

The Influence of Brand Image on the Acceptance of Autonomous Vehicles: The Role of Perceived Data Privacy, Hedonic Motivation, and Price Value

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Abstract: - Autonomous vehicles (AVs) represent the next evolution in transportation. These advanced vehicles utilize high-end sensors, cameras, and artificial intelligence technologies to operate through roadways, avoid obstacles, and carry passengers without the need for other intervention. Due to this major change, many studies discuss about People behaviour intention that they believe this behaviour intention influence AV acceptance. In the past, many papers highlighted some variable that influence behaviour intention in such as data privacy, trust, AV performance, ethical implication, and hedonic motivation, and they build price as moderating variable. In the other hand how far brand image will influence behaviour intention is not discussed yet. This study examines the critical role of brand image in shaping Behaviour intention in for private car with Theory Acceptance Model (TAM).

The study utilized a structured online survey to 159 persons that having car to collect data from a representative sample of consumers in around Indonesia. The model was evaluated with Structural Equation Modelling and the collected data was analysed using Partial least squares structural equation modelling (PLS-SEM) to test the hypothesized relationships between the variables.

The result of this study shown that Behaviour Intention has positive influence on Autonomous Acceptance, Brand Image has positive influence on Behaviour Intention, Hedonic Motivation has positive influence on Behaviour Intention. Meanwhile Perceived Data Privacy does not positive influence on behaviour intention. Price Value not become moderating factor for Behaviour Intention to Autonomous Acceptance. Based on that result, several theories & practical implementations are discussed in this paper.

Key-Words: - autonomous vehicle; technology acceptance model; acceptance; brand image

Received: March 6, 2026. Revised: April 8, 2026. Accepted: May 3, 2026. Published: July 22, 2026.

1 Introduction

The recent updates in autonomous vehicle technology, has made it more practical and realizable, seriously discussed and studied by the academics, government authorities, lead experts and media as well as by the public [2]. The evolution of self-driving technology has been a gradual process, with key breakthroughs in sensors, computer vision, and artificial intelligence paving the way for the development of fully AV. AVs utilize the technology to partially or entirely replace human-driven vehicles while preventing road hazards and providing the driver more productive time [1]. Autonomous vehicle is expected to create new opportunity for community in terms of mobility and

access to transportation in improved travelling conditions. For that, autonomous vehicles are expected to draw great demand for the technology [2]. AV with the system dynamic modelling approach, the market share for level 4 AVs estimated to be at least 15% in 2030 or 20% in 2050, and the market share will achieve 100% after 2070. While in Indonesia, the market share and growth of autonomous vehicles (AVs) in 3 big cities such as Jakarta, Surabaya, and Medan reflect a broader trend seen across Indonesia. The Indonesian government is increasingly investing in autonomous vehicle technologies as part of its push towards modernizing infrastructure and embracing electric vehicles (EVs). This includes integration into

major projects like Nusantara, the new capital city of Indonesia in East Kalimantan, where self-driving cars are a key component of the development plan [9]. Deployment of fully self-driving vehicles with complex decision-making continuing. The ability of car manufacturers to launch AV highlights their research and development capabilities, positively affecting their brand [14]. AV have the potential to drastically reduce the number of traffic accidents, as they can react faster than human drivers, never drive distracted or impaired, and are not subject to human error or reckless behaviour. Can provide greater mobility for the elderly, disabled, and those who are unable to drive, allowing them to live more independent and fulfilling lives. This can have a significant positive impact on quality of life and social inclusion. Senior drivers can be assisted by an AV during challenging driving situations and preserving their social relationships. Many AVs are designed to be electric, which can lead to reduced greenhouse gas emissions and a smaller environmental footprint. Additionally, autonomous driving can optimize traffic flow and reduce congestion, further improving energy efficiency and reducing pollution. AV still face technical hurdles, such as navigating complex urban environments, handling inclement weather conditions, and ensuring reliable sensor performance. Overcoming these limitations is crucial for widespread adoption. Others issue as AV become more connected, they may become vulnerable to cyber-attacks, data hacking, and other security breaches. Robust cybersecurity measures are essential to protect against these threats. The previous studies have analysed perceived usefulness, behavioural attitude, subjective norms as well as perceived ease of use, but there are other important factors, such as brand image which have not been adequately considered. This study explores how brand image influences the acceptance of AV, incorporating perceived data privacy, hedonic motivation, and brand image as an independent variable. Behavioural intention and AV acceptance are the dependent variables, with price value acting as a moderating variable between behavioural intention and AV acceptance.

2 Literature Review

Artificial Intelligence (AI) is fundamental to the progression and functionality of autonomous vehicles, responsible as the critical framework for their decision-making and operational processes. AI technologies are indispensable to the perception, planning, and control mechanisms of autonomous vehicles, facilitating their ability to manoeuvre through intricate environments with safety and

efficiency. AI algorithms analyse this sensor information to recognize and categorize objects, forecast their trajectories, and comprehend the vehicle's environment in real-time. This functionality is paramount for guaranteeing that the vehicle can execute well-informed decisions regarding its trajectory and actions [10]. This study is arranged by using the extension of the original TAM [3] incorporating the important factor which is brand image. According to Chen et al. [1], it has been shown that brand image may influence AV acceptance.

2.1 Brand Image

Brand image is the perception, emotions, and beliefs that individuals associate with an organization [12]. Unlike brand identity, which originates from the company, brand image is received by the consumer. Brand image represents the consumer's perception of the brand, reflecting how it "unpacks" the brand message [11]. A strong brand image can positively influence consumers' perceptions of quality, reliability, and effectiveness of the product. Consumers often associate well-known, high-end brands with superior engineering, advanced features, and exceptional craftsmanship, which can increase their willingness to accept and adopt new technologies like AV. Brands that cultivate an image of being socially responsible, innovative, and customer-centric can foster emotional connections with consumers. This can be particularly important for AV, as consumers may be more willing to trust and accept a technology that aligns with their personal values and preferences. Brands that are perceived as technological innovators can benefit from consumer acceptance of their AV offerings. Consumers may be more inclined to adopt self-driving cars from brands they associate with cutting-edge technology, advanced engineering, and a commitment to safety and innovation.

2.2 Perceived Data Privacy

Perceived data privacy relates to concerns about personal trip data collection [1]. Perceived data privacy in AV refers to individuals' beliefs about the security and confidentiality of their personal information collected and used by these vehicles [6]. Consumers are increasingly aware of the importance of data privacy, especially when it comes to emerging technologies like AV. The collection and use of personal data by these vehicles can raise concerns about how this information will be protected and used. Consumers want to feel in control of their data and have a clear understanding of how it is being collected

and used by AV manufacturers. Transparency around data privacy policies and giving users control over their information can help address these concerns. Addressing perceived data privacy issues in AV requires a multi-faceted approach involving various stakeholders and comprehensive strategies as outlined in the thematic analysis of the expert perceptions [8].

2.3 Hedonic Motivation

Hedonic motivation is defined as “the fun or pleasure derived from using a technology” [13]. Hedonic motivation refers to the desire for products or services that provide enjoyment, excitement, and sensory pleasure. In the context of AV, this can manifest as the thrill of riding in a futuristic, high-tech car or the pleasure of having a comfortable, luxurious driving experience. Consumers with strong hedonic motivation are likely to form an emotional connection with AV brands that can deliver a stimulating and pleasurable driving experience. This emotional bond can enhance brand loyalty and increase the likelihood of purchase. The hedonic aspects of AV, such as their innovative design, advanced features, and the overall driving experience, can contribute to the perceived value and desirability of these products. Consumers with a high hedonic motivation may be willing to pay a premium for the pleasure and excitement that AV can provide.

2.4 Behavioural Intention

Behavioural Intention in AV affected by perceived data privacy, hedonic motivation, and Brand Image. The behavioural intention could be used as a key factor in the acceptance of technology, particularly in the context of AV. Several studies have verified the relationship between the intention to use new technology and behavioural intention [1]. Moreover, research has indicated that individuals with higher levels of confidence in AV are more inclined to demonstrate favourable behavioural intentions towards their acceptance. This suggests that building trust in AV technology through transparent data privacy policies, appealing design features, and strong brand reputation can significantly influence consumer attitudes and adoption behaviour. In addition, studies have indicated that the availability of reliable customer support and clear communication channels regarding data handling practices can further enhance trust levels and foster a sense of security among potential AV users.

2.5 Price Value

Price Value is has been identified as a significant factor of behaviour intention for the AV acceptance [13]. Additionally, the investigation revealed that perceived usefulness and ease of use were recognized as pivotal determinants impacting consumers' attitudes towards AV. Moreover, the study emphasized that individuals with previous exposure to advanced technology were inclined towards exhibiting favourable attitudes towards AV, indicating a connection between technological familiarity and levels of acceptance.

2.6 User Acceptance Models

User acceptance of AVs is a complex topic influenced by various factors. Research indicates that individuals with lower anxiety and higher self-confidence are more open to using AVs. Additionally, technology affinity also plays a significant role in acceptance [4]. Technology Acceptance Model (TAM) used to investigate and identify the factors impacting people's motivation to utilize AV [3].

Research Model

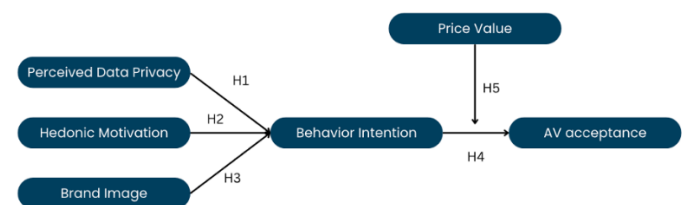


Fig. 1: Research Model

Hypotheses Development

- H1: Perceived Data Privacy has a positive influence on Behaviour Intention.
- H2: Hedonic Motivation has a positive influence on Behaviour Intention.
- H3: Positive brand has a positive influence on Behaviour Intention.
- H4: Behavioural intention have a positive influence on acceptance of autonomous vehicle.
- H5: Price Value has a moderating impact between behavioural intention and autonomous vehicle acceptance.

Operationalization Variables

Table 1. Operationalization Variable

Variable	Definition	Indicators	Scale
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Perceived Data Privacy	Perceived data privacy is the extent to which people are worried about the data collection of any personal trip. Therefore, the extent to which an individual care about the unauthorised collection and access of data represents the perceived data privacy [1]	1. AV cars would not collect too much information about your data 2. AV cars would not share your information with other parties without your permission 3. AV cars would have strong security measures to protect your personal information	Likert Scale (1-5) 1 – Strongly disagree 2 – disagree 3 – Neither disagree or agree 4 – Agree 5 – Strongly agree
Hedonic Motivation	the degree to which enjoyment and sensation-seeking force an individual towards the satisfaction of his or her basic needs and drive individuals' willingness to act	1. Travelling with AV would be fun for its own sake 2. Travelling with AV would make me feel good 3. I would spend time spared by using AV for having fun 4. Travelling with AV would be enjoyable	Likert Scale (1-5) 1 – far below competitors 5 – far above competitors
Brand Image	Brand image is the core driver of brand assets, and the level of brand assets determines user brand loyalty, thereby directly	1. The products of this car brand have unique features. 2. Purchasing products from this car brand would bring me pleasure. 3. The products of this car brand are	Likert Scale (1-5) 1 – Strongly disagree 2 – disagree 3 – Neither disagree or agree 4 – Agree

	influencing consumer behavioural intentions. Brand image plays a crucial role in differentiating companies and serves as a powerful marketing tool. [5]	currently popular. 4. The products of this car brand can reflect my personal style.	5 – Strongly agree
Behavioural Intention	The behavioural intention could be used as a key factor of adopting technology acceptance because several studies have verified the relationship between the intention to use new technology and behavioural intention [13]	1. I intend to use the AV car 2. When I see automated cars on the roads, I would intend to adopt them 3. I plan to use automated cars in the future for my workplace trip 4. I intend to use AV cars in future if they are able in the market	Likert Scale (1-5) 1 – Strongly disagree 2 – disagree 3 – Neither disagree or agree 4 – Agree 5 – Strongly agree
Price Value	Price value, one of the original constructs introduced in UTAUT2, is reported to be a significant predictor of behaviour intention within the context of technology acceptance	1. I would be willing to pay more for the autonomous car compared to what I would pay for a regular (normal) car. 2. The benefits of the AV car would justify the price. 3. The cost of the AV car would be the most important	Likert Scale (1-5) 1 – Strongly disagree 2 – disagree 3 – Neither disagree or agree 4 – Agree 5 – Strongly agree

	research [15].	thing I would consider before purchasing, regardless of its benefits.	
AV Acceptance	In this context, acceptance is defined as an individual's assent or approval for the usage of AV. Since humans are habitual creatures, the introduction of new technologies such as AV is expected to present huge public resistance to the acceptance of AV. [14]	1. I would consider using AV when they are available in the market. 2. I would recommend AV to my family and peers. 3. I would encourage others to use AV. 4. I have positive things to say about AV.	Likert Scale (1-5) 1 – Strongly disagree 2 – disagree 3 – Neither disagree or agree 4 – Agree 5 – Strongly agree

DATA & METHOD

A survey methodology is applied in this paper, in line with the quantitative research on the AV acceptance and by using validated scales. This study proposes that AV acceptance is affected by brand image, perceived data privacy, hedonic motivation, behaviour intention and price value. The subsequent subsection discusses the indicator selection, survey design, and administration procedures and demographics of the survey respondents. The paper employed a quantitative, cross-sectional research design to investigate the influence of brand image on consumers' acceptance of AV. The surveys will be conducted to collect data from a representative sample of consumers and consist of 3 main sections. The first section of the questionnaire the respondents are introduced to a brief information of AV. It aims to show the respondents how PAVs can function on a daily life basis. The second section, included the socio-demographic (e.g., age, gender, education, income, employment status) and mobility characteristics (e.g., driving license, car ownership status) The third section it comprises the indicators presented in Table 1. To explore the influence of

brand image on AV acceptance, the researchers conducted in-depth interviews with a diverse sample of consumers. The survey data provided quantifiable measures of factors like perceived data privacy, hedonic motivation, and price sensitivity. The interviews then allowed the researchers to delve deeper into the underlying reasons and decision-making processes behind consumer attitudes and behaviours. By combining these complementary techniques, the researchers were able to generate a rich, comprehensive dataset. The analysis of this data revealed nuanced insights into the complex interplay between brand image, consumer perceptions, and purchase intentions in the context of AV. The questionnaires will create in Bahasa and translated into English for research objectives. The surveys will be taken on October 2024 in Jakarta, Indonesia.

3 Result and Discussion

Indicators validity and reliability need to defined to operationalize the constructs by A measurement model analysis. PLS algorithm used to assess the adequacy of the measurement model. Below tables showing the results.

Table 2.

Variable	Items	Convergent validity			Cr.α
		Factor loading	CR	AVE	
Perceived Data Privacy	PDP1	0.771	0.913	0.779	0.857
	PDP2	0.928			
	PDP3	0.939			
Hedonic Motivation	HM1	0.874	0.937	0.788	0.910
	HM2	0.874			
	HM3	0.878			
	HM4	0.925			
Brand Image	BM1	0.752	0.914	0.727	0.874
	BM2	0.904			
	BM3	0.889			
	BM4	0.857			
Behaviour Intention	BI1	0.911	0.949	0.822	0.928
	BI2	0.901			
	BI3	0.880			
	BI4	0.936			
Avs Acceptance	AA1	0.921	0.953	0.836	0.934

	AA2	0.943			
	AA3	0.891			
	AA4	0.901			
Price Value	PV1	0.926	0.924	0.858	0.835
	PV2	0.927			
	BI	1.000			

Table 3.

	AA	BI	BM	HM	PDP	PV
AA	0.914					
BI	0.900	0.907				
BM	0.760	0.765	0.853			
HM	0.731	0.781	0.818	0.888		
PDP	0.446	0.434	0.446	0.462	0.883	
PV	0.784	0.773	0.624	0.689	0.362	0.926

Above table no. 2 & table no.3 shown model fit, reliability and validity result of this study. The result present factor loading of indicator all above 0.7 means a variable is strongly associated with a factor. Cronbach's alpha also shown a good result above 0.8. Next, the CR of the construct shown all above 0.7 indicate good reliability. Convergent validity also confirmed because the AVE is greater than 0.5. The last from Fornell-lacker criterion also shown in the diagonal are all the biggest value. From that explanation the measurement model possesses a good fit.

The hypothesis tested after measurement model test done. The relationship between all variables hypotheses examined by using SEM. Below table no.4 shown Behaviour Intention has positive influence to Autonomous acceptance, Brand Image has positive influence to Behaviour Intention and Autonomous Acceptance, Hedonic Motivation has positive influence to Behaviour Intention and Autonomous Acceptance. Meanwhile Perceived Data Privacy does not positive influence to behaviour intention and Autonomous acceptance. Price Value has positive influence to Autonomous Acceptance, but Price Value not become moderating factor for Behaviour Intention to Autonomous Acceptance.

Table 4.

Total effect	P values
BI -> AA	0.000
BM -> BI	0.003
HM -> BI	0.000

PDP -> BI	0.358
PV x BI -> AA	0.440

To provides Robust evidence of the reliability and validity of the measurement model used in this study the analysis should be done. The factor loadings of all indicators exceeding 0.7 demonstrate a strong association with their respective factors, indicating that the items are good measures of the constructs. The Cronbach's alpha values above 0.8 further confirm the internal consistency of the constructs, ensuring that the scales used are reliable. The Composite Reliability (CR) values greater than 0.7 indicate good reliability across the constructs, while the Average Variance Extracted (AVE) values above 0.5 confirm convergent validity, suggesting that the constructs explain more than half of the variance of their indicators. The Fornell-Larcker criterion, with the highest values on the diagonal, indicates good discriminant validity, meaning the constructs are distinct from one another.

The structural model reveals several significant relationships among the constructs: Behaviour Intention: This has a positive influence on Autonomous Acceptance, suggesting that individuals with a strong intention to engage in a behaviour are likely to accept autonomous systems. Brand Image: It positively influences both Behaviour Intention and Autonomous Acceptance, highlighting the importance of a positive brand image in fostering both the intention to use and the acceptance of autonomous systems. Hedonic Motivation: This factor also positively impacts Behaviour Intention and Autonomous Acceptance, indicating that the enjoyment or pleasure derived from using autonomous systems can drive both the intention to use and acceptance. Perceived Data Privacy: Contrary to expectations, this does not positively influence either Behaviour Intention or Autonomous Acceptance, suggesting that concerns about data privacy might not significantly deter individuals from accepting autonomous systems in Indonesia. Price Value: While it positively influences Autonomous Acceptance, it does not moderate the relationship between Behaviour Intention and Autonomous Acceptance, implying that while price is a consideration, it does not change the strength of the influence of behavioural intention on acceptance.

4 Conclusion

These findings offer valuable insights for both researchers and practitioners. For practitioners, particularly those in the autonomous systems industry,

focusing on enhancing brand image and hedonic aspects could be key strategies for increasing acceptance. The unexpected finding regarding data privacy indicates a potential area for further research to understand the nuanced role it plays. For researchers, the study validates the robustness of the measurement model used and provides a foundation for future studies to determine others factors that might influence the acceptance of autonomous systems. Seen from overall model fit, reliability and validity of the constructs suggest that the measurement model is well-specified, and the findings are trustworthy. For futures studies can be developed to give more understanding related to acceptance of autonomous system influencing factors.

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Contribution of Individual Authors to the Creation of a Scientific Article (Ghostwriting Policy)

The authors contributed in the present research, at all stages from the formulation of the problem to the final findings and solution.

Sources of Funding for Research Presented in a Scientific Article or Scientific Article Itself

No funding was received for conducting this study.

Conflict of Interest

The authors have no conflicts of interest to declare that are relevant to the content of this article.

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