Proceedings of the International Conference on Industrial Engineering and Operations Management

Publisher: IEOM Society International, USA DOI: 10.46254/AU04.20250107
Published: November 25, 2025

Identifying the Determinant Factors of Customer Satisfaction in Automotive Technology Using the Kano Model Approach

Teuku Yuri M. Zagloel and Rafalia Maritza
Department of Industrial Engineering
Universitas Indonesia
Depok, Jawa Barat, Indonesia
yuri@ie.ui.ac.id, rafalia.maritza51@ui.ac.id

Abstract

The automotive industry in Indonesia has shown significant growth since 2020. This is marked by increased technological innovation in vehicles to meet increasingly dynamic customer needs and preferences. In facing changing sales trends, understanding the factors that determine customer satisfaction is crucial to maintaining a competitive advantage. This study aims to identify automotive technology attributes, particularly for electric vehicles, that are considered important by users and potential users in Indonesia, using the Kano Model approach. The Kano Model aims to classify customer preferences for 12 electric vehicle technology attributes. The results show that technology attributes are divided into attractive and one-dimensional categories. Attributes in the one-dimensional category, such as "Fast Charging," "Cybersecurity," "Curtain Airbags," "IP67 Certification," and "Automatic Emergency Braking," have a direct contribution to customer satisfaction levels, thus needing to be prioritized in the product development process. Meanwhile, attributes in the attractive category, such as "360-Degree Sensors and AI Cameras," "Adaptive Cruise Control," "Lane Keeping Assist," "Pedestrian Detection System," "Side Collision Prevention," "Rear Collision Warning," and "Tire Pressure Monitoring System," are features that significantly improve customer satisfaction and experience beyond their expectations. This research is useful for providing information and insights for automotive manufacturers in order to develop strategies for developing customer-oriented electric vehicle technology.

Keywords
Customer Satisfaction, Automotive Technology, Electric Vehicles, Canoe Models, and Quality Attributes.

1. Introduction
According to Statista, the automotive industry is one of the fastest growing sectors since 2020 and is expected to continue to grow in 2023 and beyond. As a result of this expansion, the automotive industry was forced to develop new technologies to meet changing customer demands. It is also critical to be aware of additional factors that can make customers happier. Because of this, businesses must understand what makes people happy with automotive technology.

Indonesia's automotive industry has emerged as a key driver of economic growth (Gaikindo, 2022). Statista data backs this up, showing that car sales increased significantly between 2020 and 2022. However, the automotive industry's expansion may be hampered by an 11.8% drop in new car sales in June 2024 compared to June 2023. This is due to shifting customer preferences, new technologies, and market trends (Cimigo, 2024). To remain competitive in the automotive market, automakers must understand what customers want and need as trends shift.

The Indonesian automotive industry has undergone a significant transformation, with the emergence of electric vehicles being one of the most notable trends. Battery Electric Vehicle (BEV) sales achieved 43,188 units in 2024, a

153% increase from the previous year's 17,051 units, as per data from the Association of Indonesian Automotive Industries (Gaikindo). Despite the fact that the total car market experienced a decline in comparison to the previous year, electric car sales experienced substantial growth. BEV sales have now accounted for 5% of the total car market share (Gaikindo, 2024). This increase is indicative of the increasing interest of Indonesian customers in environmentally sustainable vehicles. In the interim, the most recent electric car technology incorporates more advanced Advanced Driver Assistance Systems (ADAS) that include Adaptive Cruise Control (ACC), Lane Keeping Assist (LKA), Automatic Emergency Braking (AEB), as well as a 360-degree sensor system and AI camera that aid users in parking and avoiding blind spots.

These innovations has a direct impact on the expectations and preferences of both customers and vehicle users. This is due to the significant relationship between users and automotive technology. In addition to wanting products that meet basic needs, users also expect a better experience through technology. High-quality service is often supported by technology, significantly impacting customer satisfaction (Noor, 2019). Therefore, understanding and identifying customer preferences is crucial in order to design products that meet customer expectations (Angraini, 2023).

The Kano Model is a particular approach to determine these preferences. This model aids in identifying technology attributes significant to existing and potential electric vehicle customers. Moreover, use of the Kano Model can assist vehicle manufacturers in identifying which characteristics should be prioritized in new product development. Understanding new technological features in electric vehicles in Indonesia is essential for comprehending present market dynamics and for strategizing future innovations. By comprehending customer desires, car manufacturers not only fulfill expectations but also enhance the satisfaction of their product design (Balinado et al., 2021).

1.1 Objectives

This study aims to identify the attributes of emerging technologies considered important by potential and current electric vehicle users in Indonesia and to measure the priority level of these attributes.

2. Literature Review

2.1 Customer Satisfaction

In general, customer satisfaction is defined as the feeling of pleasure or displeasure that arises from a customer's experience after using a product or service, based on a comparison between expectations and actual experience. According to Kotler and Keller, in a study by Imamah & Iradawaty (2022), satisfaction can be defined as the feeling of pleasure or disappointment experienced by customer after comparing their perceptions of product or service performance with their expectations. Customer satisfaction can also be defined as the result of customers' evaluations of their experiences with a product or service (Slack et al., 2020). Therefore, satisfaction can be defined as the result of a cognitive evaluation related to the comparison between expectations and reality. If the experience meets or exceeds expectations, customers will be satisfied. Conversely, if the experience does not meet expectations prior to using a particular product or service, they will be dissatisfied.

In a business context, customer satisfaction can be considered a key indicator of how well a company meets customer expectations. Satisfied customers are more likely to make repeat purchases, which will positively impact company revenue (Angraini, 2023). This suggests that satisfaction not only impacts the tendency to provide positive experiences but also has the potential to encourage repeat purchases in the future.

2.2 Kano Model

Noriaki Kano developed the Kano Model in the 1980s as method to help people understand and assess what customers are interested in and expecting from products or services (Singh & Kohli, 2020). This model classifies the features of products or services into groups based on how they affect how satisfied customers are. The classification categories in the Kano Model consist of several attributes: must-be (M), one-dimensional (O), attractive (A), indifferent (I), reverse (R), and questionable (Q) (Shahin et al., 2017). The general concept of the Kano Model is depicted in Figure 1.

In a Kano chart, the horizontal axis reflects the degree of product fulfillment. Meanwhile, the vertical axis depicts the level of customer satisfaction. Must-have attributes are those that buyers consider or expect to find in a product or service. The absence of these features will cause severe customer disappointment. However, the existence of must-have features does not necessarily result in improved pleasure because buyers consider them basic and necessary

(Barsalou, 2023). For example, while brakes are a standard element in automobiles, their absence will result in severe customer discontent.

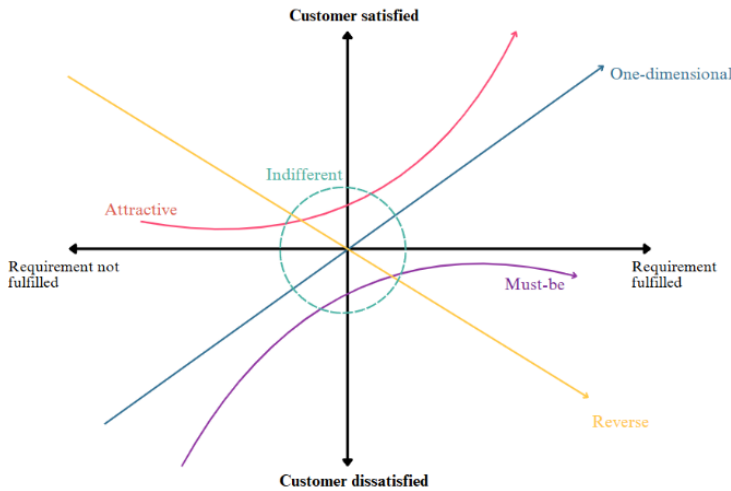

Figure 1. Kano Model (Source: Janatyan and Shahin, 2020)

Companies often focus solely on resolving must-be issues at the bottom of the curve, thus not having a significant impact on customer satisfaction (Lin et al., 2017). Addressing customer complaints only at the initial stage (only improving without innovation) is an inappropriate solution and will not optimally improve customer satisfaction. This is supported by research showing that companies that only fix basic problems without innovating will struggle to achieve higher levels of customer satisfaction (Mishra & Singh, 2023; Madzík, 2016).

Therefore, one-dimensional aspects are crucial to improve to create greater improvements and innovations. One-dimensional aspects are attributes that, if met, can increase customer satisfaction, and if lacking, will lead to customer dissatisfaction (He et al., 2017). Research conducted by Mkpojiogu & Hashim (2016) and Chen et al. (2019) indicates that one-dimensional factors exert a greater influence on customer satisfaction compared to must-be features. One example is that faster service results in higher levels of satisfaction (Tormudzi et al., 2023). This is also illustrated by the increasing trend in Figure 1 of the Kano Model (Table 1).

Table 1. Kano Model Evaluation Table

Customer Needs / Quality Attributes		Dysfunctional				
		1. *like*	2. *must-be*	3. *neutral*	4. *live with*	5. *dislike*
functional	1. *like*	Q	A	A	A	O
	2. *must-be*	R	I	I	I	M
	3. *neutral*	R	I	I	I	M
	4. *live with*	R	I	I	I	M
	5. *dislike*	R	R	R	R	Q

(Source: Lacerda et. al, 2021)

After grouping respondents' responses into Kano attributes, quantitative calculations are also necessary to more accurately understand customer expectations. First, the customer satisfaction (CS) and customer dissatisfaction (CD) coefficients are calculated, as each customer has different needs and expectations (Wang et al., 2009). A value between zero and one indicates a positive customer satisfaction coefficient. The larger the coefficient (closer to one), the greater the influence of the attribute on customer satisfaction. The reverse is true for the customer dissatisfaction coefficient (Singh & Kohli, 2020).

$$CS = \frac{A + O}{A + O + M + I} \quad (1)$$

$$CD = -\frac{O + M}{A + O + M + I} \quad (2)$$

Where: CS = *Customer* satisfaction; CD = *Customer* dissatisfaction; O: *One* dimensional; I: Indifferent; A: Attractive; M: *Must be*

3. Methods

This study aims to identify the attributes of emerging technologies considered important by potential and current electric vehicle users in Indonesia and to measure the priority level of these attributes. Therefore, this study uses the Kano model to classify the attributes that customers consider important. The Kano model used consists of three stages: the Kano questionnaire, the Kano evaluation table, and the Kano category classification.

3.1 Data Collection

The study's cohort comprised Indonesians who were either potential or current electric car users aged 21 and older. Respondents were aged 21 and older, as persons within this demographic typically possess enhanced logical decision-making ability, particularly with automobile acquisitions. Simultaneously, the sample, indicative of the population, was calculated by multiplying the number of indicators by a value ranging from 5 to 10 (Hair et al., 2019). The quantity of quality characteristic indicators was 12. Consequently, a minimum of 120 respondents was necessary for data collection. The questionnaire was disseminated from March to May 2025.

3.2 Questionnaire Design

This study employed the three-stage Kano methodology as delineated by Berger et al. (1993): the Kano questionnaire, the Kano evaluation table, and the Kano category classification. The Kano questionnaire comprises functional and dysfunctional enquiries. Functional questions evaluate customer satisfaction about the presence of a specific attribute, whereas dysfunctional questions examine the effect of the absence of that feature on customer satisfaction. The questionnaire includes 12 technological aspects crucial to the research, obtained from official websites of several electric car manufactures and interviews with specialists in automotive industry, as presented in Table 2.

The questions in the Kano questionnaire were constructed via a Google Form and disseminated online to individuals who were either current or potential electric vehicle users. Examples of questionnaire questions are presented in Table 3. Five response options will be classified utilising the Kano approach. Each question contains comprehensive definitions of technological features, offering responders supplementary information to reduce ambiguities.

Table 2. Electric Car Technology Features

Code	Technology Features	Function
X1	Adaptive Cruise Control (ACC)	Automatically changes vehicle speed based on distance from the automobile in front.
X2	Lane Keeping Assist (LKA)	Keeps the car in the correct lane.
X3	Automatic Emergency Braking (AEB)	Automatically applies the brakes when a probable accident is detected in front of the vehicle.
X4	360 Degree Sensor and AI Camera	Reduces blind spots and increases object detection accuracy around the automobile.
X5	IP67 Certification for Water and Dust Resistance	Protects the battery from harsh situations, such as passing through flooded roads.
X6	Cybersecurity	Protects user information from unauthorized access on electric vehicles.
X7	Pedestrian Detection System	Automatically stops the vehicle if a pedestrian suddenly crosses.
X8	Side Collision Prevention	Helps to avoid collisions with other vehicles when changing lanes.
X9	Rear Collision Warning	Provides warnings and automatic braking if an object is detected behind the car.
X10	Tire Pressure Monitoring System	Monitors the car's tire pressure.
X11	Fast Charging	Allows the car's battery to be charged in a shorter time.

X12	Curtain Airbags	Protects passengers from side hits.

3.3 Validity and Reliability Test

In this study, the correlation coefficient, which represents the strength of the relationship between two data sets, was calculated using the Pearson correlation method. The R-Calculated value was derived from the correlation between individual items and the total score. The questionnaire had 223 responses, resulting in a 95% confidence level and a significance level of 0.05, with a correlation factor or R-table value of 0.131. The valid items in the questionnaire were assessed based on the values of R-Calculated and R-Table. If the R-Calculated value exceeds the R-Table, the question is deemed genuine. According to the validity test, all questions provided valid replies, indicating that the questionnaire items had excellent accuracy and could produce exact results (Table 4).

Table 3. Example of Questionnaire Questions

	Option
Functional Question	1. like
How would you feel if an electric car had Adaptive Cruise Control (ACC)? *Adaptive Cruise Control (ACC)*: automatically changes vehicle speed based on distance from the automobile in front.	2. must-be
	3. neutral
	4. live with
	5. dislike
Dysfunctional Questions	
How would you feel if an electric vehicle did not have Adaptive Cruise Control (ACC)? *Adaptive Cruise Control (ACC)*: automatically changes vehicle speed based on distance from the automobile in front.	1. like
	2. must-be
	3. neutral
	4. live with
	5. dislike

The reliability test applied the Cronbach's Alpha method to determine the consistency of the relationships among items in the questionnaire. A coefficient may be considered reliable if its value above 0.70 (Iba & Wardhana, 2024). A reliability coefficient approaching 1 signifies that the questionnaire items exhibit high internal consistency. The results derived from the instrument are reliable indicators of the construct being measured. The computation of Cronbach's Alpha in the reliability assessment is outlined as follows. In this study, the number of valid questions (k) was 24. The variance of each question item was 22,321, with a total variance of 154,571 (Table 4). Therefore, the reliability of the instrument or questionnaire, calculated using the Cronbach's Alpha formula, yielded a reliability of 0.893. The outcome shows that the instrument used in this study is reliable since it has a high level of internal consistency.

$$r_x = \left(\frac{k}{k-1}\right)\left(1 - \frac{\sum \delta_b^2}{\delta_t^2}\right) \tag{3}$$

Where: $\boldsymbol{r_x}$ = Instrument reliability; $\boldsymbol{k}$ = Number of questions (items); $\sum \boldsymbol{\delta_b^2}$ = Total variance of each question item; $\boldsymbol{\delta_t^2}$ = Total variance

3.4 Data Processing

The following phase is to map the responses of potential and current electric car users after ensuring that the data used is valid and reliable. This mapping involves categorising needs or quality attributes into Kano attribute classifications. Grouping occurs according to attribute categories in the Kano model: must-be (M), one-dimensional (O), attractive (A), indifferent (I), reverse (R), and questionable (Q). Table 5 summarises the total of the Kano categories for each attribute. The Kano category for each attribute is typically determined by the mode of the data. However, it is important to recognise that these results may be influenced by the respondents' limited understanding of the technology attribute's function or by their excessively technical enquiries, which could lead to their selection of neutral responses. As a result, a modification to the Kano analysis was made to reduce bias in the results.

Table 4. Results of Validity and Variance Tests

Question	R-Count	R-Table	Status	Variance
$X1_1$	0,232	0,131	Valid	0,667
$X1_2$	0,636	0,131	Valid	1,244
$X2_1$	0,236	0,131	Valid	0,647
$X2_2$	0,640	0,131	Valid	1,254
$X3_1$	0,324	0,131	Valid	0,643
$X3_2$	0,757	0,131	Valid	1,396
$X4_1$	0,218	0,131	Valid	0,429
$X4_2$	0,747	0,131	Valid	1,373
$X5_1$	0,247	0,131	Valid	0,412
$X5_2$	0,790	0,131	Valid	1,374
$X6_1$	0,257	0,131	Valid	0,602
$X6_2$	0,750	0,131	Valid	1,437
$X7_1$	0,319	0,131	Valid	0,892
$X7_2$	0,692	0,131	Valid	1,274
$X8_1$	0,284	0,131	Valid	0,426
$X8_2$	0,709	0,131	Valid	1,285
$X9_1$	0,347	0,131	Valid	0,671
$X9_2$	0,707	0,131	Valid	1,213
$X10_1$	0,261	0,131	Valid	0,503
$X10_2$	0,737	0,131	Valid	1,175
$X11_1$	0,294	0,131	Valid	0,335
$X11_2$	0,767	0,131	Valid	1,436
$X12_1$	0,287	0,131	Valid	0,353
$X12_2$	0,790	0,131	Valid	1,278

This is achieved by totalling the key categories that affect customer satisfaction: must-be (M), one-dimensional (O), and attractive (A) categories. Subsequently, compare the sum of the outcomes with the totals of the indifferent (I), reverse (R), and questionable (Q) categories. If the total sum of the must-be (M), one-dimensional (O), and attractive (A) categories exceeds a certain threshold, the chosen Kano category is determined as the maximum value among M, O, and A. The maximum values of the indifferent (I), reverse (R), and questionable (Q) categories increase with higher summed results. If the aggregated results of M, O, and A with I, R, and Q are equivalent, the chosen Kano category corresponds to the highest value among the six categories. Furthermore, to enhance the assessment of customer satisfaction, the Kano model employs quantitative measures of customer satisfaction (CS) and customer dissatisfaction (DS), as articulated by Berger et al. (1993) in the study conducted by Wang & Ji (2009).

Table 5. Kano Category Grouping Results

Code	Technology Features	A	O	M	I	R	Q	Total
X1	Adaptive Cruise Control (ACC)	83	35	19	70	2	14	223
X2	Lane Keeping Assist (LKA)	80	55	12	62	1	13	223
X3	Automatic Emergency Braking (AEB)	55	65	43	47	1	12	223
X4	360 Degree Sensor and AI Camera	84	59	26	42	0	12	223
X5	IP67 Certification for Water and Dust Resistance	41	84	57	30	0	11	223
X6	Cybersecurity	47	78	47	38	2	11	223
X7	Pedestrian Detection System	70	57	18	63	4	11	223
X8	Side Collision Prevention	70	66	27	48	1	11	223
X9	Rear Collision Warning	63	60	26	60	3	11	223
X10	Tire Pressure Monitoring System	76	51	31	54	1	10	223
X11	Fast Charging	50	88	44	29	0	12	223
X12	Curtain Airbags	36	94	55	27	0	11	223

4. Results and Discussion

4.1 Respondent Profile

This survey had 223 respondents aged 45-55 (24.6%), with the second-highest proportion of respondents aged 21-24 (25.1%). The majority of respondents, aged 45-55, believe that opinions of car features are impacted by safety and practicality. Meanwhile, the younger age group (21-24) may value innovation and technical experience. According to their educational level, the majority of respondents (62.8%) held a bachelor's degree or diploma IV, with some falling into other categories. Most respondents have a relatively high level of education, indicating their potential ability to understand new concepts in the context of electric vehicle technology. The majority of respondents (28.3%) worked in the private sector. 93.7% of respondents were interested in purchasing an electric vehicle, while only 6.3% were currently using one. Additionally, 66.8% of respondents still drove conventional cars, while 26.9% did not own one. This indicates that although there is a high level of interest in using electric cars, the adoption rate is relatively low (Table 6).

Table 6. Final Determination of Kano Categories

No.	Technology Features	O+A+M	I+R+Q	Category	CS	CD
X1	Adaptive Cruise Control (ACC)	137	86	A	0,570	-0,261
X2	Lane Keeping Assist (LKA)	147	76	A	0,646	-0,321
X3	Automatic Emergency Braking (AEB)	163	60	O	0,571	-0,514
X4	360 Degree Sensor and AI Camera	169	54	A	0,678	-0,403
X5	IP67 Certification for Water and Dust Resistance	182	41	O	0,590	-0,665
X6	Cybersecurity	172	51	O	0,595	-0,595
X7	Pedestrian Detection System	145	78	A	0,611	-0,361
X8	Side Collision Prevention	163	60	A	0,645	-0,441
X9	Rear Collision Warning	149	74	A	0,589	-0,411
X10	Tire Pressure Monitoring System	158	65	A	0,599	-0,387
X11	Fast Charging	182	41	O	0,654	-0,626
X12	Curtain Airbags	185	38	O	0,613	-0,703

4.2 Kano Category Grouping Analysis

Based on data processing and calculations using the Kano method, the majority of features were identified as attractive (A). The features with the highest number of attractive (A) features were attribute X4 (360-Degree Sensor and AI Camera), attribute X1 (Adaptive Cruise Control (ACC)), and attribute X2 (Lane Keeping Assist (LKA)). In addition to these three features, the attributes X7 (Pedestrian Detection System), X8 (Side Collision Prevention), X9 (Rear Collision Warning), and X10 (Tire Pressure Monitoring System) were included. These characteristics or aspects are considered attractive, indicating that they provide considerable additional value or delight to customers, even when not explicitly anticipated. The presence of attractive (A) features can significantly improve customer satisfaction. However, their absence will not be disappointing.

More in-depth analysis reveals that respondents may view aspects classified as attractive as sophisticated and appealing. hey may associate features such as attribute X4 (360-Degree Sensor and AI Camera), attribute X1 (Adaptive Cruise Control (ACC)), and attribute X2 (Lane Keeping Assist (LKA)) with innovation, luxury, and comfort. This is the reason for the increase in emotional satisfaction that also symbolizes technological progress. In addition, these features provide "pleasure" because they can exceed expectations, not just meet basic needs. In today's market, these features may still be considered special or premium, especially among the majority of older respondents who prioritize practicality but still prioritize modern innovation.

The one-dimensional (O) category is the largest category, besides the attractive (A) category. Features that are included in one-dimensional (O) include attribute X12 (Curtain Airbags), attribute X11 (Fast Charging), attribute X5 (IP67 Certification for Water and Dust Resistance), attribute X6 (Cybersecurity), and attribute X3 (Automatic Emergency Braking). In the Kano Model, the one-dimensional (O) category indicates a direct linear relationship between the level of feature fulfillment and the level of customer satisfaction. This means that the presence and better performance of the feature, the higher the level of customer satisfaction. In contrast, if this feature is unavailable or performs poorly, users will be extremely dissatisfied.

Furthermore, this indicates that customers consider one-dimensional features to be standard expectations in high-tech vehicles. For example, Curtain Airbags and Automatic Emergency Braking are considered crucial safety components, while Fast Charging is a demand for efficiency in electric cars, and Cybersecurity is a key protection feature in modern electric vehicles. Therefore, manufacturers must ensure these attributes are available and perform well to maintain customer satisfaction.

4.3 Customer Satisfaction Results Analysis

The Kano model not only categorizes product or service attributes as must-have (M), one-dimensional (O), attractive (A), indifferent (I), reverse (R), and questionable (Q), but it also assesses customer satisfaction in greater detail. This is accomplished through a quantitative approach to the Kano model, which calculates the Customer Satisfaction (CS) and Customer Dissatisfaction (CD) coefficients. Table 6 presents the results of data processing using the CS and CD formulas for each service or product attribute. The attribute or feature with the highest CS value is X4 (360-Degree Sensor and AI Camera), which has a coefficient of 0.678. This suggests that feature X4 has the greatest impact on increasing customer satisfaction when compared to the other features. Meanwhile, attribute or feature X12 (Curtain Airbags) has the highest CD value, indicating that its absence will result in significant dissatisfaction. X12 is a safety feature that protects passengers from side impacts, so its absence results in the highest CD coefficient value of -0.703.

In addition, the diagram in Figure 2 is divided into four major quadrants: attractive, one-dimensional, must-have, and indifferent. The horizontal axis represents the level of customer dissatisfaction if the attribute is missing, while the vertical axis represents the level of customer satisfaction if the attribute is present and working properly. Attributes in the attractive quadrant are those that can significantly increase customer satisfaction when available but do not cause dissatisfaction when unavailable. The one-dimensional quadrant includes features that directly influence customer satisfaction and dissatisfaction. There were no attributes found in the Must-be or Indifferent categories, indicating that all attributes tested make a significant contribution to customer satisfaction, and thus no attributes are truly mandatory (Must-be) or irrelevant (Indifferent). The absence of must-have features suggests that respondents likely considered all of the tested attributes valuable. This also indicates that the Indonesian electric vehicle market is still in its development phase (early stages), with users not yet having or setting expectations for mandatory features in electric vehicles (Figure 2).

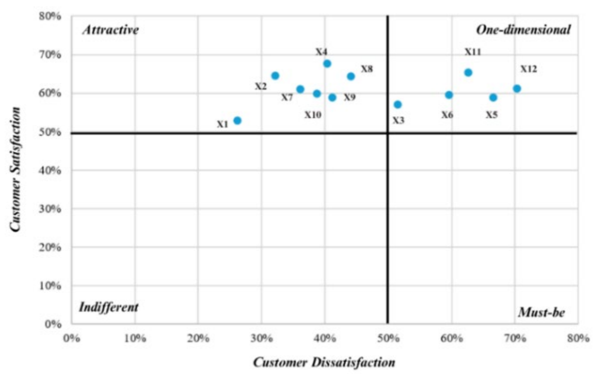

Figure 2. Kano Category Results Chart

5. Conclusion

This study aims to identify the attributes of emerging technologies considered important by potential and current electric vehicle users in Indonesia and to measure the priority level of these attributes. Thus, the following results were achieved for identifying technology attributes:

1. The twelve quality attributes evaluated are divided into two categories: attractive and one-dimensional. The attractive category consists of X4 (360 Degree Sensor and AI Camera), attribute X1 (Adaptive Cruise Control (ACC)), attribute X2 (Lane Keeping Assist (LKA)), attribute X7 (Pedestrian Detection System), X8 (Side Collision Prevention), X9 (Rear Collision Warning), and X10 (Tire Pressure Monitoring System). Meanwhile, the one-dimensional category includes attributes X12 (Curtain Airbags), X11 (Fast Charging), X5 (IP67 Certification for Water and Dust Resistance), X6 (Cybersecurity), and X3 (Automatic Emergency Braking).

2. Attributes in the One-Dimensional category, such as X3, X5, X6, X11, and X12, are critical features because they are directly related to customer satisfaction and dislike. As a result, these features must be prioritized based on quality, availability, and performance.
3. Attributes X1, X2, X4, X7, X8, X9, and X10, which fit into the Attractive category, serve as unexpected features that significantly enhance the customer experience. These features must be constantly maintained and improved as part of a competitive advantage strategy.
4. The results of the attribute identification show that the electric car segmentation strategy categorized into three groups: exclusive, mid-range, and economy. The exclusive segment combines all attributes from the Attractive and One-Dimensional categories to meet high user expectations for comfort and advanced technology. In the mid-range segment, attributes from the One-Dimensional category are prioritized (Automatic Emergency Braking (X3), IP67 Certification for Water and Dust Resistance (X5), Cybersecurity (X6), Fast Charging (X11), Curtain Airbags (X12)), supported by several Attractive attributes that provide high added value whereas remaining affordable (such as Adaptive Cruise Control (X1), Lane Keeping Assist (X2), Tire Pressure Monitoring System (X10), and Pedestrian Detection System (X7)). Meanwhile, in the economy segment, feature selection focuses on essential one-dimensional attributes (IP67 Certification attributes for Water and Dust Resistance (X5), Cybersecurity (X6), Fast Charging (X11), and Curtain Airbags (X12), with the addition of several Attractive attributes (Tire Pressure Monitoring System attributes (X10) and Rear Collision Warning (X9)) as the main selling points that remain relevant to market needs.

References

Afriliana, I., Munadia, H. and Hasta, I. D., Ekupel: e-kuesioner kepuasan pelanggan pada PT. PLN (Persero) Rayon Tegal Timur, *Jurnal ICT: Information Communication & Technology*, vol. 17, no. 1, pp. 28–33, 2018, https://doi.org/10.36054/jict-ikmi.v17i1.37.

Akmal, S., Hambali, R. H., Tormudzi, U. N., Kamalrudin, M. and Hakimi, H., Identifying aesthetic quality attributes using Kano model: Case study of Malay women's office outfit design, *International Journal of Sustainable Construction Engineering and Technology*, vol. 14, no. 2, 2023, https://doi.org/10.30880/ijscet.2023.14.02.017.

Angraini, N., Mengukur kepuasan pelanggan, *Jurnal Administrasi Bisnis*, vol. 2, no. 1, p. 1, 2023, https://doi.org/10.26858/jab.v2i1.43447.

Barsalou, M., Illuminating the Kano model with a case study, *TEM Journal*, pp. 614–622, 2023, https://doi.org/10.18421/tem122-04.

Balinado, J. R. O., Prasetyo, Y. T., Young, M. N., Persada, S. F., Miraja, B. A. and Redi, A. A. N. P., The effect of service quality on customer satisfaction in an automotive after-sales service, *Journal of Open Innovation: Technology, Market, and Complexity*, vol. 7, no. 2, p. 116, 2021, https://doi.org/10.3390/joitmc7020116.

Berger, C., Blauth, R. and Boger, D., Kano methods for understanding customer-defined quality, *Center for Quality Management Journal*, vol. 4, pp. 3–36, 1993.

Biondi, A., Mengenal fitur IOV dari Wuling yang tidak dimiliki kompetitor, *Otodriver*, 2025, https://otodriver.com/berita/2022/mengenal-fitur-iov-dari-wuling-yang-tidak-dimiliki-kompetitor-menchbbetor.

Chen, C., Wang, X. and Wu, C., Integrating refined Kano model and QFD for service quality improvement in healthy fast-food chain restaurants, *International Journal of Environmental Research and Public Health*, vol. 15, no. 7, p. 1310, 2018, https://doi.org/10.3390/ijerph15071310.

Chen, H.-T. and Chen, B.-T., Integrating Kano model and SIPA grid to identify key service attributes of fast food restaurants, *Journal of Quality Assurance in Hospitality and Tourism*, vol. 16, no. 2, pp. 141–163, 2015, https://doi.org/10.1080/1528008X.2015.1013407.

Chen, Y., Zhang, J. and Li, X., Service quality and customer satisfaction in pharmaceutical logistics: An analysis based on Kano model and importance-satisfaction model, *International Journal of Environmental Research and Public Health*, vol. 16, no. 21, p. 4091, 2019, https://doi.org/10.3390/ijerph16214091.

Cheng, L., Hu, Y. and Wu, H., An evaluation instrument and strategy implications of service attributes in LOHAS restaurants, *International Journal of Contemporary Hospitality Management*, vol. 31, no. 3, pp. 987–1010, 2019, https://doi.org/10.1108/ijchm-06-2017-0361.

Dwi, A., Mobil listrik bisa diajak ngobrol, ini kecanggihan teknologi i-SMART, *ListrikIndonesia.com*, 2025, https://listrikindonesia.com/detail/15918/mobil-listrik-bisa-diajak-ngobrol-ini-kecanggihan-teknologi-ismart.

Gaikindo, Industri otomotif berperan penting terhadap pertumbuhan ekonomi, *Gaikindo Official Website*, 2022, https://www.gaikindo.or.id/industri-otomotif-berperan-penting-terhadap-pertumbuhan-ekonomi/.

Gaikindo, Mengapa GAIKINDO menggelar pameran otomotif GIIAS di Bandung?, *Gaikindo Official Website*, 2025, https://www.gaikindo.or.id/mengapa-gaikindo-menggelar-pameran-otomotif-giias-di-bandung/.

Goldental, A. and Kanter, I., A minority of self-organizing autonomous vehicles significantly increase freeway traffic flow, *Journal of Physics A: Mathematical and Theoretical*, vol. 53, no. 41, p. 414001, 2020, https://doi.org/10.1088/1751-8121/abb1e1.

Hair, J. F., Jr., Black, W. C., Babin, B. J. and Anderson, R. E., *Multivariate Data Analysis*, 8th ed., Cengage Learning, 2019.

Hais, Y., Fuady, S., Nehru, N., Pathoni, H., Tesal, D., Manab, A. and Rabiula, A., Workshop edukasi pembuatan robot line follower menggunakan metode aktif eksperimental untuk meningkatkan kompetensi siswa di SMAN 15 Muaro Jambi, *Ejoin Jurnal Pengabdian Masyarakat*, vol. 1, no. 3, pp. 116–124, 2023, https://doi.org/10.55681/ejoin.v1i3.636.

He, L., Ming, X., Li, M., Zheng, M. and Xu, Z., Understanding customer requirements through quantitative analysis of an improved fuzzy Kano's model, *Proceedings of the Institution of Mechanical Engineers, Part B: Journal of Engineering Manufacture*, vol. 231, no. 4, pp. 699–712, 2017, https://doi.org/10.1177/0954405415598894.

Iba, Z. and Wardhana, A., Uji validitas dan uji reliabilitas pada data penelitian kuantitatif, 2024.

Imamah, N. and Iradawaty, S. N., The strategy of coffee customer satisfaction improvement through atmosphere store, discounts and service quality, *Jurnal Akuntansi dan Ekonomi (JAE)*, vol. 7, no. 2, pp. 137–146, 2022, https://doi.org/10.29407/jae.v7i2.18151.

Islamy, G., Faktor penentu niat pembelian ulang merchandise BTS HYBE Labels, *Jurnal Multidisiplin Indonesia*, vol. 2, no. 3, pp. 451–465, 2023, https://doi.org/10.58344/jmi.v2i3.181.

Kano, N., Attractive quality and must-be quality, *Hinshitsu: Quality, The Journal of Japanese Society for Quality Control*, vol. 14, pp. 39–48, 1984.

Kenny, Produsen mobil beraksi di GIIAS 2024, melawan penurunan industri di Indonesia, *Market Research Vietnam Indonesia*, 2024, https://www.cimigo.com/id/trends/giias-2024-melawan-penurunan-industri-otomotif/.

Kohli, A. and Singh, R., An assessment of customers' satisfaction for emerging technologies in passenger cars using Kano model, *Vilakshan – XIMB Journal of Management*, vol. 18, no. 1, pp. 76–88, 2021, https://doi.org/10.1108/XJM-08-2020-0103.

Kurniawan, A., Analisis penjualan mobil listrik Indonesia: Januari–November 2024, *KOMPAS.com*, 2024, https://otomotif.kompas.com/read/2024/12/30/080200315/analisis-penjualan-mobil-listrik-indonesia--januari-november-2024.

Lacerda, A. B., Souza, A. S. da S., Silva, G. K. L. da, Azevedo, E. H. M. de and Melo, F. J. C. de, Basic Health Units services quality assessment through Kano and SERVQUAL models, *Benchmarking: An International Journal*, vol. 29, no. 9, pp. 2858–2880, 2022, https://doi.org/10.1108/BIJ-06-2021-035.

Li, J., Wang, Q., Xuan, Y. and Zhou, H., User demands analysis of eco-city based on the Kano model—an application to China case study, *PLOS ONE*, vol. 16, no. 3, e0248187, 2021, https://doi.org/10.1371/journal.pone.0248187.

Li, M., Li, Z., Zhou, Y. and Wu, J., A cooperative energy efficient truck platoon lane-changing model preventing platoon decoupling in a mixed traffic environment, *Journal of Intelligent Transportation Systems*, vol. 28, no. 2, pp. 174–188, 2022, https://doi.org/10.1080/15472450.2022.2119386.

Lin, H., Li, S. and Yang, Y., Empirical research on Kano's model and customer satisfaction, *PLOS ONE*, vol. 12, no. 8, e0183888, 2017, https://doi.org/10.1371/journal.pone.0183888.

Lo, C., Application of refined Kano's model to shoe production and consumer satisfaction assessment, *Sustainability*, vol. 13, no. 5, 2484, 2021, https://doi.org/10.3390/su13052484.

Ma, B., Limierta, J., Teo, C.-C. and Wong, Y. D., Unveiling consumers' nonlinear evaluation of service performances in online food delivery: A quantitative Kano analysis, *British Food Journal*, vol. 126, no. 2, pp. 834–863, 2024, https://doi.org/10.1108/BFJ-06-2023-0503.

Madzík, P., Increasing accuracy of the Kano model – a case study, *Total Quality Management & Business Excellence*, vol. 27, no. 11–12, pp. 1194–1210, 2016, https://doi.org/10.1080/14783363.2016.1194197.

Mishra, M. K. and Singh, L., Customer empowerment, customer retention, and performance of firms, *Advances in Marketing, Customer Relationship Management, and E-Services*, pp. 112–132, 2023, https://doi.org/10.4018/978-1-6684-5853-2.ch006.

Mkpojiogu, E. O. C. and Hashim, N. L., Understanding the relationship between Kano model's customer satisfaction scores and self-stated requirements importance, *SpringerPlus*, vol. 5, no. 1, 1974, 2016, https://doi.org/10.1186/s40064-016-1860-y.

MG Motor Indonesia, Fitur Keamanan Mobil Listrik 2025: Inovasi terkini, *MG Motor Indonesia Official Site 2025*, 2025, https://www.mgmotor.id/news/fitur-keamanan-mobil-listrik-2025-inovasi-yang-wajib-anda-ketahui.

Noor, M., Pengaruh kualitas pelayanan dan harga terhadap kepuasan pelanggan jasa transportasi online (Gojek), *Sebatik*, vol. 23, no. 2, pp. 498–504, 2019, https://doi.org/10.46984/sebatik.v23i2.804.

Panday, R., Dampak COVID-19 pada kesiapan teknologi dan penerimaan teknologi di kampus, *Jurnal Kajian Ilmiah*, vol. 1, no. 1, pp. 107–116, 2020, https://doi.org/10.31599/jki.v1i1.276.

Pahlevi, A. B. and Suryanegara, M., Identifying 4G service attributes on customer satisfaction in Indonesia market: Kano model approach, *Proceedings of the International Conference on Control, Electronics, Renewable Energy and Communications (ICCREC)*, pp. 212–216, 2017.

Rampal, A., Mehra, A., Singh, R., Yadav, A., Nath, K. and Chauhan, A. S., Kano and QFD analyses for autonomous electric car: Design for enhancing customer contentment, *Materials Today: Proceedings*, vol. 62, no. 3, pp. 1481–1488, 2022, https://doi.org/10.1016/j.matpr.2022.02.154.

Reddy, K. V. M. K., Reddy, B. M., Kolli, C. S. R., Kartheek, P. and Adarsh, T. S., Comparative investigation of electronic fuel injection in two-wheeler applications: a review, *IOP Conference Series: Materials Science and Engineering*, vol. 1116, no. 1, 012073, 2021, https://doi.org/10.1088/1757-899x/1116/1/012073.

Sandi, F., Penjualan Mobil Listrik di RI Naik 152%, Mobil Bensin Nangis Darah, *CNBC Indonesia*, 2025, https://www.cnbcindonesia.com/news/20250114114646-4-603012/penjualan-mobil-listrik-di-ri-naik-152-mobil-bensin-nangis-darah.

Sauerwein, E., Bailom, F., Matzler, K. and Hinterhuber, H., The Kano model: How to delight your customers, *International Working Seminar on Production Economics*, vol. 1, 1996.

Segoro, W., Pengaruh persepsi kualitas pelayanan, faktor penambat dan kualitas hubungan relasional terhadap kepuasan dan loyalitas pelanggan: Suatu penelitian pada penyedia jasa telepon selular di Jawa Barat, *Jurnal Telekomunikasi dan Komputer*, vol. 2, no. 2, p. 181, 2017, https://doi.org/10.22441/incomtech.v2i2.1110.

Setiawan, F. B., Sutrisno, P. U., Pratomo, L. H. and Riyadi, S., Penerapan algoritma HSV pada autonomous car untuk sistem self-driving, *Jurnal Rekayasa Elektrika*, vol. 18, no. 4, 2022, https://doi.org/10.17529/jre.v18i4.27495.

Sobuj, M., Alam, M. A. and Zannat, A., Evaluation of face masks quality features using Kano model and unsupervised machine learning technique, *Research Journal of Textile and Apparel*, 2022, https://doi.org/10.1108/RJTA-11-2021-0141.

Shahin, A., Mohammadi, S., Harsij, H. and Qazi, M. R. R., Revising satisfaction and dissatisfaction indexes of the Kano model by reclassifying indifference requirements, *The TQM Journal*, vol. 29, no. 1, pp. 37–54, 2017, https://doi.org/10.1108/tqm-05-2015-0059.

Shahrestani, H. V., Shahin, A., Teimouri, H. and Barzoki, A. S., Revising the Kano model for designing an employee compensation system: Developing one-dimensional attributes, *The TQM Journal*, vol. 32, no. 1, pp. 78–91, 2020, https://doi.org/10.1108/TQM-05-2019-0153.

Slack, N., Singh, G. and Sharma, S., Impact of perceived value on the satisfaction of supermarket customers: developing country perspective, *International Journal of Retail & Distribution Management*, vol. 48, no. 11, pp. 1235–1254, 2020, https://doi.org/10.1108/ijrdm-03-2019-0099.

Statista, Automotive industry in Indonesia [Statistics report], *Statista*, 2024, https://www.statista.com/study/37680/automotive-industry-in-indonesia-statista-dossier/.

Statista, Automotive industry worldwide [Statistics report], *Statista*, 2024, https://www.statista.com/study/9644/automotive-industry-statista-dossier/.

Sukwika, T., Menentukan Populasi dan Sampling, *Metode Penelitian (Dasar Praktik dan Penerapan Berbasis ICT)*, pp. 159–173, 2023.

Suzianti, A., Haqqi, F. R. and Fathia, S. N., Strategic recommendations for financial technology service development: A comprehensive risk-benefit IPA-Kano analysis, *Journal of Modelling in Management*, vol. 17, no. 4, pp. 1481–1503, 2022, https://doi.org/10.1108/JM2-11-2020-0297.

Tanjung, J., Pengaruh kualitas pelayanan, kualitas produk dan kepercayaan terhadap kepuasan dan loyalitas pelanggan Indihome PT. Telkom Indonesia Pekanbaru, *Jurnal Bansi - Jurnal Bisnis Manajemen Akutansi*, vol. 3, no. 1, pp. 27–45, 2023, https://doi.org/10.58794/bns.v3i1.451.

Tseng, C. C., An IPA-Kano model for classifying and diagnosing airport service attributes, *Research in Transportation Business & Management*, vol. 37, 100499, 2020, https://doi.org/10.1016/j.rtbm.2020.100499.

Wang, X., Tang, P., Jiang, Y., Yuan, Z., Tang, L., Qiao, S. and Chen, D., The application value of Kano model in quality of healthcare: a scoping review, 2024, https://doi.org/10.1101/2024.03.30.24305047.

Wang, T. and Ji, P., Understanding customer needs through quantitative analysis of Kano's model, *International Journal of Quality & Reliability Management*, vol. 27, no. 2, pp. 173–184, 2010, https://doi.org/10.1108/02656711011014294.

Wismantoro, Y., Pengaruh self-service technology (ISST) terhadap kepuasan dan loyalitas: Dengan mediasi relational benefits, *Jurnal Penelitian Ekonomi dan Bisnis*, vol. 1, no. 1, 2017, https://doi.org/10.33633/jpeb.v1i1.1479.

Wu, T., Weng, S. J., Pan, R. B., Kim, S. H., Gotcher, D. and Tsai, Y. T., Exploring service quality combining Kano model and importance-performance analysis – customer satisfaction of luxury housing service management, *International Journal of Services, Economics and Management*, vol. 11, no. 1, p. 71, 2020, https://doi.org/10.1504/ijsem.2020.107797.

Biographies

Prof. Dr. Ir. Teuku Yuri M. Zagloel, M.Eng.Sc. is a professor at the Department of Industrial Engineering, Universitas Indonesia, and a leading expert in Total Quality Management, lean operations, and sustainable manufacturing systems. He earned his master's degree from the University of New South Wales (Australia) and his doctorate from Universitas Indonesia. He has actively published scholarly work in high-impact international journals, such as Sustainability and Cogent Business and Management. His current research interests include supply chain digitalization, system dynamics modeling, and the adoption of blockchain in logistics systems. According to institutional records, he holds an h-index of 17 on Google Scholar and 12 on Scopus.

Rafalia Maritza is a master's student in the Department of Industrial Engineering at Universitas Indonesia. Her research interests include operations management, quality systems, logistics, industrial system design, supply chain management, and service innovation.