descriptive statistical techniques can be used to describe in detail the patterns of data contained in the variables used in this analysis. Accordingly, mean, mode, and median can be used to describe the central tendency, and range, variance, and standard deviation can be used to describe the deviation of the data. Furthermore, variables can be analyzed in univariate analysis using each type of chart and diagram, such as column charts, pie charts, histograms, frequency distributions, etc. T-test, one-way ANOVA, and numerical analysis methods were used to identify factors affecting a Passenger Information Management System (PIMS). Furthermore, a model was developed under multiple regression. Accordingly, the classification of the variables in this study can be illustrated by the following conceptual diagram (Figure 1):

Figure 01: Analytical framework
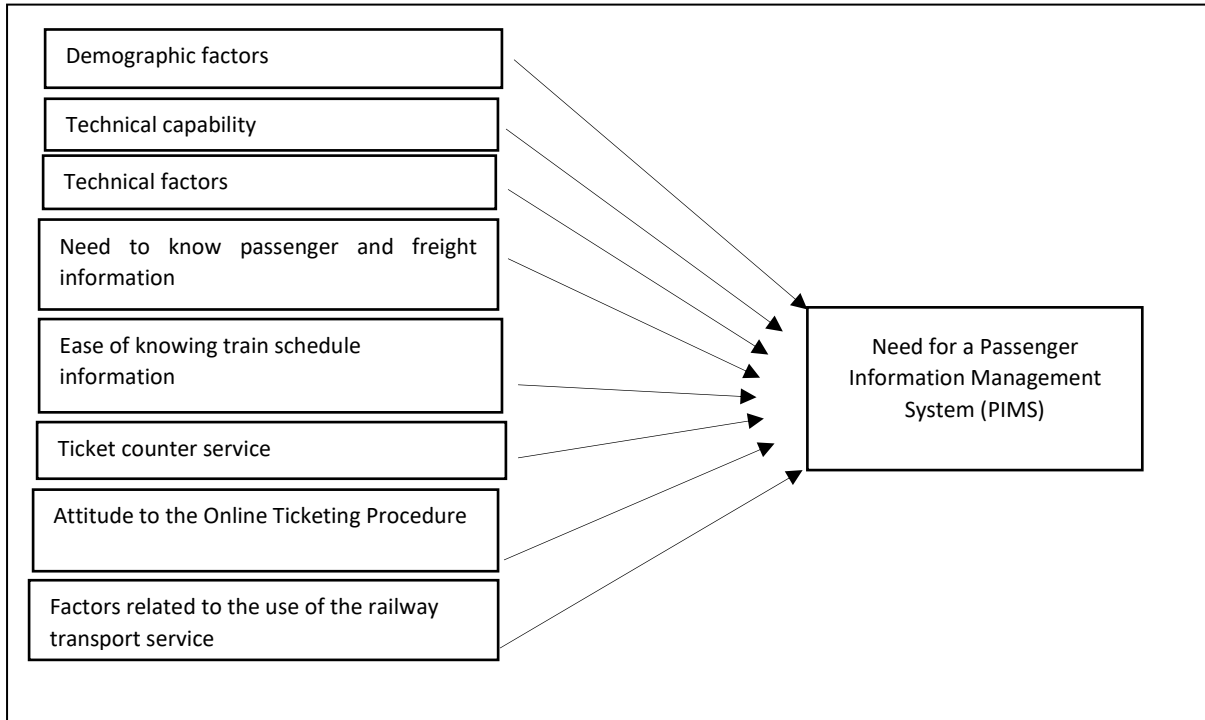
Note: Developed the analytical framework by using theoretical models (Abugabah et al., 2009; Beul-Leusmann et al., 2014).

RESULTS AND DISCUSSION

Here the data collected concurrently with the study is analyzed and presented according to the objectives of the study. The data analysis was done in three parts. The first part analyzes the sample composition using descriptive statistics, and the second part analyzes the data using bivariate analysis. Part three builds a multivariate regression model for estimating the need for a Passenger Information Management System (PIMS). The response rate in this study was eighty-five percent.

Using descriptive statistical methods, the composition of the sample can be described from different angles. There was a 51 percent female response rate. However, it is evident that there is no huge difference in the use of railways in terms of gender.

The response rate of train passengers according to the occupations of the participants is shown in Figure 02. Most of the passengers are public and private sector employees and students. Thirty-one percent of passengers work in the government sector. Very few respondents of the sample who are retirees and businessmen used railways.

Figure 02: Percentage of respondents' occupation
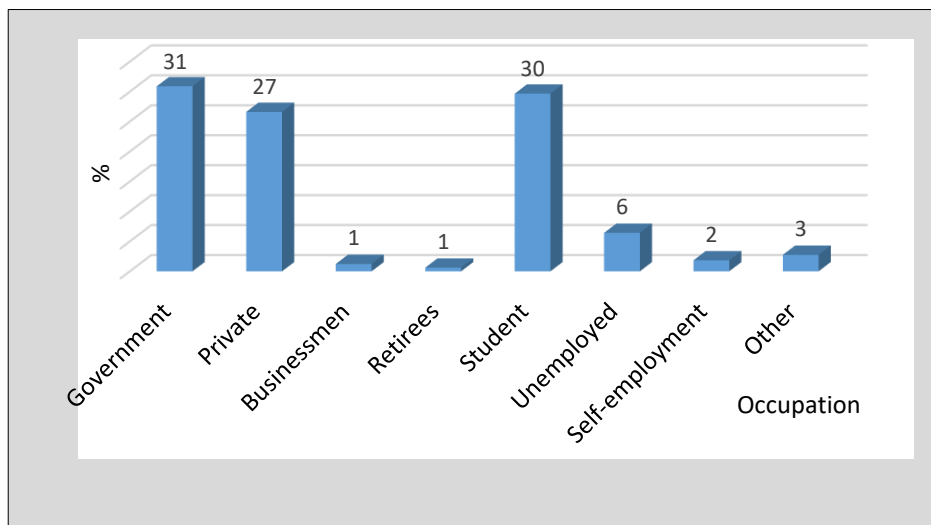
Source: Field Survey, 2020

Most train passengers live in suburban areas. According to the descriptive analysis, the lowest number of train users live in urban areas, which is 20 percent while 36 percent of train passengers are from rural areas and the remaining 44 percent are from suburban areas. Furthermore, most

respondents of the sample (around 33 percent) use the train to travel to their employment destinations. Ticketing service is one of the important variables of the study. Although the mobile ticketing service is available at the railway department, more than three fourth (77 percent) of

passengers purchase their tickets at the ticket counters. It is clearly shown in the following figure.

Figure 03: Descriptive analysis for the method of purchasing tickets
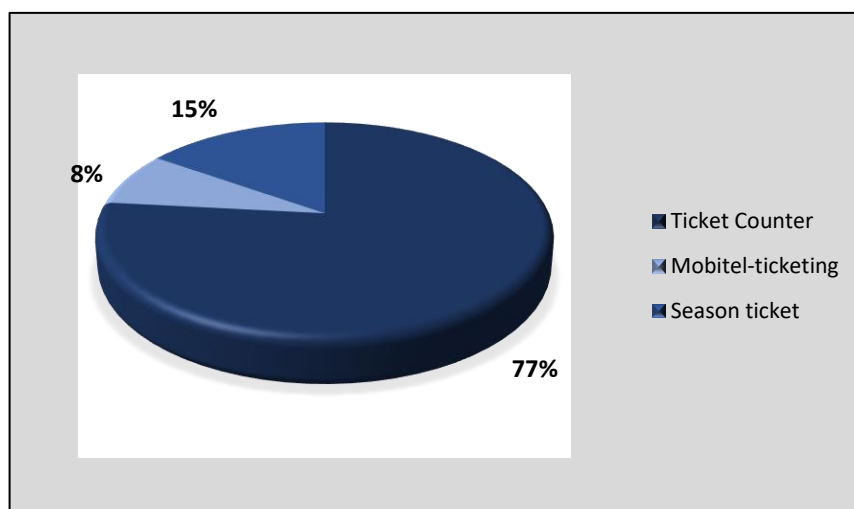
Source: Field Survey, 2020.

The findings of the reliability and validity tests revealed the suitability of variables for advanced analytical methods. The following table No. 01, Cronbach's alpha value is greater than 0.7, it can be concluded that the data is reliable. Also, if the KMO value is greater than 0.6 and the test frequency ($\chi^2 = 676.293, p = 0.000$) for Bartlett's test is significant, then it can be concluded that the data must be consolidated. Accordingly, it can be said with 95% reliability that the sample correlation matrix related to the data varies from unit to unit. This means that the data is suitable for analysis.

Table 01: Findings of the reliability and validity Tests

Cronbach's Alpha	KMO	*Bartlett's* Test Chi-Square	df	P Value
0.741	0.828	676.293	28	0.000

Source: Field Survey, 2020

Since the data meets the above requirements, the composite index built into the need for a PIMS can be described in detail as follows:

Table 02 and figure 04 show the summary measurements and condition of the normality test of the study. These results help to construct a composite index value relevant to the need for a Passenger Information Management System (PIMS) for the sample. According to Table 02, the median value of the composite index corresponding to the need for a Passenger Information Management System (PIMS) in the sample is 39.1835 units. Its maximum value is in the range of 98.4560 units and its minimum value is in the range of 3.3543 units. Accordingly, the needfulness varies by 20.6583 (standard deviation) units. Since the skewness is 0.1431, it can be seen that the distribution of the composite index value of the needfulness is approximately symmetrically distributed.

Table 02: Summary measurements

Variable	Mean	St.Dev	Minimum	Median	Maximum	Skewness	Kurtosis
Needfulness	39.1835	20.6583	3.3543	40.0419	98.456	0.1431	2.1874

Source: Compiled by the researcher based on Field Survey data, 2020

Figure 04: Distribution of Need for a Passenger Information Management System (PIMS)
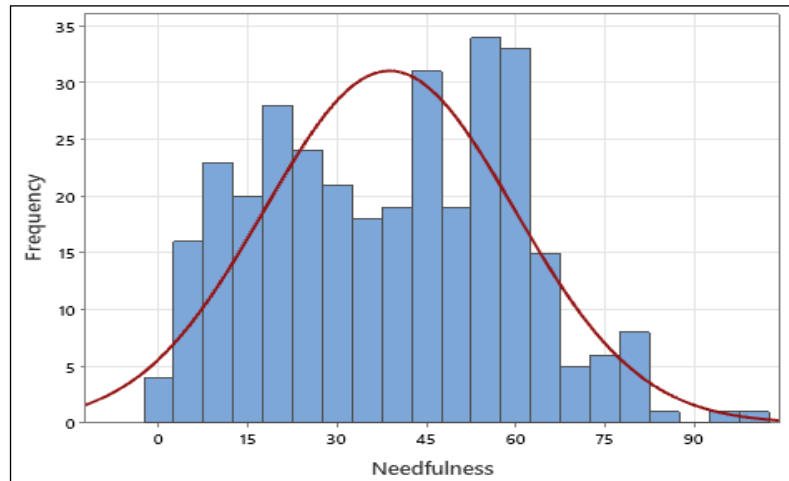
Source: Field Survey, 2020

According to Table 03, significant differences can be identified among computer knowledge, online knowledge level, knowledge of electronic card usage, the primary purpose of using the train service, train service usage frequency, satisfaction with the M-ticketing service, and the need of Passenger Information Management System (PIMS). That is, the factors mentioned above have an impact on the need for a management system.

Table 03: Results of one-way ANOVA

Variable	F- value	p-value
Age	1.894	0.095
Living Area	2.236	0.099
Educational Level	1.081	0.357
Job-status	1.137	0.339
Monthly income	2.274	0.061
Computer Knowledge	5.364	0.000
Online knowledge level	5.098	0.001
Knowledge of electronic card usage	4.868	0.001
The primary purpose of using the train service	7.383	0.000
Train service usage frequency	38.738	0.000
Train class	0.240	0.787
Satisfaction of M-ticketing service	3.657	0.009

Source: Field Survey, 2020

The results of the multiple regression analysis in Table 04 show that the F value (F = 46.2576, p = 0.0000) is significant. It can be concluded that the overall model is significant with 95% reliability. This means that at least one variable has a specific impact on the need for a PIMS. Accordingly, the attitude towards an online ticketing procedure (t = 5.5794, p = 0.000), the ticket counter service (t = -5.8093, p = 0.000), and the ease of knowing the train schedule (t = -3.7856, p = 0.0002) when examining the effect of each variable separately, the variables have a significant impact on the need for a Passenger Information Management System (PIMS). Furthermore, it can be stated with 95% confidence that the variables of need for passenger and freight information (t = 0.2324, p = 0.8163) and technical capability (t = 0.2979, p = 0.7659) do not have a specific effect on the need for a PIMS. It can also be concluded that the proposed model describes 40.97% of the total variation in the need for a Passenger Information Management System (PIMS).

Table 04: Results of Regression analysis

Variable	Coefficient	Std. Error	t-Statistic	Prob.
ONLINE_TICKET	0.207571	0.037203	5.579373	0.0000
P_AND_G_INFO	0.300462	1.292465	0.232472	0.8163
T_COUNTER	-0.272051	0.046830	-5.809339	0.0000
TECH_SKILL	0.359944	1.208126	0.297936	0.7659
TRAIN_INFO	-0.848328	0.224092	-3.785625	0.0002
C	126.3975	22.98549	5.499011	0.0000
R-squared	0.418782	Mean dependent var		39.18385
Adjusted R-squared	0.409728	S.D. dependent var		20.65826
S.E. of regression	15.87156	Akaike info criterion		8.385114

Sum squared resid	80862.01	Schwarz criterion	8.454654
Log-likelihood	-1364.966	Hannan-Quinn criter.	8.412861
F-statistic	46.25761	Durbin-Watson stat	1.908629
Prob(F-statistic)	0.000000		

Accordingly, a model for estimating the need for a Passenger Information Management System (PIMS) from these variables can be developed as follows:

Need for a PIMS = 126.3975+ 0.2076 Attitude towards an Online Ticket Procedure -0.2721 Ticket counter service - 0.8483 Ease of getting information about train schedules

According to the above equation, the intersection is 126.3975. Therefore, the need for Passenger Information Management System (PIMS) can be expected to be 126.3975 units without independent variables. The coefficients for the variance of the online ticketing procedure, ticket counter service, and train schedule information are 0.2076, -0.2721, and -0.8483 respectively. Therefore, it can be expected that the need for the Passenger Information Management System (PIMS) will increase by an average of 0.2076 units as the attitude towards the online ticketing process increases by one unit while the other variables remain constant. It can also be expected that the Passenger Information Management System (PIMS) requirement will decrease by an average of 0.2721 units as the service of the ticket counter increases by one unit while the other variables remain constant. It can also be expected that the need for a Passenger Information Management System (PIMS) will decrease by an average of 0.8483 units as the ease of knowing train schedules increases by one unit while the other variables remain constant.

CONCLUSIONS

Conclusions of the study are made based on the analytical findings. According to the first objective of the study, the average value of the index related to the need for a Passenger Information Management System (PIMS) is 39.18. Most passengers' need for a Passenger Information Management System (PIMS) index value is higher than the average value. That is, it can be identified that there is a need for a Passenger Information Management System (PIMS) for the majority of railway passengers. The study conducted by (De Silva, 2010), it has been found that there is a need for an efficient ticketing system for Sri Lanka's bus and railway services. It has also been mentioned that it can be reduced the revenue loss of public transport. A contactless card and a mobile phone-based application have been proposed for that.

Several factors could be identified when focusing on the factors affecting the need for a Passenger Information Management System (PIMS) for the Sri Lanka Railway Department. The factors are computer knowledge, online knowledge level, knowledge of electronic card usage, the primary purpose of using the train service, train service usage frequency, and satisfaction with the M-ticketing service. Moreover, it can be identified that factors such as the age of railway passengers, living area, education level, employment status, monthly income, and the class of train traveled in do not affect the need for a Passenger Information Management System (PIMS).

According to the regression analysis, it can be concluded that the attitude towards an online ticketing procedure, the service at the ticket counter, and the ease of knowing about the train schedule have a significant effect on the need for a Passenger Information Management System (PIMS). Accordingly, when the service at the ticket counter is more efficient, the need for a Passenger Information Management System (PIMS) decreases; and when the attitude of railway passengers toward an online ticketing procedure increase, the need for a Passenger Information Management System (PIMS) also increases.

It can also be further concluded that if the ease of knowing information about the train schedule increases, the need for a Passenger Information Management System (PIMS) will decrease. The study conducted by Yaparathna & Ratnajeewa, (2018) also confirmed the finding recognizing the availability of online ticketing facilities and the display of correct information as key determinants of rail passenger satisfaction. These conclusions imply that the need for a Passenger Information Management System (PIMS) will decrease if the service at the ticket counter is more efficient and if there is an easy way for train passengers to get information about the train schedule quickly. It can be concluded that there is a need for a Passenger Information Management System (PIMS) for the Railway Department. Therefore, it was clear that the Department of Railways should establish an easy-to-use, secure Passenger Information Management System (PIMS) covering all sectors, using a simple interface that is tailored to the individual at all levels. It was further demonstrated that the government and the Railway Department should pay special attention to this.

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