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Exploring factors influencing Thai autonomous vehicle acceptance: A grounded theory approach

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Abstract: This research explores factors influencing consumer acceptance of autonomous vehicles (AVs) in Thailand, where local culture, infrastructure, and habitual behaviors are essential factors often overlooked in regional studies. Most previous research on AV acceptance has employed quantitative methods and focused on Western, developed contexts. This study aims to develop a framework for AV adoption incorporating contextually relevant factors, utilizing the qualitative grounded theory approach. Data were collected through 24 semi-structured interviews with AV owners in Thailand. An iterative analysis process involving three stages, open, axial, and selective coding, resulted in the identification of 19 categories. These categories were integrated into five overarching themes: (1) vehicle characteristics, (2) customer experience and support, (3) user-related factors, (4) financial aspects, and (5) external support mechanisms, which influence AV acceptance. The findings indicate that while many existing technology acceptance constructs are applicable, their interaction with indigenous factors such as trust in established brands, congested traffic conditions, and the need for post-purchase education and support is crucial in the Thai context. A comprehensive framework summarizing these findings is proposed, emphasizing the contingent, multi-dimensional, and nuanced nature of AV diffusion in emerging economies. The model provides a foundation for future quantitative validation and offers practical insights for policymakers, manufacturers, and researchers to facilitate AV adoption in Thailand and similar developing regions.
Keywords: *Autonomous vehicles, Self-driving vehicles, Technology acceptance, Thailand.*

1. Introduction

The growing global adoption of autonomous vehicles (AVs) presents a significant opportunity to enhance road safety, alleviate traffic congestion, and mitigate environmental impacts. Road safety is a vital concern that confounds policymakers, businesses, and society. According to the World Health Organization [1], 1.35 million people die each year from road-related accidents; it is one of the leading causes of death globally. Thailand, in particular, has a high incidence of road fatalities and injuries, with 9,879 deaths and 599,797 injuries as of 17 September 2024 [2]. The adoption of autonomous vehicles (AVs) could transform this situation by significantly reducing human error, which is a major contributor to traffic accidents [3].

The possibility of AVs is not limited to providing more road safety. Autonomous driving technology also has a range of other societal applications that will benefit users' quality of life, especially in urban areas. AVs will reduce traffic congestion, a key source of stress and economic inefficiency in urban areas [4]. By optimizing the driving pattern and control, AVs may encourage more efficient use of roads and decrease fuel use, leading to a smaller environmental footprint and lower emissions [5]. In addition, as AVs become more practical, EVs will encourage the economic growth of the automotive and transportation industries, further stimulating innovation. This is particularly relevant to economies with a well-developed automotive industry and a growing interest in technological innovation, such as

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Thailand.

Nonetheless, accepting AVs is a complex issue involving a combination of factors [6]. The bulk of acceptance research in the area of AV has focused on extending existing models in the information systems (IS) field, such as the Technology Acceptance Model (TAM) and the Unified Theory of Acceptance and Use of Technology (UTAUT) [7, 8]. While these models help explain how users accept novel technologies, they do not entirely account for AV acceptance, especially in Thailand [9, 10].

One major obstacle to AV adoption is the passive role of the user of shared AVs compared to other, older forms of technology. Unlike a conventional vehicle, where the driver actively engages with the system, AVs significantly reduce or eliminate the need for human input, redirecting the focus of adoption models away from ease of use and perceived usefulness towards trust, safety, and system reliability [11]. This is further reflected in the proliferation of more detailed acceptance models, such as the Car Technology Acceptance Model (CTAM) and the Autonomous Vehicle Acceptance Model (AVAM), which emphasize trust in the technology and perceived safety as significant drivers of adoption [12]. In tandem with AVAM and CTAM, additional frameworks, such as the Multi-Level Model on AV Acceptance (MAVA), have sought to address AV-specific concerns more effectively, particularly the relationship between individual users of AVs and the wider social and infrastructural environment in which such vehicles operate [13].

Thailand is a country where road safety is a significant issue, with a substantial need to understand consumer perceptions toward AVs to promote mass adoption. Most prior studies have investigated AV acceptance in Western countries. However, the social, economic, and cultural aspects of Western regions differ significantly from those in Southeast Asian countries. Previous research on conventional vehicle acceptance has demonstrated that brand loyalty, social influence, and sociodemographic variables can significantly influence consumer demand [14, 15]. These findings hold for consumers in the AV adoption context, while accounting for the challenges facing Thai consumers, such as infrastructure readiness [16], cultural perceptions toward technology, and safety perceptions of using AVs in highly congested traffic.

Thus, this study aims to investigate the factors influencing the adoption of AVs in Thailand. The study will employ semi-structured interviews and a grounded theory approach to identify key factors influencing Thai consumers' decisions to accept AV technology [17]. In particular, this study will explore the effect of global trust, system trust, perceived safety, and social norms on consumer attitudes. This study aims to provide a more nuanced understanding of AV acceptance in the context of a developing country. It will also help provide a theoretical framework for policymakers, automotive manufacturers, and technology developers to offer suitable strategies for promoting the adoption of AVs in Thailand and other similar global regions.

By focusing on the Thai context, this study contributes to the literature on AV adoption by providing a viewpoint that has been largely overlooked in past studies. As advancements in AV technology progress, understanding the diverse factors that affect its adoption in various cultural and socioeconomic settings will be crucial for the successful integration of AV technology into global transportation systems.

1.1. Research Gap

While the acceptance of autonomous vehicles (AV) has been well-researched in Western markets, little is known about this phenomenon in Southeast Asia, including Thailand, a market with a very different socio-cultural and infrastructure landscape. Acceptance models, which are based on constructs such as those in the Technology Acceptance Model (TAM) and the Unified Theory of Acceptance and Use of Technology (UTAUT), help provide a basic understanding of technology acceptance, but are predominantly developed through quantitative research in many developed countries. As such, these pre-determined models may not accurately describe specific, grounded factors that affect Thai consumers, such as the trust explicitly placed in existing brands, local traffic conditions, and dealer support networks. Moreover, the existing quantitative approach cannot reveal such driving or controversial factors that emerge through the application of relatively strict, pre-determined factor constructs. Thus, there is a need for an inductive, qualitative approach to discover the organic, emergent factors that comprise AV acceptance. AI21 3/15/23 additional text 8 Therefore, there is a need to consider the factors of AV acceptance from the perspective of a Thai user in an emerging economy.

1.2. Research Objectives

The study seeks to fill this research gap through the following research aims:

RO1: To qualitatively explore and identify the key factors influencing consumer acceptance of autonomous vehicles in Thailand.

RO2: Explore actual AV users' perspectives regarding the interrelationships between these factors;

RO3: To construct an integrated, empirically based framework that accounts for acceptance of AVs in the Thai context.

1.3. Research Questions (RQS)

Bearing these aims in mind, this research is guided by the following broad research question:

RQ1: What are the factors and emergent themes that account for autonomous vehicle acceptance among consumers in Thailand?

In order to provide increased focus, this central research question is supported by two sub-questions:

SQ1: How do vehicle-specific characteristics and user-centric experiences shape Thai consumers' acceptance of AVs?

SQ2: How do external factors, such as government policy and local traffic conditions, influence the adoption of AVs in Thailand?

2. Literature Review

2.1. Overview of Autonomous Vehicles: Techniques and Technologies

Research efforts into AV technologies have been ongoing since the 1980s. From rule-based approaches to machine learning–based pipelines, AV technologies have undergone substantial advances in environmental perception and decision-making under uncertainty in real-time. Navlab at Carnegie Mellon University and PROMETHEUS, initiated by Mercedes-Benz from Europe, are two significant milestones in autonomous vehicle research [18, 19].

Modern AV systems are conventionally structured into three main subsystems perception, decision, and control that interact collaboratively in an ongoing sense–plan–act cycle [6, 20]. The perception module uses multimodal sensor fusion across LiDAR, RADAR, ultrasonic sensors, high-definition cameras, and Global Navigation Satellite Systems (GNSS) to detect obstacles, classify objects, interpret lane markings, and decipher traffic signals [21, 22]. Machine learning models, including convolutional neural networks (CNNs), improve perception accuracy by enabling semantic segmentation and depth estimation under changing weather and illumination conditions [23].

The decision-making system converts sensory information into control commands through high-level behavioral planning and low-level trajectory generation. High-level planners often exploit Markov Decision Processes (MDPs) and reinforcement learning to select an optimal path relative to dynamic environmental constraints, and trajectory generation often uses model predictive control (MPC) to follow a path defined by the high-level planner while simultaneously optimizing some performance criteria (minimizing travel time, passenger comfort, energy/fuel consumption, etc., in addition to the dynamic constraints) [6, 24]. The decision-making, planning, and control systems framework can be further integrated with vehicle-to-everything (V2X) communication networks to enhance situational awareness and navigation, and facilitate cooperative driving among connected autonomous vehicles [25].

Lastly, the control subsystem ensures the vehicle's smooth operation by utilizing adaptive control algorithms that adjust throttle, steering, and braking to achieve trajectory tracking precision within milliseconds [20]. These systems thus combine to produce the hierarchical levels of autonomy initialized by the SAE J3016 standard, from driver assistance (Level 1) to full automation (Level 5) [26].

The development of modern AVs represents a confluence of robotics, computer vision, sensor fusion, and artificial intelligence, in a sustained transition from prototype-phase AVs as innovative demonstrations to productive, commercially viable smart transport vehicles.

2.2. Models for Autonomous Vehicle (AV) Acceptance

Research on AV acceptance has developed rapidly with the move from experimental autonomous mobility prototypes to commercial deployment [7, 13, 17]. The theoretical basis of AV acceptance research is drawn from information systems acceptance frameworks, with the Technology Acceptance Model (TAM) and its later extensions being the most prominent. TAM was initially proposed by Davis [27] and is rooted in the Theory of Reasoned Action (TRA) [28]. TAM argues that users' behavioral intention to use a technology is determined mainly by perceived usefulness and ease of use. Besides TAM, TAM2 [29] and TAM3 [30] have also been widely used in information systems (IS) research. However, TAM and its derivatives only partially explain AV adoption because autonomous driving radically shifts the user's role from active driver to passive passenger [11, 31].

To overcome such limitations, the Unified Theory of Acceptance and Use of Technology (UTAUT) integrates constructs from eight previous models [32] and identifies four key determinants of behavioral intention: performance expectancy, effort expectancy, social influence, and facilitating conditions [29]. Its subsequent revision, UTAUT2, added hedonic motivation, price value, and habit to better capture the consumer technology acceptance context [33]. Previous studies have used UTAUT-based frameworks in AV contexts [34]. However, these frameworks often must be adapted to include constructs reflecting perceptions of trust, safety, and system reliability, as they are less important in traditional IS use.

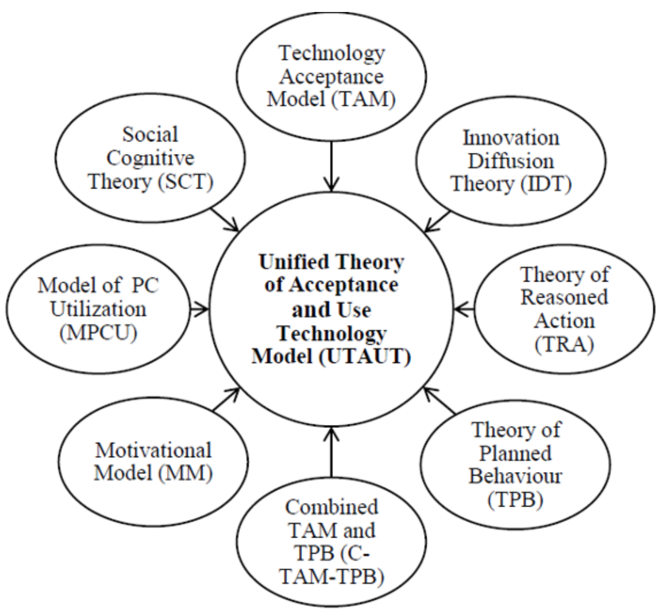

Figure 1.
UTAUT Model's Evolution and Integration.
Source: Al-Okaily, et al. [32].

As a result, several domain-specific models have been proposed. The Car Technology Acceptance Model (CTAM) [35] and Autonomous Vehicle Acceptance Model (AVAM) [36]. Return self-efficacy,

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perceived safety, and trust in automation [12]. The Multi-Level Model of AV Acceptance (MAVA) further distinguishes between micro-level psychological drivers (e.g., hedonic motivation, injunctive social norms) and meso-level contextual influences (e.g., policy, infrastructure readiness), enabling more precise prediction of AV adoption [13]. Altogether, these frameworks suggest a paradigm shift: as user control decreases in automated systems, trust, perceived safety, and system performance become the primary predictors of acceptance, surpassing ease of use and perceived effort, as traditionally considered in TAM [37].

2.3. Conventional Vehicle Acceptance Research

Conversely, research on conventional vehicle acceptance has long focused on individual and contextual predictors, such as socio-demographics, brand loyalty, perceived value, and social identity. For example, Belgiawan et al. [14] found that social norms and lifestyle preferences strongly influence people's car purchase intentions, while Danish et al. [15] indicated that brand attachment and environmental concern are important psychological mediators of vehicle choice.

Advertising effectiveness and symbolic consumption motives also contribute to behavioral intention in this market segment [38]. Given that autonomous vehicles remain within the broader automobile paradigm, these traditional consumer-behavior determinants, most notably brand trust, perceived status, and driving-related behavioral norms, could indirectly impact AV acceptance and should be incorporated into future next-generation AV acceptance models.

2.4. Gap Analysis

Although the acceptance of AVs has been extensively discussed in the global literature [35, 36], little attention has been given to the contextual and methodological challenges of implementing such models within Thailand's mobility ecosystem. First, most previous AV studies were conducted in Western and East Asian contexts and rarely accounted for cultural dimensions that influence the psychological antecedents of technology adoption in Thailand, such as collectivism, uncertainty avoidance, and hierarchical trust in technology [39]. Second, empirical studies have predominantly employed quantitative surveys, providing limited insight into the qualitative aspects of user perception, particularly the affective and contextual dimensions that influence the willingness to adopt autonomous systems. Third, current AV studies rarely incorporate conventional vehicle acceptance variables, such as brand perception and social identity, which may mediate trust and intention toward AVs.

To close these gaps, this study uses a grounded-theory-driven, mixed qualitative framework to investigate the complex relationship between trust, safety perception, cultural values, and prior mobility experience that shape AV acceptance among Thai consumers. The framework helps expand existing acceptance models by reflecting context-sensitive behavioral constructs, thereby making theoretical and practical contributions to the AV acceptance models for emerging markets in the Southeast Asian region.

3. Methods

3.1. Research Design and Rationale

This study employed a qualitative research design, utilizing Grounded Theory (GT) methodology to investigate the factors influencing autonomous vehicle (AV) acceptance in Thailand. GT was selected for its capacity to generate theory fundamentally derived from data gathered from participants in real-world settings [40-42]. This approach is particularly suited to exploring complex social phenomena where pre-existing theories may be insufficient [43, 44].

In contrast to hypothesis-testing models, this study adopted an inductive approach, beginning with data collection through semi-structured interviews. The analysis followed the core GT tenets of constant comparison and theoretical sampling, moving through iterative cycles of open, axial, and selective coding to build a data-grounded theory of AV acceptance [45, 46].

3.2. Data Collection Procedure

3.2.1. Participant Recruitment and Sampling

A combination of purposive and snowball (chain referral) sampling techniques was used to recruit participants. Purposive sampling ensured the selection of individuals who were owners and regular users of vehicles with autonomous capabilities, as they possessed direct, relevant experience. Snowball sampling was then employed to access this niche population, where initial participants helped identify other qualified individuals within their networks [47].

Prospective individuals were initially screened via social media platforms, including Facebook and Line Open Chat, to verify their eligibility based on AV ownership and usage. The final sample consisted of 24 participants, providing diverse perspectives based on profession, income, age, and driving history.

3.2.2. Interview Protocol and Data Collection

Semi-structured, in-depth interviews served as the primary method of data collection. This format strikes a balance between interview consistency and the flexibility to probe unique insights from participants [48]. The interview guide was developed by integrating themes from established technology acceptance literature [49] with context-specific considerations for AVs in Thailand [17], following the methodological framework for interview guide development proposed by Joungtrakul et al. [47].

The guide contained 14 open-ended questions designed to elicit rich, detailed responses on key themes, including:

- Trust in AV technology.
- Perceptions of usability and utility.
- Safety concerns.
- Behavioral intentions towards AV adoption.
- The influence of social norms and personal values.

All interviews were conducted by researchers who were trained in qualitative methods and adhered to ethical standards.

3.3. Participant Profile

The 24 participants represented a demographically diverse group, aged 22 to 58 years ($M = 36$) and with annual incomes ranging from 120,000 to 60,000,000 THB. The sample included nine female and fifteen male participants. They owned a variety of AV brands, with Tesla ($n = 10$) and BYD ($n = 8$) being the most common, followed by BMW ($n = 2$) and other brands. This diversity in demographics, vehicle brand, and driving experience (see Table 1) ensured that a broad spectrum informed the emerging theory of user experiences and socioeconomic contexts.

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Table 1.
Participant Profiles.

ID	Age	Gender	Yearly income (฿)	Profession	T1	T2	D1
ID01	28	Man	1.2 million ฿	Mechanical Engineering	2	6	10
ID02	22	Woman	0.6 million ฿	Accountant	1	3	20
ID03	47	Man	4.0 million ฿	Finance Director	3	22	40
ID04	54	Woman	1.8 million ฿	University Academic	4	30	30
ID05	38	Man	1.6 million ฿	Automotive Mechanic	3	18	20
ID06	36	Woman	0.84 million ฿	Computer Professional	2	17	30
ID07	29	Man	0.54 million ฿	Hotel Receptionist	1	10	20
ID08	31	Man	2.4 million ฿	Physician	2	12	20
ID09	34	Man	1.2 million ฿	Attorney	1	13	60
ID10	36	Woman	1.2 million ฿	Home maker	1	15	20
ID11	42	Woman	0.72 million ฿	Biomedical Researcher	2	20	40
ID12	29	Man	0.84 million ฿	Software Engineering	6 months	2	30
ID13	37	Man	1.8 million ฿	Agriculture	8 months	12	20
ID14	35	Man	0.9 million ฿	News Reporter	4	15	400
ID15	26	Woman	0.36 million ฿	Government Servant	1	1	60
ID16	51	Man	12 million ฿	Gas Station Owner	4	30	60
ID17	26	Woman	0.6 million ฿	Physician	2	2	60
ID18	58	Man	2.4 million ฿	Senior Engineering Manager	3	30	40
ID19	38	Man	1.2 million ฿	Software Engineering	7	16	30
ID20	52	Man	60 million ฿	Real Estate Owner	1	20	50
ID21	38	Woman	0.7 million ฿	Freelancer	10 months	10	10
ID22	34	Woman	0.36 million ฿	Administrator	3	12	40
ID23	29	Man	0.12 million ฿	Graduate Student	2	8	20
ID24	24	Man	0.48 million ฿	Electrical Engineering	3	3	80

Note: ID= Interviewed Driver, T1 = AV years driving experience, T2 = Total years driving experience, D1= Daily driving distance (kilometers).

3.4. Data Analysis: The Grounded Theory (GT) Process

The data analysis adhered to the systematic process of GT [44, 45]. The process was iterative and involved three primary stages:

1. Open Coding: Interview transcripts were analyzed line by line to identify key concepts and ideas. These were labeled with initial codes that described the participants' perspectives and actions.
2. Axial Coding: The initial codes were compared and grouped into higher-level categories based on their relationships and properties. This stage constantly compared new data with existing codes and categories to refine their definitions.
3. Selective Coding: A core category was identified that represented the central phenomenon of the study. The analysis then focused on systematically relating all other categories to this core category to form a coherent theoretical framework.

Data collection and analysis proceeded concurrently until theoretical saturation was achieved, which occurred when analysis of additional interviews no longer yielded new thematic insights or properties for the developing categories.

4. Results

4.1. Iterative Interview and Coding Process

This study employed semi-structured, in-depth interviews with 24 participants to explore their perceptions and attitudes toward the adoption of autonomous vehicles. All interview sessions were audio-recorded, transcribed verbatim, and analyzed in parallel with ongoing data collection. Coding was performed iteratively, and the point of code saturation was reached with Participant ID18, at which no substantially new conceptual codes were observed. The final six interviews (Participants ID19–ID24) served primarily to confirm and refine the relationships among established codes and categories. In total, the analysis generated 1,487 coded excerpts, yielding 305 distinct initial codes that served as the basis for further categorization and thematic development.

4.2. Thematic Analysis

Thematic analysis was used as the principal method for organizing and interpreting the qualitative data. This process involved identifying, reviewing, and refining recurring patterns within participants' narratives [50, 51]. Multiple rounds of comparison and discussion were conducted among the research team members to ensure analytical rigor and consensus on the thematic structure. Through this constant comparative approach, the research team refined the theme boundaries merging, renaming, or subdividing them as necessary to ensure the final framework accurately represented the shared perspectives of participants.

Previous literature provides several taxonomies for factors influencing autonomous vehicle (AV) acceptance. For example, Martina and Kathrin [37] identified user-specific, car-specific, and contextual determinants. Bornholt and Heidt [52] focused on individual characteristics, vehicle characteristics, and societal factors, whereas Kaye et al. [7] introduced psychological models that emphasized perceived ease of use and perceived benefits. Drawing conceptually on these frameworks, this research organized the 19 empirically derived categories into five comprehensive themes:

1. Vehicle Characteristics,
2. Customer Experience and Support,
3. User-Related Factors,
4. Financial Considerations, and
5. Complementary System Support.

This thematic configuration offers an integrated view of the major factors shaping autonomous vehicle adoption within the Thai context, synthesizing both individual and contextual influences identified during analysis.

4.3. Categorizing Codes

Following the initial open coding, the 305 unique codes were systematically clustered into 19 intermediate categories based on conceptual similarity and interrelationships. These categories were subsequently abstracted into five overarching themes, corresponding to the thematic framework described above. Table 2 summarizes these themes along with representative participant excerpts that exemplify each category and highlight the nuances of respondents' perspectives.

Table 2.
Intention to Purchase Autonomous Vehicles Framework.

Themes	AV Categories	Sample Driver Comments
Automated Vehicle Characteristics (AVC)	Car appearance and design (AVC01)	"The design of my vehicle has a sleek, modern aesthetic that aligns perfectly with its advanced self-driving capabilities" [ID01].
	Vehicle performance (AVC02)	"For me, the critical factors are performance-related: top speed, a responsive suspension, and rapid acceleration. These elements are fundamentally linked to safer driving" [ID05].
	Vehicle quality (AVC03)	"I place a high value on quality in all my purchases, especially for a vehicle with autonomous features" [ID06].
	Vehicle safety (AVC04)	"The most significant advantage of autonomous cars is enhanced safety. Artificial intelligence and high-precision sensor systems are key to making roads safer" [ID10].
	Perceived ease of use (AVC05)	"The user interface for an autonomous car must be simple and intuitive. The integration of technology and AI is what makes this possible" [ID11].
	Smart Technology and AI (AVC06)	"Although the sensors on my car are not large, their role in maintaining safety is immense, which directly impacts the vehicle's overall performance" [ID05].
	Smart Infrastructure Integration (AVC07)	"Improvements to Thailand's infrastructure, such as clearer road signage and better-maintained surfaces, would significantly encourage the use of self-driving cars" [ID14].
Customer Experience and Support (CES)	Dealer service center after-sales service (CES01)	"I have been impressed with my brand's extensive service network and the expertise of its technicians. My interactions with the dealership have been consistently positive" [ID06].
	Customer education (CES02)	"Automakers need to do more to inform the public about AVs. Offering test drives would be an effective way to build consumer confidence and familiarity" [ID09].
	Customization (CES03)	"I would appreciate more customizable options for family travel, particularly increased cargo space. Our single AV is not sufficient for long trips" [ID10].
User Related Factors (URF)	AV Technology trust (URF01)	"Working in the tech industry, I strongly believe in AV systems. This is my second autonomous vehicle, and the technological progress between models is evident" [ID19].
	Brand trust (URF02)	"The long-established reputation of European and Japanese automotive brands in the Thai market gives me greater assurance in their product quality" [ID03].
	Perceived usefulness (URF03)	"Using the autopilot feature on my daily commute reduces fatigue, allowing me to arrive at the office feeling relaxed" [ID16].
	Personal traits and lifestyle (URF04)	"I was an early adopter of AV technology, partly for professional efficiency and partly because of my passion for innovative automobiles" [ID14].
Financial Factors (FF)	Vehicle use expenses (FF01)	"The operating costs for my electric AV are lower; for instance, it only requires servicing every 40,000 kilometers, which is less frequent than a conventional car" [ID15].
	Price Value (FF02)	"Government subsidies played a decisive role in my purchase. A 15% price reduction made the investment immediately worthwhile" [ID12].
Complementary Full Support (CFS)	Traffic environment (CFS01)	"Navigating Thailand's traffic, with its unpredictable pedestrians and motorcycles, is complex. My AV's systems have prevented potential collisions on multiple occasions" [ID04].
	Social influences (CFS02)	"My decision to purchase was influenced by a friend who recommended the technology and offered a test drive. That hands-on experience and marketing finalized my choice" [ID15].
	Government policies (CFS03)	"Public adoption of AVs relies heavily on government support through financial benefits such as tax incentives and direct investment in supporting infrastructure" [ID12].

5. Discussion

5.1. Emergent Themes

The categories emerging from this study show significant overlap with dimensions found in existing theoretical models. Vehicle safety concerns are, for example, captured in the CTAM [35, 53, 54] MVAM and AVAM models. Social pressure or social influence is a prominent component of both

UTAUT and CTAM, and basic technology adoption constructs such as perceived ease of use and perceived usefulness underpin the TAM framework [7]. Likewise, trust is included in some of the later iterations of these models, such as UTAUT2 [55]. Vehicle performance is also a common factor in both UTAUT and CTAM, and the importance, or lack thereof, of a test drive is related to the user experience factor within TAM3. Individual differences in personal characteristics and lifestyle are relevant to MVAM, as is aesthetic design, albeit implicitly. Price value is an economic factor that is explicitly captured within UTAUT2.

Analysis of qualitative data suggests that the product's design is considered a crucial element in the buying decision process by Thai consumers. They argue whether AVs should have a conventional or dramatically futuristic design [56, 57]. In addition to the look, product functionality, determining how fast it will accelerate, how agile it will be in the corner, and how efficient it will be, also play a crucial role in the buying decision process [55, 58]. Vehicle consumers and customers generally define the quality of AVs as build quality, including durability, reliability, fit, and finish. Quality is a key driver that creates customer value [59, 60]. The primary concern in the context of autonomous vehicles is safety. Passengers expect advanced active and passive systems to ensure physical safety [13, 61].

Autonomous Vehicles (AVs) are equipped with technologies such as artificial intelligence, LIDAR, and radar that allow them to operate without a human driver [20, 62]. Intervehicle and vehicle-to-infrastructure communication, based on technologies such as DSRC and C-V2X, enhances the safety and efficiency of AVs [63]. However, due to safety concerns, current road conditions in Thailand may impede the implementation of technologies required to operate autonomous vehicles (AVs) at full capacity. Moreover, the purchasing cost [60, 64, 65], Government subsidies, and anticipated price reductions are influential factors in the Thai AV market. Fortunately, reduced operating costs, in the form of lower fuel and potential maintenance expenditures, create a financial motivation for the broader adoption of electric AVs [66].

The belief that AVs are easy and valuable to operate will influence the adoption of the technology, especially among those who are more technologically savvy [67, 68]. Individual personality is also a factor, with people with a greater propensity for innovation being more willing to adopt, whereas driving enthusiasts tend not to want to relinquish control [69, 70]. Trust in the technology is also a primary factor, with positive experiences helping to encourage acceptance, while negative experiences may have the opposite effect. In Thailand, trust in long-standing, familiar automotive brands from Europe and Japan demonstrates a strong influence among consumers [71].

After-sales support, including services provided by dealerships and access to parts and technical knowledge, is crucial for owners' continued satisfaction and ultimately affects the success of AVs [72]. Educating consumers, for instance, through test drives, is crucial for building familiarity and developing the trust necessary to utilize the technology [50, 58]. Additionally, the Thai traffic environment, particularly the high congestion levels and unpredictable behavior of other road users, presents challenges for AVs compared to lower traffic levels in overseas contexts [73]. The behavior of others also influences purchasing decisions, and recommendations from friends and family, as well as media exposure, have been identified as impacting consumer decisions regarding AVs [13]. Finally, government policy, including infrastructure, financial incentives, and regulations, presents crucial catalysts for the diffusion of AVs [74, 75].

5.2. Theme 1: Vehicle Characteristics

The inherent attributes of an AV are essential to the mindset and possibility of adopting the technology. Design, encompassing both aesthetic and performance-related aspects, construction quality, usability, smart technology, and safety systems, are key characteristics that directly impact purchase satisfaction and trust in the technology. Many participants noted that features related to AI and car sensors significantly contributed to their perception of safety and convenience. One owner who explained the importance of even the smaller features expressed this: *Although the sensors on my car are not large, their role in maintaining safety is immense, which directly impacts the vehicle's overall performance*

[ID05]. The similarity of these results can be observed when compared to factors relating to cars as described by Martina and Kathrin [37], vehicle characteristics [52], and the perception of AVs [9]. This demonstrates a more tangible, product-oriented focus in some studies that contrasts with a psychological-oriented focus in others [76].

5.3. Theme 2: Customer Experience and Support

The ownership journey captures all aspects of the customer lifecycle, from point of sale through post-sale support. This incorporates interactions with dealerships, after-sales service, consumer education, and customization options. An important factor for adoption was the existence of support mechanisms that facilitated new users in overcoming the initial learning curve. *Automakers need to do more to inform the public about AVs. Offering test drives would be an effective way to build consumer confidence and familiarity*, [ID09] was one participant's suggestion. Also important in this theme was the ability to customize the vehicle to the lifestyle. *I would appreciate more customizable options for family travel, particularly increased cargo space. In its current state, our single AV is not sufficient for long trips*; [ID10] was the desire of another respondent. This empirical observation corroborates the findings of Rahman and Thill [31] on the association between family structure, psychological variables, and purchase intention. This theme parallels user-specific determinants based on knowledge and experience [37]. The specific roles of dealership and after-sales services in addressing determinants, however, appear less explored in the AV literature and represent an identifiable contribution of this study.

5.4. Theme 3: User-Related Factors

This theme encompasses the individual characteristics that affect how a consumer interacts with and evaluates AV technology. It includes trust in the brand, technology, perceptions of usefulness, and personal lifestyle traits. A user's faith in the underlying technology is a significant driver, as illustrated by a participant who stated, " *Working in the tech industry, I have a strong belief in AV systems. This is my second autonomous vehicle, and the technological progress between models is evident*" [ID19]. Lifestyle needs also directly influence adoption, with one user citing work-related efficiency as a key motivator for their early purchase [ID14]. These factors correspond to the user-specific determinants outlined by Martina and Kathrin [37], the individual characteristics noted by Bornholt and Heidt [52], and general AV perceptions [9]. They also share common ground with the psychological models emphasized by Kaye et al. [76], particularly in terms of perceived utility and usability.

5.5. Theme 4: Financial Considerations

Economic factors significantly influence the decision to purchase a vehicle. This theme encompasses the total cost of ownership, which is categorized into expenses incurred during use and the initial purchase price. Participants frequently highlighted the long-term financial implications of ownership. One owner contrasted their experience, sharing, "*The operating costs for my electric AV are lower; for instance, it only requires servicing every 40,000 kilometers, which is less frequent than a conventional car*" [ID15]. This theme connects with existing research on AV pricing [64, 65]. It also aligns with studies on perceived value [9] and vehicle characteristics, including cost [52]. However, a specific focus on ongoing usage expenses remains relatively unexplored in prior studies, marking a distinct finding of this research.

5.6. Theme 5: External and Contextual Support

This theme refers to the external ecosystem of services, benefits, and policies that support the AV ownership experience. It includes traffic conditions, social influence, and government policy, all of which can enable or hinder adoption. The importance of government action was underscored by a participant who argued that *Public adoption of AVs relies heavily on government support, through both financial benefits like tax incentives and direct investment in supporting infrastructure* [ID12]. Another pointed out the challenging local driving context: *Navigating Thailand's traffic, with its unpredictable pedestrians and motorcycles, is complex. My AV's systems have prevented potential collisions on multiple occasions* [ID04]. This

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theme relates to the social and contextual determinants identified by Bornholt and Heidt [52] and environmental factors in acceptance research of AV [9]. The unique challenges posed by local traffic conditions in Thailand add a layer of complexity to AV deployment that is particularly salient in this context.

6. Conclusions

In addition to the five core themes discussed, the study's framework also incorporates demographic variables frequently examined in AV research. This structured, multi-faceted approach provides a holistic understanding of the various forces shaping AV adoption in Thailand, enriching the broader knowledge of consumer behavior in emerging markets. The identified themes establish a foundation for future investigation into the dynamics of AV integration and inform the development of targeted strategies and policies to facilitate a smoother transition toward autonomous transportation.

Institutional Review Board Statement:

This research involved human participants and was conducted in accordance with the Declaration of Helsinki, with all participants providing informed consent. However, the study protocol was exempt from institutional ethics review under Thailand's TSRI Guidance No. 3(3), as the research was conducted anonymously, did not collect identifiable information, involved no intervention, and posed no risk to participants' physical or mental integrity [77].

Transparency:

The authors confirm that the manuscript is an honest, accurate, and transparent account of the study; that no vital features of the study have been omitted; and that any discrepancies from the study as planned have been explained. This study followed all ethical practices during writing.

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