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Factors Influencing Consumers' Willingness to Pay and Powertrain Preferences for High-Performance Hybrid Cars

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Abstract. As the automotive industry moves toward electrification, high-performance vehicle manufacturers face the challenge of adopting electrified powertrains while preserving engine sound, mechanical feedback, and driving engagement valued by consumers. This study examines how objective technical knowledge, emotional attachment to internal-combustion-engine (ICE) characteristics, and household income influence consumers' willingness to pay (WTP) and powertrain preferences for high-performance hybrid cars. A quantitative, cross-sectional design was adopted using an online questionnaire completed by 296 respondents with certain automotive and ownership backgrounds. Descriptive statistics, Spearman correlations, chi-square tests, OLS regression, and binary Logit models were used to analysize the relationships between the independent and dependent variables. The results show that ICE emotional attachment was the clearest predictor of WTP: each one-level increase in attachment was associated with a 2.81-percentage-point increase in the premium respondents were willing to pay. Household income showed a weaker, marginally significant positive relationship with WTP, whereas objective technical knowledge had no significant independent effect. None of the three principal variables consistently predicted hybrid powertrain selection. The study concludes that consumers' financial valuation of high-performance hybrid technology is influenced more strongly by emotional value and financial capacity than by technical knowledge, but these factors do not necessarily determine their final powertrain choice.

Keywords: High-performance hybrid vehicles, Willingness to pay, Powertrain preference, ICE emotional attachment

1. Introduction

The global automotive industry is undergoing a transition toward vehicle electrification. While this transition creates opportunities to improve environmental efficiency and vehicle performance, it presents a distinctive challenge for high-performance vehicle manufacturers seeking to adopt electrified powertrains while preserving the emotional and mechanical characteristics of ICE. Lotus illustrates this challenge by introducing its 900-volt Hyper Hybrid EV technology in response to evolving market demand, as it aims to transform into an all-electric global luxury technology brand by 2028 [1, 2]. Although Lotus provides the initial motivation for this study, the issue is not limited to one company but extends across the high-performance vehicle market. As manufacturers

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introduce hybrid powertrains, it becomes significant to understand whether consumers may accept or reject this technology, especially for high-performance hybrid vehicles. Purchasing intention may be influenced by consumers' technical knowledge, as those who better understand the system may be more capable of evaluating its performance and benefits. Meanwhile, acceptance may also depend on consumers' financial ability to afford advanced hybrid technology and their emotional attachment to the ICE. Examining these factors together can provide manufacturers with a clearer understanding of consumer acceptance, which becomes extremely important in adjusting their future product policies and electrification strategies to align more closely with consumer expectations and market demand. Nowadays, existing research on consumers' adoption of electrified vehicles has mainly examined mainstream EV markets, where some studies have considered technical knowledge and emotional attachment. However, limited attention has been given to the high-performance vehicles market. The correlation between technical knowledge, ICE attachment, and financial income also remains unclear, and research has rarely discussed consumers' financial valuation of hybrid technology in their final powertrain selection. Thus, this study addresses this gap by examining these factors within the high-performance hybrid vehicle market, aiming to clarify whether valuing high-performance hybrid technology financially translates into consumers' powertrain selection.

2. Literature review

Consumer adoption of electric vehicles has received considerable attention as the automotive industry attempts to reduce transport emissions. Reviews of the literature show that previous research has predominantly examined practical factors such as purchase price, operating costs, driving range, charging infrastructure, and government incentives [3, 4]. Higueras-Castillo et al. also identify perceived usefulness, environmental concern, and social influence as important determinants of EV adoption [5]. Furthermore, consumers do not necessarily prioritize environmental benefits when purchasing a vehicle. Egbue and Long found that cost, range, technical uncertainty, and perceived performance can outweigh sustainability considerations [6]. Taken together, these findings suggest that electric vehicle acceptance involves a combination of technological, economic, and psychological considerations.

Technical knowledge may influence consumers' ability to evaluate the benefits and risks of unfamiliar powertrain technologies. A previous study found that technological knowledge was positively associated with perceived usefulness, ease of use, and EV adoption intention [7]. At the same time, Wang et al. demonstrated that knowledge increased perceived usefulness and reduced perceived risk [8]. However, understanding a technology does not necessarily result in purchasing behaviour. Lane and Potter identified an attitude–action gap, showing that favourable attitudes toward cleaner vehicles may not translate into actual adoption [9]. One possible constraint is financial ability, in which consumers may recognize the benefits of an electrified vehicle but still be unable or unwilling to pay its price premium. Their willingness to pay also depends on whether they consider the vehicle's benefits worth the additional cost. Hidrue et al. found that consumers' valuation of electric vehicles varied according to attributes such as driving range, charging time, fuel-cost savings, pollution reduction, and performance [10]. Since technical knowledge and financial consideration may influence WTP through different mechanisms, their relationships with purchasing intention should be examined separately.

In addition to technical and financial considerations, vehicle purchasing decisions also involve emotional value. Research found that emotional reactions were among the strongest determinants of electric-car usage [11]. Schuitema et al. further demonstrated the emotion's impact by claiming that driving pleasure and symbolic identity contributed to EV-adoption intention alongside functional

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attributes [12]. These considerations may be especially important in high-performance vehicles, where consumers may value engine sound, mechanical feedback, and driver engagement. Supporting the importance of sensory experience, several studies indicate that vehicle sound can influence consumers' evaluations of the driving experience. Münder and Carbon found that powertrain sound affected perceived vehicle quality [13], while Swart and Bekker associated vehicle sound characteristics with subjective consumer satisfaction [14]. Nevertheless, these studies focus primarily on general emotional responses to EVs and perceptions of vehicle sound. Limited research has directly examined whether consumers' emotional attachment to ICE characteristics influences their willingness to pay for high-performance hybrid technology or their final powertrain preference.

Overall, previous research has established the importance of technical, financial, and emotional factors, but these factors are frequently examined separately and mainly within mainstream EV markets. Comparatively little attention has been given to high-performance hybrid consumers. It also remains unclear whether consumers who are willing to pay a premium for hybrid technology will select a hybrid powertrain across different vehicle contexts. This study addresses these gaps by examining how technical knowledge, ICE emotional attachment, and financial ability relate to both WTP and powertrain preference for sports cars and performance SUVs.

3. Methodology

The study adopted a quantitative, cross-sectional research method using an online questionnaire. The survey aims to examine the relationships between consumers' technical knowledge, emotional attachment to ICE characteristics, financial income and their purchasing intentions toward high-performance hybrid vehicles and powertrain selection. The final dataset contained 296 respondents with relevant automotive backgrounds.

Three independent variables were examined, in which objective technical knowledge was measured by the number of correct answers to Questions 15-18, producing a score ranging from zero to four. ICE emotional attachment was measured using the ordered response scale in Question 8, which was used to assess the importance respondents placed on traditional ICE characteristics. Financial income was represented by the household income categories reported in Question 27. Six personal-background variables from the demographic and automotive-background sections of the questionnaire were included as control variables in the adjusted regression models. Two dependent variables, WTP and Powertrain preference, represented different dimensions of purchasing intention. WTP was measured using Question 20, which presented the percentage premium respondents were willing to pay for Super Hyrbid technology. Powertrain preference was measured separately for a sports car in Question 13 and a performance SUV in Question 14. For the binary regression models, these responses were coded according to whether respondents selected a hybrid powertrain in both Questions 13 and 14. Technical overconfidence was additionally measured by the differences between respondents' perceived knowledge score in Question 19 and their actual knowledge score from Questions 15-18, where positive values represented overconfidence, zero represented accurate calibration, and negative values represented underconfidence.

The analysis examined the relationship of each independent variable with both dependent variables. Descriptive statistics, Spearman correlations, cross-tabulations, and chi-square tests were used to identify the major patterns. OLS regression was used to estimate the relationships with WTP while considering the control variables. Meanwhile, the Logit models examined WTP and hybrid powertrain selection, while the Linear probability models were also used to check the robustness of the results.

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4. Results

4.1. Descriptive statistics and preliminary observation

The final sample consisted of 296 respondents and was mainly female, young and highly educated. Most respondents' ages were between 18 and 34, and they were highly educated, as bachelor's degrees was the most common education level. For automotive background, mainstream commuter vehicles were the most common current vehicle type. Additionally, respondents reported experience across ICE, hybrid and Battery Electric Vehicle (BEV), providing perspectives from users with different automotive experience. The purchasing-intention analysis indicates generally favourable attitudes toward high-performance hybrid technology. As shown in Table 1, respondents were willing to pay an average premium of 17.5%, with 84.1% reporting a positive WTP. However, the standard deviation of 15.3 percentage points showcases a considerable variation in individual valuations. The respondents' powertrain preferences were also broadly toward hybrid technology. As shown in Table 2, Plug-in-Hybrid Vehicle (PHEV) and Super Hybrid were the two most selected categories in both vehicle contexts, with 57.4% of sports car preferences and 58.4% of performance-SUV preferences. These initial findings demonstrate a broad acceptance of high-performance hybrid technology among respondents.

Table 1. Values of key willingness-to-pay measures

Statistic	Value	Unit/ definition
Valid responses	296	Respondents
Mean WTP	17.5	Premium (%)
Median WTP	20.0	Premium (%)
Standard deviation	15.3	Percentage points
Positive WTP	249 (84.1%)	Q20 > 0%

Table 2. Frequencies and percentages of powertrain choices by vehicle type

Powertrain choice	Q13 n	Q13 %	Q14 n	Q14 %
ICE	33	11.1	25	8.4
PHEV	86	29.1	97	32.8
Super Hybrid	84	28.4	76	25.7
BEV	69	23.3	73	24.7
No strong preference	24	8.1	25	8.4
Combined hybrid choice	170	57.4	173	58.4

4.2. Relationship between independent and dependent variables

Table 3. Results of bivariate association tests between the independent and dependent variables

Independent Variable	WTP (Continuous) — Spearman's ρ (p-value)	Sports-Car Preference — χ^2, Cramér's V (p-value)	Performance-SUV Preference — χ^2, Cramér's V (p-value)
Objective Techinical Knowledge	−.016 (.779)	$\chi^2(16) = 15.70$, V = .115 (.474)	$\chi^2(16) = 20.73$, V = .132 (.189)

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Table 3. (continued)

ICE Emotional Attachment	.101 (.082)	$\chi^2(16) = 31.95$, V = .165 (.009)	$\chi^2(16) = 24.31$, V = .143 (.085)
Household Income	.186 (.002)	$\chi^2(12) = 20.20$, V = .154 (.063)	$\chi^2(12) = 21.10$, V = .157 (.049)*

Table 3 summarizes the relationships between the three independent variables—objective technical knowledge, ICE emotional attachment, and household income—and the two dependent variables: WTP and powertrain preference. Spearman's rank correlation was used for WTP, and chi-square analysis and Cramér's V were used for the categorical powertrain-preference outcomes. Objective technical knowledge was not significantly related to WTP ($\rho = -.016$, $p = .779$), indicating that respondents with greater technical knowledge were not consistently willing to pay a higher premium for a Super Hybrid. Its associations with sports-car preference (V = .115, p = .474) and performance-SUV preference (V = .132, p = .189) were also weak and statistically insignificant. ICE emotional attachment had a weak positive relationship with WTP ($\rho = .101$, $p = .082$). Its association with sports-car powertrain preference was statistically significant but weak (V = .165, p = .009), whereas the relationship with SUV preference was marginal (V = .143, p = .085). The earlier percentage distributions showed that stronger attachment was generally associated with greater conventional-ICE preference in the sports-car context, suggesting that emotional attachment may be more relevant when the vehicle's performance identity is closely connected to engine sound and mechanical feedback. Household income showed the clearest bivariate relationship with WTP ($\rho = .186$, $p = .002$). Higher-income respondents generally reported greater willingness to accept a Super-Hybrid price premium, although the relationship remained weak. Income was marginally associated with sports-car preference (V = .154, p = .063) and weakly associated with performance-SUV preference (V = .157, p = .049). However, no individual powertrain category increased consistently across income levels, and the highest-income group contained relatively few respondents.

4.3. Regression with control variables

Table 4 presents the OLS regression results for WTP, using HC3 heteroskedasticity-robust standard errors. The model included objective technical knowledge, ICE emotional attachment and financial income, while controlling for age, gender, education, automotive involvement, performance-car ownership and current BEV use. After controlling for these background characteristics, ICE emotional attachment was positively and statistically significantly associated with WTP, with B = 2.81, SE = 1.29, p = .029. Holding the other variables constant, each one-level increase in ICE attachment was associated with an estimated 2.81-percentage-point increase in the premium respondents were willing to pay for Super-Hybrid technology. Household income also showed a positive relationship with WTP, with B = 2.36, SE = 1.33, p = .077, although the result was only marginally significant. In contrast, objective technical knowledge was not significantly associated with WTP, with B = −0.75, SE = 0.77, p = .330. None of the six background control variables was statistically significant, and the model explained approximately 5.4% of the observed variation in WTP, with $R^2 = .054$; adjusted $R^2 = .023$. Overall, emotional attachment provided the clearest adjusted relationship with WTP, while income offered weaker evidence and technical knowledge showed no independent relationship.

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Table 4. OLS regression predicting willingness to pay

Predictor	B	HC3 robust SE	t	p	95% CI
Constant	+2.82	7.87	+0.36	.720	[−12.62, +18.25]
Objective technical knowledge	-0.75	0.77	-0.97	.330	[−2.27, +0.76]
ICE emotional attachment	+2.81*	1.29	+2.18	.029	[+0.29, +5.33]
Household income	+2.36†	1.33	+1.77	.077	[-0.26, +4.97]
Age category	+1.03	1.13	+0.91	.365	[-1.20, +3.25]
Education level	-0.31	1.57	-0.19	.846	[-3.39, +2.78]
Female	+0.21	1.90	+0.11	.911	[-3.52, +3.94]
Automotive involvement	+1.20	2.05	+0.59	.558	[-2.81, +5.22]
Performance-car owner	+0.78	2.51	+0.31	.757	[-4.14, +5.69]
Current BEV user	-1.57	1.79	-0.88	.381	[-5.08, +1.94]

Observations = 285; R^2 = .054; Adjusted R^2 = .023

Table 5. Logit models predicting hybrid powertrain choice

Predictor	Sports Car (Q13)	Performance SUV (Q14)
Objective technical knowledge	1.08 [0.87, 1.33]	1.06 [0.85, 1.31]
ICE emotional attachment	1.12 [0.84, 1.50]	1.09 [0.82, 1.44]
Household income	0.97 [0.69, 1.37]	1.08 [0.77, 1.51]
Age category	0.81 [0.57, 1.15]	1.12 [0.79, 1.58]
Education level	0.87 [0.54, 1.39]	1.23 [0.80, 1.89]
Female	0.79 [0.47, 1.32]	1.23 [0.73, 2.05]
Automotive involvement	0.99 [0.58, 1.70]	0.96 [0.56, 1.65]
Performance-car owner	0.67 [0.36, 1.24]	0.79 [0.42, 1.49]
Current BEV user	0.50* [0.29, 0.85]	0.67 [0.40, 1.14]
Constant	3.10 [0.47, 20.46]	0.39 [0.06, 2.40]
Observation	285	285
R^2	.036	.015

Table 5 used two binary Logit models to examine hybrid powertrain choice for sports cars and performance SUVs. Respondents who selected PHEV or Super Hybrid were coded as one, while ICE, BEV and no-preference responses were coded as zero. Both models included objective technical knowledge, ICE emotional attachment and household income, while controlling for age, gender, education, automotive involvement, performance-car ownership and current BEV use. After controlling for the other variables, none of the three principal predictors significantly predicted hybrid powertrain choice in either vehicle context. For sports cars, objective technical knowledge, with OR = 1.08, p = .502, and ICE emotional attachment, with OR = 1.12, p = .427, showed small positive associations with hybrid-choice odds, whereas household income had an odds ratio close to one, with OR = 0.97, p = .876. However, all confidence intervals included one, indicating that these relationships were statistically insignificant.

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The performance-SUV model produced similarly weak results. Objective technical knowledge, with OR = 1.06, p = .622, ICE emotional attachment, with OR = 1.09, p = .571, and household income, with OR = 1.08, p = .664, were positively associated with hybrid-choice odds, but none of these relationships were statistically significant. Therefore, the results provide no reliable evidence that the three principal factors independently determined whether respondents selected a hybrid powertrain for a performance SUV.

Comparison of the two models indicates that the three principal predictors operated similarly across sports cars and performance SUVs: their effects were small and statistically insignificant in both contexts. The sports-car model had slightly greater explanatory power than the performance-SUV model, with R^2 = .036 versus .015, but both values were low. Overall, the Logit results suggest that technical knowledge, ICE emotional attachment and financial ability did not consistently determine consumers' final powertrain selection. Although ICE attachment and income were associated with consumers' financial valuation of hybrid technology in the WTP analysis, these factors did not reliably increase the probability of selecting PHEV or Super Hybrid. Financial valuation and final powertrain choice should therefore be understood as related but distinct dimensions of purchasing intention.

4.4. Overconfidence analysis

To examine whether respondents' perceptions of their knowledge differed from their actual understanding, an additional overconfidence analysis compared the self-assessed score in Question 19 with the objective score from Questions 15-18. Respondents expected to answer an average of 2.29 out of four questions correctly, compared with an actual mean of 1.50, while 60.3% overestimated their performance. Nevertheless, overconfidence was not significantly associated with WTP and powertrain preferences, suggesting that neither actual technical knowledge nor overestimating that knowledge reliably translated into a purchase intention of high-performance hybrid technology.

5. Discussion

This study examined whether objective technical knowledge, ICE emotional attachment, and household income influenced consumers' WTP for high-performance hybrid technology and their power-train preferences. Overall, the findings suggest that consumers' financial valuation of hybrid technology and their final power-train selection are influenced differently. Furthermore, ICE emotional attachment was the strongest predictor of WTP while household income showed weaker positive evidence, and technical knowledge had no significant independent effect. However, none of these variables could consistently predict the respondents' power-train selection. The COM-B model provides a potential explanation for these results. Objective technical knowledge represents capability, but greater capability did not produce higher WTP or stronger hybrid preference. Therefore, consumers may understand hybrid technology while remaining concerned about factors, such as weight, maintenance costs, or reliability. Technical knowledge may help consumers evaluate a vehicle, but understanding alone does not create purchasing intention. Household income represents financial opportunity. Higher-income respondents generally reported greater WTP, because they may be more able to accept a price premium. However, income did not consistently predict power-train preference because financial opportunity makes a hybrid purchase possible, but it does not determine the motivation for buying it. ICE attachment represents emotional motivation and showed the clearest relationship with WTP. Consumers attached to engine sound, mechanical

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feedback, and driver engagement may perceive a Super Hybrid as preserving ICE characteristics while improving performance through electrification, which explains why stronger ICE attachment increased the premium consumers were willing to pay. Nevertheless, attachment did not consistently predict hybrid selection since final choice also depends on vehicle type and intended use.

Taken together, these findings have several practical implications for high-performance vehicle manufacturers. Although introducing consumers of the additional technical information may improve their understanding of the power-train system, education itself is unlikely to create purchasing intention, as knowledge did not significantly influence WTP. For such a reason, manufacturers should connect technical knowledge to benefits valued by consumers, such as acceleration, driving range, reliability and overall driving experiences. Moreover, the positive relationship between ICE attachment and WTP suggests that electrification strategies should preserve emotional continuity. Manufacturers should position high-performance hybrids as an evolution of the traditional combustion engine that retains engine sound and mechanical engagement while using electrification to enhance efficiency. Finally, household income showed a positive but marginal relationship with WTP, but it did not consistently influence power-train preference, which suggests that income may affect the amount consumers can afford to pay, rather than whether they prefer hybrid technology. Manufacturers could therefore offer different price tiers or different financing options to reduce the financial barrier for different income groups.

6. Conclusion

This study investigated what factors influence consumers' willingness to pay and power-train preferences for high-performance hybrid cars, and the extent of these influences. Overall, the results show that consumers' WTP was influenced primarily by emotional attachment and, to a lesser extent, financial income, whereas technical knowledge had insignificant influence. In contrast, final power-train preference could not be consistently explained by any single factor examined in this study. Specifically, ICE emotional attachment had the clearest influence on WTP: one level increase in ICE attachment was associated with a 2.81 percentage point increase in the premium consumers were willing to pay. Household income had a weaker, marginally significant effect, with each one category increase in income associated with a 2.36 percentage point increase in WTP. Objective technical knowledge had no significant influence on WTP. Additionally, the factors influencing power-train preference were less consistent, and none of the three independent variables significantly predicted hybrid selection after respondent characteristics were controlled. However, several limitations should be acknowledged in this paper. The majority of the respondents were based in China, relatively young and highly educated, while only 19.9% currently drove a performance or sports car. Thus, the sample may not fully represent the wider international performance-car market, especially consumers in countries with different automotive cultures, electrification policies and income levels. The study measured respondents' stated WTP and hypothetical power-train preferences rather than their behaviour in an actual vehicle purchase. As the participants did not face real financing conditions when answering the survey, they may have reported a higher premium than they would choose at a dealership, which would be interpreted as an overestimate of purchasing intentions. In addition, some variables were measured using a limited number of questions: ICE emotional attachment and financial ability were primarily represented by single survey items, while objective technical knowledge was based on only four questions. Meanwhile, some groups of control variables were small, particularly the highest-income category, which contained only 12 respondents. Consequently, these measures may not capture the full complexity of each concept, and the statistical results for the control groups may be less precise.

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Future research should address these limitations by using larger and more diverse samples, with more balanced representation across personal backgrounds. Researchers could also use experimental choice scenarios or actual purchasing data to examine whether stated WTP and power-train preferences translate into real consumer behaviour. Future studies could also examine additional factors, including brand loyalty, charging access, maintenance costs, environmental concern, and government incentives. Despite its limitations, this study contributes to understanding the high-performance hybrid market by demonstrating that the factors influencing consumers' financial valuation of hybrid technology do not necessarily determine their final power-train selection.

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