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Assessment of Trans Banyumas Services Based on the Opinions of Female Passengers from a Promotional Point of View

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Abstract

Public transportation is a fundamental element significantly influencing smart cities and smart mobility within communities. Banyumas Regency is currently one of the regions implementing the smart city concept in its urban development. One of the tangible proofs of this implementation by the Banyumas Regency government is the introduction of BRT Trans Banyumas, aimed at increasing public interest in using public transportation, facilitating more effortless mobility, reducing air pollution, and boosting the local economy. Evaluating public transportation services is essential to attract public interest, particularly regarding the intelligent public transport system (IPTS) aspects. This study evaluates Trans Banyumas services to analyze the level of IPTS implementation from the perspective of female passengers. Female passengers' perceptions are used because women have unique mobility patterns, making them an essential indicator for assessing smart mobility. The method used in this research is General Linear Model ANOVA. Data collection was conducted qualitatively with 357 respondents. The test results show that demographics significantly influence the intelligent public transport system aspects: ICT, IoT, integration, safety and security, and smart accessibility and mobility. The result can be used to develop recommendations for improvements in the Trans Banyumas service related to intelligent public transportation system technology. However, implementing an intelligent public transport system in the Trans Banyumas service cannot be done individually. Therefore, there needs to be cooperation from both the government and the private sector to promote sustainable transportation, reduce the use of private vehicles, and minimize environmental impacts.

Keywords

BRT, female, intelligent public transport system, passengers, smart mobility, Trans Banyumas

1 Introduction

The world's population is projected to reach 9.7 billion by 2050, putting significant pressure on countries' natural resources, infrastructure, and public services (Bahar et al., 2020). Developing countries are experiencing faster population growth than developed countries, resulting in a decline in welfare due to economic and social disparities in society (Didu and Fauzi, 2016). Even worse, mass migration of people to a country's big cities can lead to extreme overcrowding, triggering problems such as congestion, pollution, and pressure on public services (Cattaneo and Foreman, 2023). To prevent or reduce these impacts, a country needs to realize sustainable urban development, such as public transportation (Bespalyy and Petrenko, 2023).

In Indonesia, especially in Banyumas Regency, the population has reached 1.828.570 in 2023, with a population density of 1.380 people per km^2 (BPS, 2023). This population density indicates that the Banyumas Regency is classified as a medium-density or moderately dense region and will continue to increase (Sihombing and Utami, 2023). The increasing population density will harm several aspects of urban development infrastructure, such as congestion and a decrease in the quality of public services (Syafrina, 2022). Thus, the number of private vehicles owned by the community will affect the increase in the volume of cars on the road, causing traffic jams to occur daily (Harvianti and Kurniadi, 2021).

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The regional medium-term development plan of Banyumas Regency, for the years 2018–2023, states that the local government plans to optimize integrated transportation management in the Banyumas region (Regent of Bappeda Banyumas, 2021). Trans Banyumas is a Bus Rapid Transit (BRT) service, and it has three travel corridors: Corridor 1 serves the Pon Market - Ajibarang bus station, Corridor 2 serves the Notog bus station - Baturaden bus station, and Corridor 3 serves the Bulupitu bus station - Kebondalem bus station, with two travel direction systems (Prasojo et al., 2023).

The operation of the Trans Banyumas service is one of the local government's strategies for realizing smart mobility and developing the smart city concept (Salamah et al., 2023). Smart city is an innovative urban concept that utilizes information and communication technology, which are integrated into all aspects of life to form an element that can organize and manage urban assets (Nisa and Amrozi, 2019). Smart mobility is one of the foundations of smart city development in the city management sector (Aliyah et al., 2024). Smart mobility is a smart movement system that aims to result in less movement, less obstruction, and be less time-consuming for people in daily mobility (Safitry et al., 2020). Smart mobility has the main scope of transportation systems, urban infrastructure, and technology that are integrated and sustainable (Romadlon, 2021). In its implementation, smart mobility is expected to significantly improve public transportation systems that are better, safer, more systematic, and more reliable, encouraging people to use public transportation (Agni et al., 2021).

To maintain the existence of Trans Banyumas as the public transportation choice, the local government needs to evaluate the service regularly. One approach to assessing public transportation services is to determine the implementation of an intelligent public transportation system (IPTS) (Duan, 2023). IPTS is a subsystem of intelligent transportation systems (ITS) that aims to control public transportation networks, maintain public transportation performance, provide up-to-date information about travel to users in real-time, and create an integrated network operating condition system (Elkosantini and Darmoul, 2013).

The need to evaluate the Trans Banyumas service requires an assessment of the perception of user experience, predominantly female passengers. The perception of the evaluation of female passengers is essential because women dominate 70% of the total use of public transportation in Banyumas (Romadlon et al., 2020). Moreover, most Trans Banyumas users are women, with a percentage of 72%, while only 28% are male users (Salamah et al., 2023). Despite having a large number of public transportation users compared to men, female mobility has a diversity of problems that often occur related to public transportation services, such as harassment and pickpocketing, which make women feel less safe and comfortable in using public transportation (Malik et al., 2020). Therefore, an evaluation effort is needed to improve public transportation services in terms of safety and comfort based on gender equality and social inclusion, accompanied by the application of technology in its implementation (Romadlon, 2021).

Furthermore, assessing female perceptions of public transportation services' unique mobility patterns is essential. This unique mobility pattern is based on the habit of women who prefer public transportation to carry out their daily activities. They tend to go to various places rather than private transportation like men, even though the frequency of travel time is longer due to limited transportation access. This unique mobility pattern of women can be used as a basis for smart mobility assessment indicators (Romadlon and Saintika, 2023).

Based on these problems, this study examines the influence of female passengers' views on promoting intelligent public transportation systems in Trans Banyumas. This study is expected to be a basis for consideration for Trans Banyumas operators and the Ministry of Transport in Banyumas to provide better service to the community, so that service existence is maintained and sustainable. In addition, this research will be a reference for female passengers to understand the concept of an intelligent public transport system in Trans Banyumas' service.

1.1 Literature review and hypotheses development

The promotion of intelligent public transportation systems is compulsory to guarantee a high level of service quality for its users in terms of punctuality and frequency of transportation (Huo et al., 2022). This difficulty may be due to the continuous increase of urbanization in a region, making the transportation network more extensive and complex to manage (Sumule, 2021). Therefore, an intelligent transportation system is needed in public transportation to provide better services to the community.

IPTS implements many innovative technologies (Diderot et al., 2023). All systems and information technology in this IPTS concept share information through a system relationship, which will then be processed using advanced technology (Mastalerz et al., 2020). The system applied to this IPTS is generally based on the Internet of Things (IoT),

which can help a city implement the concept of a smart city in terms of public transportation (Visan et al., 2022).

IPTS technologies are geographic information systems (GIS) that are useful for designing strategic routes on BRT services (Triviño and Garcia, 2021), automatic vehicle location system (AVLS) uses the global positioning system (GPS) in the bus position and traveler information systems (TIS), which provide users with real-time information on the status of the transportation network (Megawati and Lawi, 2021). The IPTS also allows for the integration of a decision support system (DSS) to suggest regulatory strategies and control decisions to maintain network performance (Elkosantini and Darmoul, 2013). The conceptual model of this research can be seen in Fig. 1.

ICT, and other technologies applied to transportation today, have made the concept of intelligent transport systems increasingly developed (Salamah et al., 2023). ICT can certainly be applied to develop an intelligent public transport system from an intelligent transport system. In addition, the application of information and communication technology (ICT) and the integrated Internet of Things (IoT) is one of the applications of the smart city concept in sustainable urban development (Hasibuan and Sulaiman, 2019). In addition, the application of ICT can undoubtedly improve the high quality of service for users, and it follows the concept of intelligent public transportation systems with the following hypothesis.

H1: Demographic factors affect the application of ICT in the IPTS aspect of the Trans Banyumas service.

IoT is a technology that connects humans with devices over the internet, using sensors and artificial intelligence (AI) for automation (Prawiyogi and Anwar, 2023). Various information types can be easily obtained in the transportation sector in real-time. This is very useful for reducing the uncertainty of a system, which will increase the ability of fast control response and proper management of the system (Luo et al., 2019). The application of IoT to public transportation systems as a whole has the benefit of providing better control strategies and system scheduling schemes, thereby increasing user satisfaction (Praditya et al., 2021). Therefore, IoT can help public transportation implement an intelligent public transportation system. The hypothesis can be set out below.

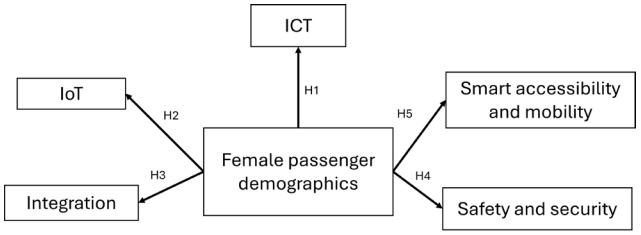


Fig. 1 Model concept

H2: Demographic factors affect the application of IoT in the IPTS aspect of the Trans Banyumas service.

One of the factors that makes people want to use public transportation is the concept of integration (Nnene et al., 2023). There are many functions of integration in public transportation, such as reducing user travel time and costs, increasing public accessibility, and reducing congestion (Whitmore et al., 2022). Therefore, integration must be applied to intelligent public transportation systems to facilitate people's daily mobility. Therefore, the hypothesis is as follows.

H3: Demographic factors affect the application of Integration in the IPTS aspect of the Trans Banyumas service.

Female passengers dominate the majority of public transportation users in various countries. This is because the majority of women have an environmentally conscious point of view in choosing a mode of transportation (Romadlon et al., 2020). However, this mobility of women has a diversity of problems that often occur related to public transportation services, such as the vulnerability to harassment, pickpocketing, and the lack of female-only facilities, which make women feel less safe and comfortable in using public transportation (Malik et al., 2020). Therefore, it is necessary to evaluate the improvement of public transportation services in terms of safety and comfort based on gender equality and social inclusion, accompanied by the application of technology in its implementation (Romadlon and Saintika, 2023). This certainly follows the application of intelligent public transportation systems, and the hypothesis is as follows.

H4: Demographic factors affect the application of Safety and Security in the IPTS aspect of the Trans Banyumas service.

Smart accessibility and mobility are one of the foundations of smart city development in the urban management sector (Aliyah et al., 2024). Smart accessibility and mobility have the goal of not having much movement, minimizing obstacles, and not taking much time for people to carry out daily mobility (Safitry et al., 2020). Smart accessibility and mobility have the main scope of transportation systems, urban infrastructure, and technology that are integrated and sustainable (Romadlon and Saintika, 2023) Therefore, it is very compatible with implementing an intelligent public transportation system. The hypothesis can be set out below.

H5: Demographic factors affect the application of Smart Accessibility and Mobility in the IPTS aspect of the Trans Banyumas service.

2 Methods

This research used a quantitative method to assess 357 Trans Banyumas female passengers using a questionnaire about demographic attributes and IPTS variables. Passenger demographics included age, vehicle ownership, trip purpose, frequently used bus corridor, occupation, and monthly income. IPTS variables included ICT, IoT, integration, safety and security, and intelligent accessibility mobility. User responses to each question were recorded via Google Forms. The data analysis used the General Linear Model ANOVA method and the Minitab 21 software to analyze the hypothesis (Minitab, online).

Table 1 shows that the intelligent public transport system has five variables: ICT, IoT, integration, safety and security, and intelligent accessibility and mobility. The first variable, ICT, relates to the ease of users in knowing information and using Trans Banyumas services. The second variable, IoT, relates to the application of IoT technology in Trans Banyumas to make it easier for users to find information in real time. The third variable is integration, which aims to make it easier for people to mobilize between modes of transportation. The fourth variable is safety and security, which is related to the comfort and safety of users using Trans Banyumas. The last variable is smart accessibility and mobility, which relates to the ease with which users access Trans Banyumas services.

3 Results and discussion

3.1 Female passengers' demography

Demographic data was obtained from a survey of 357 Trans Banyumas female passengers to determine the distribution of passengers. The following are the results of the sociodemographic data on Trans Banyumas passengers, which can be seen in Table 2.

Table 2 shows that most Trans Banyumas female passengers are dominated by women aged 21-25 years old, with a percentage of 37.8%. The occupational status of Trans Banyumas female passengers is led by private employee workers 34.2%, followed by students 26.6%, students 17.6% and the rest are busy as civil servants, entrepreneurs, homemakers, and not working with a percentage of 9.5% to 0.8%. In addition, the average Trans Banyumas female passenger has no income, with a percentage of 38.7%, followed by passengers who have an income between IDR 3.000.000 – 4.500.000, with a percentage of 27.2%, and after that, passengers who have an income of IDR 1.500.000 – 3.000.000, at 23%. Regarding vehicle ownership, Trans Banyumas female passengers, on average, own a motorcycle with a percentage of 61.8%. In the aspect of frequently used corridors, Trans Banyumas Corridor 1 is used primarily by female passengers with a percentage of 46.3%, Corridor 2 with a percentage of 30.7%, and Corridor 3 with a percentage of 23%. The purpose of the trip, the average female passenger using the Trans Banyumas service is for commuting activities at 31.6%, followed by working at 24.8%, going to school or college at 18.2%, and the rest of them are traveling, shopping, and other activities.

Table 2 shows that vehicle ownership data, frequently used corridors, and travel destination data are multiple-choice questions, and passengers can answer more than one option listed on the questionnaire. Therefore, regarding frequently used corridors, the demographic details of female passenger mobilization when using the Trans Banyumas service are shown in Table 3 and Fig. 2.

Based on passenger mobilization data in Table 3 and Fig. 2, 63% of passengers still dominate one corridor trip without transit, and 37% of other female passengers have or often make transit trips using the Trans Banyumas service. The small number of passengers who travel on more than one corridor is due to the current Trans Banyumas transportation system still not facilitating passengers' convenience in making transit mobilization. Passengers who can transit for free are only passengers who make payments using electronic money (E-money).

Meanwhile, the payment method is inversely proportional to passengers who still use the QRIS (Quick Response Code Indonesian Standard) method due to the lack of availability of E-money. The passenger transit system using E-money is sometimes problematic, such as the limited time to transit for free, and this free transit system has a usage limit that can only be used once for free transit. Then, the lack of adequate transit stop locations is another aspect that affects passenger transit mobilization. It shows that Trans Banyumas transit stops are very few and do not cover the entire corridor directly. The following are the details of the Trans Banyumas transit stops listed in Fig. 3.

Fig. 3 shows that Corridor 1 and Corridor 2 of Trans Banyumas are currently not directly integrated, and passengers who want to transit between the two corridors must use Corridor 3 bus services or other public transportation services to reach their destination. Some Trans Banyumas transit stops are not directly located in the same place or across from each other. This occurs at the DAOP 5 bus stop, SDN 3 Kedungwuluh bus stop, Tanjung Nirwana bus stop, and Kelurahan Tanjung bus stop. These transit stops cross each other on the edge of a large highway. It is pretty

Table 1 Variable of intelligent public transport system

Variable	Code	Explanation
ICT	P1	Passengers know and own public transportation apps
	P2	Passengers easily understand the use of public transportation apps
	P3	Public transportation apps make it easier for passengers to find out information
	P4	Cashless payment (e-money & QRIS)
	P5	The application provides information on the best route and the predicted time to the destination
	P6	There is information about the number and maximum limit of passengers
	P7	Make cashless payments and check in using the app
	P8	Easy trip planning in the app
IOT	P9	Automation system for passengers with disabilities
	P10	Disability-friendly notification system
	P11	Location and arrival time can be monitored in real-time
	P12	The notification system is systematized by bus distance to the bus stop
	P13	Transportation arrival time following the estimated time
	P14	An RFID system that can recognize the identity of passengers and count the number of passengers on the bus
	P15	Transportation arrival delay information on the application and the bus stop
Integration	P16	Public transportation routes are interconnected and integrated
	P17	Public transportation is integrated with other public vehicles
	P18	Passenger stops are integrated with strategic places
	P19	Passengers can access integrated transportation schedule information
	P20	Passengers can easily make transit trips
	P21	Public transportation has implemented integrated tariffs
Safety and security	P22	There is a helper at the bus stops and on the vehicles
	P23	Seat belts in every passenger seat
	P24	Priority seats and information through a recurring notification system
	P25	The public transport app help center responds quickly and responsively
	P26	There is a reporting feature on public transportation apps
	P27	Security alarm buttons and safety devices are available on public transportation
	P28	Closed Circuit Television (CCTV) is available
Intelligent accessibility and mobility	P29	Information about vehicle speeds that are within normal limits
	P30	Information on emergency response situations on applications and monitors in transportation
	P31	Accessible and disability-friendly bus stops
	P32	It has a transit stop center that is integrated with various services
	P33	Bus stops have dynamic and disability-friendly digital information boards
	P34	Bus stops have free Wi-Fi access and smartphone charging points
	P35	Bus stops have implemented exceptional standards for passenger comfort
	P36	Bus stops have integrated and easy-to-understand corridor maps

dangerous for passengers to make a transit because there are no supporting facilities for passage between stops, such as a pedestrian bridge or a red light with a zebra crossing for safer crossing of passengers.

3.2 Instrument test results

Instrument testing is employed to meet the criteria for conducting the final analysis stage. Instrument testing consists of a validity test, a reliability test, and a normality test. Data processing was carried out using IBM SPSS 26 software and Minitab 21. The confidence level in this test is 95%, with an error rate of 5%. The validity, reliability, and normality test results can be seen in Table 4.

Table 4 shows that the validity test of each question item produced a p-value of less than 0.05, and the data tested were valid. In the reliability test, each variable tested got a Cronbach's Alpha value above 0.6. The data test results showed that the data was reliable. The last data analysis

Table 2 Demographics of female passengers.

	Variable	N	%
Age	Less than 15	15	4.2
	16–20	80	22.4
	21–25	135	37.8
	26–30	66	18.5
	More than 30	61	17.1
Occupation	Student	63	17.6
	College student	95	26.6
	Priv. employee	122	34.2
	Housewife	20	5.6
	Govt. employee	34	9.5
	Entrepreneur	20	5.6
	Does not work	3	0.8
Salary (monthly)	Less than IDR 1.500.000	34	9.5
	IDR 1.500.000 – 3.000.000	82	23.0
	IDR 3.000.000 – 4.500.000	97	27.2
	More than IDR 4.500.000	6	1.7
Private vehicle ownership	No income	138	38.7
	Bicycle	39	9.7
	Motorcycle	124	61.8
	Car	28	6.9
	No vehicle	87	21.6
Frequently used corridors	Corridors 1	231	46.3
	Corridors 2	153	30.7
	Corridors 3	115	23.0
Trip purpose	Studying	100	18.2
	Working	136	24.8
	Shopping	58	10.6
	Traveling	73	13.3
	Round-trip activities	173	31.6
	Others	8	1.5

Table 3 Passenger mobility

Trip	Amount	Total
One corridor		
Corridor 1	128	
Corridor 2	70	225
Corridor 3	27	
More than one corridor		
Corridor 1 - Corridor 2	44	
Corridor 1 - Corridor 3	49	132
Corridor 2 - Corridor 3	29	
Corridor 1 - Corridor 2 - Corridor 3	10	

requirement test was the normality test. In the normality test, the data showed that the skewness value for each variable was between −2 and +2, and the kurtosis value for each variable was between −7 and +7. Therefore, it was concluded that the data in this study were typically distributed (Salamah et al., 2023).

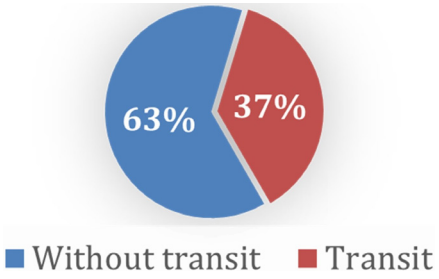


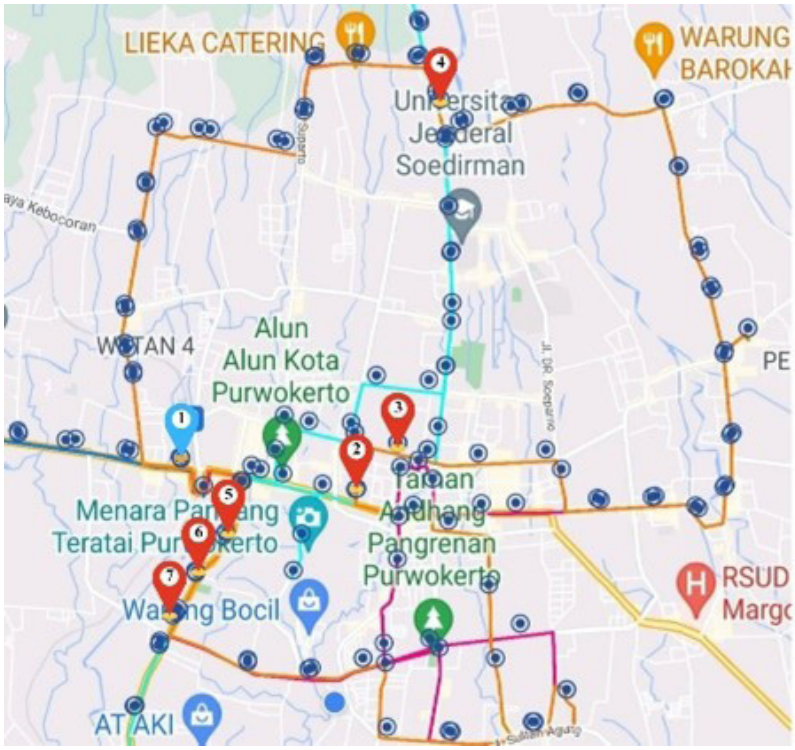
Fig. 2 Passenger mobility

3.3 ANOVA test result

The ANOVA test determines the significant influence of factors on the responses of Trans Banyumas female passengers. These include demographics and variables related to an intelligent public transport system. These factors are essential in formulating Trans Banyumas service evaluation strategies for implementing smart city and intelligent mobility concepts. The ANOVA results can be seen in Table 5.

Table 5 shows the ANOVA results, which have different significance in each response. In the first variable, ICT, statement P4 mentions that cashless payments in Trans Banyumas significantly influence the age factor. Most female passengers aged 16–25 are tech-savvy and welcome cashless payments using electronic cards and QRIS. This gives a positive perception of the Trans Banyumas service. However, some passengers over 40 years old have difficulty understanding the cashless payment method and need the help of others. This needs to be considered by Trans Banyumas to provide cash payment facilities, considering that the majority of older people prefer cash payments when using public transportation (Sudarmaji, 2020).

Statement P6 mentions the number of passengers in the Teman Bus app who own a motorcycle and often use Corridor 1. Passengers feel disappointed because the application needs to provide real-time information about the number of passengers on the bus. This leads to disappointment when the bus is full, especially during peak hours. Most female passengers want a seat during the trip, and the capacity of the Trans Banyumas bus, which is only 30 passengers with 20 seats and 10 standing passengers, is considered inadequate. Most public transportation passengers want a seat during the trip (Mahmudah et al., 2013). Therefore, Trans Banyumas needs to provide real-time information about the number of passengers in the Teman Bus app so that passengers can find the available seats before boarding the bus.



Corridor 1 – Corridor 2	
-	Not have transit bus stops
Corridor 1 – Corridor 3	
1	Pasar Pon Bus Stops
Corridor 2 – Corridor 3	
2	Daop 5 Bus Stops
3	SMKN 2 Purwokerto Bus Stops
4	SDN 1 Pabuaran Bus Stops
5	SDN 3 Kedungwuluh Bus Stops
6	TMP Tanjung Nirwana Bus Stops
7	Kelurahan Tanjung Bus Stops

Fig. 3 Trans Banyumas transit stops

Statement P10 mentions disability-friendly information on Trans Banyumas buses. Passengers appreciate the travel information displays, announcement speakers, and bus corridor maps that are easily accessible and understood by some groups. The driver's attitude towards passengers frequently asking about the trip's destination also helps minimize bus boarding errors. This disability-friendly information is considered valuable and helpful for passengers, especially older people and people with disabilities, who are using the Trans Banyumas service.

In IoT, statements P11 and P13 mention that the location and arrival time of Trans Banyumas can be monitored in real time, and following the estimated time has a significant effect on vehicle ownership factors, frequently used corridors, and travel destinations. This is because providing real-time information will make it easier for passengers who own a vehicle to make travel plans from departure to the nearest bus stop, and to know the time to reach the destination stop. This travel planning model can certainly shorten and streamline the mobility patterns of Trans Banyumas passengers (Salamah et al., 2023). While real-time information on the location and arrival time of Trans Banyumas is proper, passengers' perceptions are divided. Passengers using the Mitra Darat application respond positively because the information is accurate. In contrast, passengers who use the Teman Bus app and those who do not use the application have an adverse reaction because the information is inaccurate and not real-time. This is exacerbated by the absence of information boards at bus stops.

Statement P14 mentions the RFID system recognizing identity and counting the number of passengers. The system was not implemented. Passengers with commuting purposes often experience full buses, especially during peak hours such as going to and from work or school. The RFID system can help passengers know the number of passengers in real-time through the Teman Bus app, and they can choose another bus if it is full. The RFID system can also help identify passengers in case of unwanted events such as pickpocketing, harassment, or accidents. This system is part of the innovative public transport system that realizes the bright city concept (Rahmadiansyah and Arief, 2019).

The travel destination factor also has a significant influence on statement P15. It mentions passengers can find information on delays in the arrival of Trans Banyumas on the Teman Bus app and transit stops. Female passengers feel disappointed because Trans Banyumas has been unable to provide real-time information system services when there is a problem with Trans Banyumas travel, such as congestion and vehicle breakdown. This travel destination factor can undoubtedly impact passengers who will experience sudden delays in their travel plans if the Trans Banyumas service provides no information. Therefore, the information system on public transportation is essential to provide the best service and not confuse potential passengers (Suarna et al., 2019).

Table 4 Validity, reliability, and normality test result

Code	Validity	Reliability	Normality	
	P value	Cronbach's Alpha	Skewness	Kurtosis
P1	0.000			
P2	0.000			
P3	0.000	0.770	-0.85	-0.007
P4	0.007			
P5	0.000			
P6	0.000			
P7	0.000			
P8	0.000	0.770	-0.85	-0.007
P9	0.000			
P10	0.000			
P11	0.000			
P12	0.000			
P13	0.000	0.790	0.756	0.581
P14	0.000			
P15	0.000			
P16	0.000			
P17	0.000			
P18	0.000	0.619	0.213	0.124
P19	0.000			
P20	0.000			
P21	0.000			
P22	0.000			
P23	0.000			
P24	0.000			
P25	0.000			
P26	0.000	0.723	0.167	-0.316
P27	0.000			
P28	0.000			
P29	0.000			
P30	0.000			
P31	0.000			
P32	0.000			
P33	0.000	0.734	0.289	0.249
P34	0.000			
P35	0.000			
P36	0.000			

Table 5 ANOVA result

Variable	Code	Sig. factor	p-value
ICT	P4	Age	0.004
	P6	Vehicle ownership	0.028
		Frequently used corridor	0.027
	P10	Age	0.014
		Frequently used corridor	0.019
		Trip purpose	0.008
		Vehicle ownership	0.038
IoT	P11	Frequently used corridor	0.004
		Trip purpose	0.048
	P13	Vehicle ownership	0.039
		Frequently used corridor	0.008
		Trip purpose	0.003
	P14	Trip purpose	0.027
	P15	Trip purpose	0.029
	P16	Trip purpose	0.020
Integration	P17	Age	0.040
		Vehicle ownership	0.004
		Trip purpose	0.000
	P19	Trip purpose	0.025
	P22	Daily activities	0.005
		Trip purpose	0.019
		Daily commute	0.000
Safety & Security	P23	Frequently used corridor	0.009
		Trip purpose	0.000
	P24	Age	0.029
		Vehicle ownership	0.037
		Income per month	0.004
	P27	Vehicle ownership	0.029
	P28	Age	0.016
		Income per month	0.039
	P29	Income per month	0.027
	P30	Vehicle ownership	0.031
Smart Accessibility & Mobility	P31	Age	0.042
	P32	Frequently used corridor	0.019
	P33	Vehicle ownership	0.033
		Age	0.008
	P36	Income per month	0.001
		Trip purpose	0.049

In the integration statement, P16 mentions that integrating the Trans Banyumas corridor significantly influences travel destinations. Female passengers appreciate that the transfer system between corridors is easy to understand. There are still obstacles for passengers who want to move from Corridor 2 to Corridor 1 because it requires two transits. This is because there is no direct transit stop between the two corridors. In addition, the travel destination factor also significantly influences statement P19 regarding access to the integrated Trans Banyumas schedule information. Trans Banyumas does not have an integrated schedule information system for each corridor, making it difficult for users to know and plan their trips.

Statement P17 mentions that the integration of Trans Banyumas with other vehicles has a significant influence

on factors such as age, vehicle ownership, and trip purpose. Trans Banyumas has been integrated with Trans Jateng, public minibus, and online ride-hailing. This makes it easier for passengers who want to make transit trips, especially students, private employees, and homemakers who are traveling. Private vehicle users also prefer Trans Banyumas and Trans Jateng because they are integrated and affordable. This integration system increases mobility and encourages people to switch to public transportation (Haryanti et al., 2024).

In safety and security, statement P22 mentions the presence of helpers at bus stops and on Trans Banyumas buses, which significantly influences the factors of daily activities and travel destinations. Female passengers feel disappointed because the Trans Banyumas service does not facilitate the presence of bus helpers and bus stop security officers. Most female private employees, with the aim of commuting, certainly want bus stop employees or bus attendants who can help passengers when there is an obstacle when they want to travel by Trans Banyumas bus. Other benefits of having bus stop attendants and bus stop security officers are that they can also provide a sense of security and comfort for users of public transportation services, from waiting at a bus stop until users reach their destination (Hibatullah and Mawar, 2023).

Statement P23 mentions that the availability of seat belts in every Trans Banyumas seat significantly influences daily activities, frequently used corridors, and travel destinations. All Trans Banyumas buses have seat belts to provide passengers with security and safety. This is an attraction for passengers, especially private employees and students who want to work, go to school, or commute because they feel safer and more comfortable with Trans Banyumas than other modes of transportation.

Statement P24 mentions that Trans Banyumas buses that have provided priority seats and information through a notification system significantly influence passengers' age, vehicle ownership, and monthly income. Trans Banyumas currently has two priority seats on each bus, with a red seat color that is different from most blue seats. Trans Banyumas buses also have a priority seat information sticker on the top glass of the priority seat to inform that the seat is a priority seat. The majority of Trans Banyumas passengers are young, with an age range of 16–30 years, both workers who already have income and students who do not, who certainly understand the existence of priority seats to be given to those in need. The vehicle ownership factor has a significant influence because a few elderly and pregnant women prefer Trans Banyumas services to travel compared to private vehicles, such as motorbikes, due to travel safety and security factors. This is also related to statements P27 and P28, which explain that Trans Banyumas has a security alarm button and safety equipment, and the availability of closed-circuit television (CCTV) cameras with monitors. Female passengers have appreciated the availability of adequate security and safety equipment in the Trans Banyumas service, which supports their daily mobility (Amri, 2023).

Statement P29 mentions that Trans Banyumas provided information about vehicle speeds within normal limits, significantly influencing passengers' monthly income. Most female passengers (students and college students) who have no income consider the speed of Trans Banyumas to be within safe and efficient limits. However, some passengers complained that the bus speed was too high, making passengers stand unsteadily. Trans Banyumas does not have speed limit information stickers, which could cause drivers to forget and exceed the limit. Installing speed reminder alarms on Trans Banyumas buses is one way to minimize speed limit violations and potential accidents (Mas'idah et al., 2019).

Statement P30 mentions emergency response information in the Teman Bus app and the Trans Banyumas bus monitors. Most private vehicle users (such as motorcycle users) choose Trans Banyumas for long trips to various destinations. They feel safe because, during the three years of operation, Trans Banyumas has never had an accident. However, some passengers want notifications through speakers on how to deal with emergencies and emergency calls as a precaution. Therefore, passengers can act immediately without confusion during an emergency.

In smart accessibility and mobility, statement P31 mentions that passengers knowing the access and procedures for using Trans Banyumas significantly influences the age. Most Trans Banyumas passengers are women aged 16–30 who easily understand how to use Trans Banyumas. This is because, at the beginning of its service, Trans Banyumas provided the public with free services and information on how to use them. However, many bus stops still do not have notable buildings, only bus stop signs. This makes it difficult for users who do not know the location of the bus stop. It is necessary to build adequate and easily accessible BRT bus stops to improve the accessibility of Trans Banyumas.

Statement P32 mentions Trans Banyumas services that have accessible and disability-friendly bus stops, significantly influencing the factor of frequently used corridors. The construction of an adequate BRT bus stop has specific technical standard guidelines issued by the Decree of the Directorate General of Land Transportation No. 271/HK.105/ DRJD/96 on April 16, 1996. This decision has details: the standard completeness of a bus stop, which

should have a bus stop identity in the form of a name and number, signage, route information boards, lighting, seating, and shade that protects prospective passengers (Putri and Refranisa, 2024).

Statement P33 mentions that the Trans Banyumas service has a transit stop center integrated and connected to various services, significantly influencing the vehicle ownership. The majority of female passengers own motorcycles, which can be used to shorten the time needed for mobilization activities to reach Trans Banyumas bus stops. Most female passengers feel disappointed because transit center bus stops, such as Pasar Pon bus stop and Tanjung Nirwana TMP bus stop, that connect the three Trans Banyumas corridors do not have adequate parking areas for prospective passengers. In addition, Corridor 1 and Corridor 2 buses are not directly integrated. When passengers want to transit on the two corridors, they must first use Corridor 3 services, which is inconvenient for passengers because there are too many bus transfers. It is also known that some Trans Banyumas transit stops are not directly located in the same place or across from each other. Transit stops that cross each other on the edge of a large highway are pretty dangerous for passengers if they want to make a transit because there are no supporting facilities for passage between stops, such as pedestrian bridges or red lights with zebra crossings for safer passenger crossings.

The last statement of P36 mentions that Trans Banyumas bus stops have an integrated corridor map that is easy to understand, significantly influencing age, monthly income, and travel destination. Based on the survey results, passengers who gave a positive reaction were, on average, in the age range of 16-30 years. Students and workers with a certain income can easily understand the corridor map at the Trans Banyumas bus stop. Passengers over 40 cannot easily understand the Trans Banyumas corridor map and will usually immediately ask for the route map from other passengers to validate the correctness of their purpose of waiting for the bus at the bus stop. Furthermore, some passengers feel disappointed because the inter-corridor route integration map at the bus stop has not been updated for a long time. In simple terms, the Trans Banyumas service has made several moves or additions to passenger stops in a bus corridor. Still, the corridor route maps at Trans Banyumas bus stops have not been updated.

3.4 Practical implications and recommendations

Results show that demography affects IPTS variables. The result can be used to develop recommendations for improvements to the aspects of the intelligent public transport system in the Trans Banyumas service. It aims to help facilitate passengers regarding accessibility and mobility related to intelligent transportation system technology.

The Teman Bus app applies technology, and it represents the ICT variable. However, the Teman Bus app is still not the main priority when using accommodation for Trans Banyumas passengers because the application does not provide appropriate information, and several features cannot be used. Therefore, the Trans Banyumas operator can improve the quality of the Teman Bus app to provide real-time information, provide live tracking features on Trans Banyumas buses that are operating, improve the cashless payment, and provide Trans Banyumas schedule features. The primary reason for developing this application is that predominantly female passengers prefer transportation applications with ease of use and features (Wardhana et al., 2021). Some users have noted that they need to review the payment method, and they hope that passengers who want to pay with the QRIS and e-money method can transit for free.

Furthermore, the improvement recommendations on the IoT aspect are slightly continuous with the improvement recommendations on the ICT aspect. The IoT tool component includes the geo-fencing system, which determines the vehicle's location in real life (Megawati and Lawi, 2021). There are other recommendations from the IoT aspect, such as an RFID system on Trans Banyumas to identify and calculate the total number of bus passengers. This is useful for prospective passengers because they can see the remaining seat quota on the bus. It is also helpful for operators if an unexpected event, such as pickpocketing, occurs. The Trans Banyumas bus operator can quickly identify passenger data.

Trans Banyumas management has appropriately implemented the integration aspect in its services. This is because Trans Banyumas has integrated the entire bus corridor with the integration of essential accessibility facilities for the community, such as health facilities, tourist attractions, schools, and shopping centers. It is also integrated with other Trans Jateng, online ride-hailing, and public minibus services. To better serve passengers in the future, it is hoped that the operator of Trans Banyumas can provide notification facilities for the departure and arrival schedules at a bus stop so that passengers waiting at the bus stop know how long it takes to arrive. This integrated Trans Banyumas schedule notification is one of the integrations between IoT and ICT systems that passengers can see through display devices at the bus stop.

In safety and security variables, the factors of daily activities, and the purpose of the trip, are statements regarding the helper at the bus stops and on Trans Banyumas buses. The recommendation for improvement is that the Trans Banyumas service provider must serve bus stop helpers or servers on the bus to assist passengers in using the Trans Banyumas service from the start of waiting until the passenger arrives at the destination. The presence of a bus stop helper is also helpful in minimizing the crime that often occurs to female passengers when using public transportation (Malik et al., 2020).

The last aspect is smart accessibility and mobility; the recommendation for improvement in this aspect is that the Trans Banyumas service operator can equalize the physical development of bus stops following the standards of the Directorate General of Transportation, which defines bus stop identities in the form of names and numbers, signposts, route information boards, lighting and seats and shade that protect prospective passengers (Putri and Refranisa, 2024). The equalization of bus stops' physical forms can facilitate the accessibility and mobility of Trans Banyumas female passengers.

4 Conclusions

This research was conducted to determine the level of service implementation of the intelligent public transport system aspects of the Trans Banyumas service. This research was conducted with female passengers' views because passenger perceptions are one of the aspects that support the evaluation of public transportation services. The results showed that the demographics of female passengers affect the intelligent public transport system variables, including ICT, IoT, Integration, safety and security, and smart accessibility and mobility.

Trans Banyumas female passengers have various perceptions of the intelligent public transport system (IPTS) aspects implemented by the Trans Banyumas service. In ICT, Trans Banyumas can improve their Teman Bus app to provide real-time information, live tracking bus, cashless payment, and bus schedule. In IoT, Trans Banyumas can implement RFID to identify and count the total number of passengers on the bus. In integration, Trans Banyumas has connected and integrated with public facilities such as hospitals, shopping centers, schools, and tourist attractions.

Furthermore, regarding safety and security variables, Trans Banyumas can provide helpers who assist female passengers during their travels and minimize criminal action, especially for female passengers. The last is smart accessibility and mobility. Trans Banyumas can provide bus stop identity information such as route information, name, numbers, and signposts.

Implementing an intelligent public transport system in the Trans Banyumas service cannot be done individually; it must involve all stakeholders. Therefore, there needs to be cooperation in realizing the concept, both from the government and the private sector, to promote sustainable transportation that is faster, more flexible, effective, and efficient-reducing the use of private vehicles and environmental impacts such as pollution and congestion.

Moreover, further research can include the Teman Bus app evaluation and the creation of a prototype that is tested directly on Trans Banyumas passengers to meet the needs and expectations of passengers using the Teman Bus app. Evaluation of the Teman Bus app is critical to research in the future because the application of applications in urban public transportation is one way of implementing technology in the aspects of intelligent mobility and clever people, which play an essential role in realizing the concept of a smart city.

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