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Chin-Wen Liao , Chien-Pin Chang , Yu-Cheng Liao *

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Research on Core Competency Indicators for Battery Electric Vehicle Sales Personnel: Aligning with SDG Goals for Sustainable Mobility and Workforce Development

Chin-Wen Liao [1], Chien-Pin Chang [1] and Yu-Cheng Liao [1,2,*]

[1] Department of Industrial Education and Technology, National Changhua University of Education; Changhua City, Changhua County 50007, Taiwan
[2] Cisco Systems, Inc. 300 East Tasman Dr. San Jose, CA 95134 USA
* Correspondence: tobliao@cisco.com

Abstract: This research explores the core competency indicators required for Battery Electric Vehicle (BEV) sales personnel to enhance their professional capabilities and support the growth of the BEV industry. With the global push toward sustainable transportation solutions and the rapid adoption of BEVs, a well-equipped sales workforce is crucial to driving consumer acceptance and market expansion. The study utilizes a combination of literature review, expert interviews, and a Delphi survey conducted with 15 industry professionals to identify and validate essential competency dimensions. These competencies are organized into four dimensions—Professional Knowledge, Professional Skills, Professional Attitude, and Personal Traits—further subdivided into 20 sub-dimensions and 58 indicators. Key competencies include technical expertise in BEV technology, effective communication, customer relationship management, sales techniques, and after-sales service proficiency. The study highlights the significant role of professional knowledge in enhancing sales performance and customer trust, while emphasizing the importance of continuous learning, work attitude, and digital tools proficiency. The competency framework developed in this study offers valuable insights for recruitment, workforce training, and performance evaluation, ensuring that sales teams are well-prepared to navigate the dynamic and competitive BEV market. Furthermore, by equipping sales personnel with the right skills, the framework supports the broader goals of sustainable mobility and the adoption of BEVs, aligning with the UN Sustainable Development Goals (SDGs), specifically SDG 9 (Industry, Innovation, and Infrastructure), SDG 11 (Sustainable Cities and Communities), and SDG 4 (Quality Education). This research contributes to the development of a skilled, adaptable workforce, capable of driving the transition to a cleaner, more sustainable automotive future.

Keywords: battery electric vehicles; sales personnel; core competency indicators

1. Introduction

1.1. The Role of BEVs in Achieving Sustainability Goals

The transition to battery electric vehicles (BEVs) is a key strategy in mitigating climate change and achieving global carbon neutrality [1,2]. With 137 countries and regions committing to net-zero emissions by 2050, governments worldwide are implementing policies to phase out fossil fuel vehicles and promote sustainable transportation solutions [3–5]. In line with this global effort, Taiwan has announced its 2040 fuel vehicle ban as part of its 2050 Net Zero Pathway, reinforcing its commitment to carbon reduction and green mobility [6]. BEVs are crucial in addressing environmental challenges, mainly by reducing carbon emissions, air pollution, and dependence on fossil fuels [7]. This transition aligns with SDG 13 (Climate Action) and SDG 11 (Sustainable Cities and Communities) by fostering sustainable urban mobility and supporting the development of clean energy infrastructure [8]. However, while policy measures and technological advancements continue to drive BEV adoption, the role

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of BEV sales personnel in influencing consumer decisions remains underexplored [9,10]. A well-trained workforce with expertise in BEV technology, charging infrastructure, and sustainable driving solutions is essential for successfully integrating BEVs into mainstream transportation networks [11].

1.2. The Evolving Competency Requirements for BEV Sales Personnel

As the BEV industry expands, traditional car sales strategies are no longer sufficient to address the complexities of electric vehicle adoption [12,13]. Unlike conventional fuel-powered vehicles, BEVs require a deeper understanding of battery technology, charging infrastructure, vehicle efficiency, and government incentives [14,15]. Moreover, the transition toward digital innovation has significantly transformed automotive sales and strategic management [16]. With artificial intelligence (AI)-powered analytics, online vehicle marketplaces [17], and data-driven customer insights, BEV sales have become increasingly reliant on digital tools to optimize customer engagement and decision-making processes [18]. BEV sales personnel must possess technical knowledge and be proficient in digital marketing, consumer behavior analysis, and innovative mobility solutions [19]. The integration of these competencies aligns with SDG 9 (Industry, Innovation, and Infrastructure) [20] by emphasizing the importance of technological advancements in sustainable business landscapes [21]. Despite the growing significance of these skills, limited research has been conducted on the specific competency indicators for BEV sales personnel, creating a gap in training and workforce development efforts [22].

1.3. Research Objectives: Establishing a Competency Framework

This study seeks to develop a core competency framework for BEV sales personnel, addressing the knowledge and skill gaps necessary for effective customer engagement and market expansion. The research identifies key competency dimensions by employing the Delphi Method, expert interviews, and statistical analysis, including technical knowledge, sales skills, customer communication, and strategic market positioning. The findings aim to provide a structured framework for recruitment, training, and evaluation within the BEV industry, ensuring that sales professionals are well-equipped to drive consumer adoption. This aligns with SDG 4 (Quality Education) [23] by emphasizing the importance of structured workforce training programs that enhance professional skills and adaptability in the evolving automotive sector [24]. Additionally, the competency framework is a foundation for automobile companies, sales centers, and academic institutions to refine training models, improve curriculum design, and bridge the gap between education and industry needs.

1.4. The Role of Digital Innovation and Strategic Management

In the digital transformation era, integrating strategic management principles with digital innovation [25] is essential for sustainable business growth [26]. The BEV market is rapidly shifting towards AI-driven sales models, online customer interactions, and data-centric business strategies [27]. Companies must adopt advanced digital tools to optimize customer engagement, personalize marketing approaches, and improve consumer decision-making processes [28,29]. This study highlights the critical need for BEV sales professionals to develop digital competencies, enabling them to navigate digital sales platforms and utilize data-driven insights effectively. By embedding technology and strategic management into BEV sales training, this research aligns with the MDPI special track "Integrating Digital Innovation and Strategic Management for a Sustainable Business Landscape," demonstrating how technology can enhance workforce efficiency and sustainability outcomes. These insights will help automotive companies design innovative sales models, improve workforce productivity, and drive digital transformation in the BEV sector.

1.5. Contributions to Sustainability and Business Innovation

By enhancing the competencies of BEV sales personnel, this research contributes to a digitally integrated, sustainability-driven automotive industry. The proposed competency framework supports strategic workforce development, ensuring that BEV professionals possess the skills to drive market expansion and promote sustainable transportation solutions. Furthermore, by integrating digital tools

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into sales strategies, companies can improve customer engagement, enhance market competitiveness, and accelerate BEV adoption. The study's findings will serve as a valuable reference for automobile manufacturers, sales training centers, policymakers, and academic institutions, fostering a highly skilled workforce capable of advancing sustainability initiatives. Through integrating digital innovation, strategic business management, and professional training, this research provides a pathway for achieving long-term environmental, economic, and social benefits, reinforcing the crucial role of BEV adoption in sustainable urban mobility.

2. Materials and Methods

2.1. Research Design and Objectives

The increasing demand for battery electric vehicles (BEVs) has transformed the automotive industry and created the need for a skilled workforce capable of supporting this transition. As governments and corporations worldwide push for carbon neutrality, BEV sales personnel play a crucial role in educating consumers, addressing technological concerns, and promoting sustainable mobility. However, existing research lacks a structured framework that defines the core competencies required for BEV sales professionals. This study aims to bridge this gap by identifying and validating key competency indicators for effective BEV sales, customer engagement, and strategic business development.

This research incorporates digital innovation and strategic management principles into BEV sales training to ensure that the competency framework aligns with global sustainability efforts. It supports SDG 9 (Industry, Innovation, and Infrastructure) by enhancing workforce readiness for clean energy transitions and SDG 4 (Quality Education) by developing structured training programs tailored to the evolving BEV market. Furthermore, by equipping sales personnel with the necessary expertise, the study contributes to SDG 11 (Sustainable Cities and Communities), facilitating more significant adoption of sustainable transportation solutions.

2.2. Research Methodology

This study employs the Delphi Method to establish a consensus among experts regarding the core competencies required for BEV sales personnel. The Delphi panel comprises senior managers, industry professionals with extensive sales experience, and academic experts specializing in automotive sales and green mobility. Through multiple structured surveys and expert feedback rounds, the study refines competency indicators and assesses their importance in the real-world sales environment. To validate expert consensus, Kolmogorov-Smirnov (K-S) and Kruskal-Wallis (K-W) statistical analyses are conducted to ensure reliability and consistency in the findings.

In addition to expert input, the study conducts an extensive literature review covering BEV technology, sales strategies, consumer behavior, and government policies related to electric vehicle adoption. By integrating theoretical research and industry expertise insights, the study develops a robust competency framework applicable to BEV sales training, workforce development, and strategic business planning.

2.3. Research Process and Implementation

The research follows a structured approach, beginning with a literature review to establish foundational knowledge and identify existing competency models in automotive sales. This is followed by expert consultations and Delphi surveys, where multiple rounds of data collection refine the competency indicators. Experts provide feedback on the technical knowledge, customer engagement skills, and sales strategies required for BEV professionals. Each survey round helps to improve and validate the competency framework, ensuring its relevance to the industry.

Once expert consensus is reached, the study applies statistical analysis to evaluate the consistency and significance of the identified competencies. By examining the level of agreement among experts, the research ensures that the competency indicators are practical, relevant, and adaptable to the

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evolving BEV market. The final competency framework is a foundation for training programs, sales performance evaluation, and recruitment strategies for BEV sales personnel.

2.4. Contribution to Digital Innovation and Sustainable Business Strategies

This research integrates digital innovation and strategic management into the competency framework, aligning with the MDPI special track "Integrating Digital Innovation and Strategic Management for a Sustainable Business Landscape." As the automotive industry shifts towards digital sales models, BEV sales professionals must develop expertise in AI-powered customer analytics, online sales platforms, and data-driven marketing strategies. This study emphasizes the need for continuous learning, adaptability, and digital proficiency, ensuring that BEV sales personnel remain competitive in an increasingly technology-driven market.

By enhancing workforce training and competency-based education, this research supports the broader goals of Sustainability, digital transformation, and business innovation. The findings will serve as a valuable resource for automotive companies, policymakers, and academic institutions, enabling them to develop effective training programs, optimize sales strategies, and drive sustainable business growth. Through the integration of digital tools, strategic workforce planning, and sustainability-focused sales techniques, this study provides practical solutions for advancing BEV adoption and building a skilled workforce for the future of sustainable mobility.

2.5. Research Scope

This study focuses on the core competencies required for BEV sales personnel, covering technical knowledge and essential sales skills. The research explores BEV structural principles, vehicle models, power performance, operational features, and proper handling of charging stations and equipment. Additionally, sales personnel must develop expertise in customer relationship management, communication, automotive insurance, vehicle delivery procedures, and after-sales services. A study conducted by Power (2019) in Taiwan's automotive market identified six key factors influencing customer satisfaction in new car sales, with sales personnel and delivery processes ranking among the most critical. The findings suggest that BEV sales professionals play a central role in shaping customer perceptions, reinforcing the need for structured competency training.

In addition to technical expertise, this study examines marketing strategies used in BEV sales, including product positioning, pricing models, promotional strategy, and distribution channels. The effectiveness of these strategies in driving BEV market growth is analyzed to understand how sales personnel can enhance consumer engagement. Furthermore, the study investigates customer demand analysis, exploring how BEV sales professionals assess consumer preferences, budget constraints, and driving needs to offer tailored product recommendations. Understanding market trends and competitive dynamics is also a key focus, as the research evaluates industry shifts and competitive positioning to help sales personnel develop more effective sales approaches.

Sales data analysis is another critical aspect of this study, assessing how BEV sales professionals leverage digital tools to track market performance, compare competing brands, and identify consumer purchasing patterns. By integrating data-driven decision-making, the research highlights how sales professionals can refine their sales strategies based on real-time insights. Lastly, customer relationship management (CRM) is explored in-depth, including customer feedback collection, complaint handling, and after-sales support, ensuring that BEV sales personnel are equipped to maintain strong, long-term customer relationships.

2.6. Research Limitations

This study employs the Delphi Method to gather insights from BEV sales experts, which introduces certain limitations. The reliance on expert opinions means that responses may be influenced by subjective judgment, personal experience, or emotional bias, potentially limiting the accuracy of the findings. Since experts must rely on their industry knowledge when completing surveys, their assessments may not fully reflect the real-world complexities of BEV sales operations.

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Another limitation arises from the sampling method, as the Delphi panel comprises a select group of industry and academic professionals, including senior automotive sales managers, dealership executives, and experienced sales personnel. While these individuals provide valuable insights, the limited sample size restricts the generalizability of the findings. The research conclusions are, therefore, applicable within the specific context of the experts surveyed but may require further validation through broader industry-wide studies.

Despite these limitations, the study offers a structured competency framework as a foundation for training programs, recruitment strategies, and professional development initiatives in the BEV sector. This research advances sustainable mobility by addressing technical and strategic competencies, equipping sales personnel with the skills needed to support the growing BEV market and align with global sustainability goals.

2.7. Delphi Method

2.7.1. Introduction to the Delphi Method

The Delphi Method is a structured research technique designed to gather expert opinions and build consensus on complex issues that lack sufficient quantitative data. Unlike traditional group discussions or brainstorming sessions, the Delphi Method relies on multiple rounds of anonymous surveys, allowing experts to provide feedback independently without being influenced by dominant personalities or group pressure. This iterative approach refines expert opinions over successive rounds until a consensus is reached, making it widely used in decision-making, policy formulation, and forecasting studies.

2.7.2. Characteristics and Application of the Delphi Method

Initially developed by the RAND Corporation in the 1960s for military and technological forecasting, the Delphi Method has since been adapted for various fields, including business, healthcare, education, and engineering. Unlike face-to-face meetings, this method is conducted through written questionnaires, often distributed via email or digital platforms. The process allows experts to respond independently, review summarized feedback from the previous round, and refine their opinions in subsequent iterations.

The success of the Delphi Method depends on selecting experts with deep knowledge and extensive practical experience in the research field. These experts must represent diverse perspectives, ensuring the results capture a broad and balanced view. Additionally, the Delphi process eliminates interpersonal conflicts and social biases, allowing for a more objective analysis of the research topic. This structured communication method ensures that every expert's opinion is valued equally, leading to collective decision-making based on expertise rather than influence.

2.7.3. Strengths and Limitations of the Delphi Method

The Delphi Method offers several advantages, making it a valuable tool for predictive analysis and expert-driven research. One of its key strengths is anonymity, which prevents dominant voices from overshadowing other participants and reduces the risk of bias. Experts can express their views freely without fear of criticism or pressure. Additionally, since the process is conducted remotely, it eliminates logistical challenges such as scheduling conflicts and geographical constraints. This flexibility allows experts to provide well-thought-out responses at their convenience.

However, the Delphi Method is not without limitations. The selection of experts is crucial, and a poorly chosen panel can lead to unreliable results. Additionally, the process requires multiple rounds, making it time-consuming. Experts may also revise their responses based on group feedback rather than their original perspective, potentially introducing groupthink or reducing the diversity of opinions. Furthermore, since reactions are based on subjective expertise rather than empirical data, findings may still carry an element of personal judgment. Despite these challenges, the Delphi Method remains widely accepted for structuring expert consensus on emerging or complex topics.

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2.7.4. Delphi Method Implementation Process

Implementing the Delphi Method follows a structured, multi-step process to ensure validity, reliability, and expert consensus. First, the research topic is defined, and relevant literature is reviewed to establish a foundation for questionnaire design. Next, experts are selected based on their qualifications, experience, and knowledge. These experts remain anonymous to one another throughout the study, ensuring independent assessments.

The first round of the Delphi survey consists of an open-ended questionnaire where experts provide their initial opinions. Responses are then aggregated, analyzed, and summarized into structured statements. In subsequent rounds, experts receive a revised questionnaire containing statistical summaries and feedback from previous rounds, allowing them to refine their views. This process repeats until a consensus is reached, typically after three or four rounds. The final step involves analyzing the agreed-upon indicators and interpreting their implications for the research objectives.

2.7.5. Statistical Analysis and Data Processing

To evaluate expert responses, the study employs descriptive statistics, including mean scores and standard deviation calculations, to assess the importance of different competency indicators. Higher mean scores indicate more substantial agreement on a given competency, while lower standard deviation values suggest higher consistency among expert opinions. The study also applies Kolmogorov-Smirnov (K-S) and Kruskal-Wallis (K-W) tests to ensure statistical significance and consistency across rounds. If consensus is not reached, additional refinements are made until the results become stable.

By employing a rigorous data analysis process, the Delphi Method ensures that the research findings are credible and applicable to real-world scenarios. The final consensus is a validated competency framework, providing practical insights for training programs, workforce development, and strategic decision-making in the BEV industry. Through expert-driven evaluations and statistical validation, this study establishes a comprehensive competency model that aligns with sustainable business strategies and digital innovation in automotive sales.

2.8. Expert Panel Selection and Delphi Method Implementation

This study aims to establish core competency indicators for BEV (Battery Electric Vehicle) sales personnel by leveraging the Delphi Method, which facilitates expert consensus through iterative feedback. The study was conducted in two stages: expert review for questionnaire validation and Delphi survey rounds to refine and confirm competency indicators.

Five experts were invited to review the questionnaire for validity and content accuracy in the initial stage. This panel comprised three academic scholars specializing in competency research and automotive sales education, along with two senior managers from the automotive industry in Table 1 with extensive experience in sales management and workforce training. The experts provided critical insights and modifications to ensure that the questionnaire comprehensively covered the necessary competencies for BEV sales professionals, balancing theoretical frameworks with industry applications.

Table 1. Questionnaire Content Validity Review Panel List.

No.	Expert	Domain Expertise
1	A	Academic-related field scholar
2	B	Academic-related field scholar
3	C	Academic-related field scholar
4	D	Senior manager in stable automobile sales business
5	E	Senior manager in stable automobile sales business

The Delphi survey was conducted in three rounds following the expert review, allowing experts to assess and refine the proposed competency indicators iteratively. This process ensured that the final

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competency framework was statistically validated, industry-relevant, and applicable to real-world BEV sales operations.

2.9. Delphi Expert Panel Composition

To ensure a comprehensive and representative expert panel, this study included 15 experts from different professional backgrounds in Table 2 within the automotive sales industry in Table 3. The panel was divided into three groups based on their roles and expertise:

Table 2. Delphi Expert Sampling Group Analysis Table.

Group	Category	Number of People
1	Sales Operations Group	5
2	Sales Management Group	5
3	Senior Sales Executive Group	5
	Total:	**15 people**

Data Source: Compiled by this research.

1. BEV Sales Consultants and Assistants (5 Experts)
   - Professionals with at least two years of BEV sales experience specializing in imported or domestic electric vehicle models.
   - Their input provided practical insights into the day-to-day competencies required for front-line BEV sales personnel, including customer engagement, technical knowledge, and sales execution strategies.
2. Sales Supervisors and Team Leaders (5 Experts)
   - Mid-level managers with over four years of experience in automotive sales and workforce training.
   - Their role focused on identifying critical competencies for managing sales teams, training new sales representatives, and overseeing customer satisfaction metrics.
3. Senior Sales Directors and Dealership Managers (5 Experts)
   - High-level executives with over ten years experience in BEV sales operations, dealership management, and strategic business planning.
   - Their expertise contributed to defining long-term competency frameworks, digital transformation strategies, and sustainable business development in BEV sales.

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Table 3. Delphi Expert List.

Group	Expert	Expertise
1-1	Proficient in imported vehicle pure electric car sales and related fields, with over 2 years of experience	Sales expertise in the electric vehicle industry
1-2	Proficient in imported vehicle pure electric car sales and related fields, with over 2 years of experience	Sales expertise in the electric vehicle industry
1-3	Proficient in domestic vehicle pure electric car sales and related fields, with over 2 years of experience	Sales expertise in the electric vehicle industry
1-4	Proficient in domestic vehicle pure electric car sales and related fields, with over 2 years of experience	Sales expertise in the electric vehicle industry
1-5	Proficient in domestic vehicle pure electric car sales and related fields, with over 2 years of experience	Sales expertise in the electric vehicle industry
2-1	Experienced sales management personnel with over 4 years of experience	Sales management expertise
2-2	Experienced sales management personnel with over 4 years of experience	Sales management expertise
2-3	Experienced sales management personnel with over 4 years of experience	Sales management expertise
2-4	Experienced sales management personnel with over 6 years of experience	Sales management expertise
2-5	Experienced sales management personnel with over 6 years of experience	Sales management expertise
3-1	Sales experience of over 10 years in senior positions	Senior sales executive
3-2	Sales experience of over 10 years in senior positions	Senior sales executive
3-3	Sales experience of over 10 years in senior positions	Senior sales executive
3-4	Sales experience of over 12 years in senior positions	Senior sales executive
3-5	Sales experience of over 12 years in senior positions	Senior sales executive

Data Source: Compiled by this research.

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2.10. Delphi Survey Process and Expert Consensus Development

The first round of the Delphi survey focused on identifying core competency dimensions and sub-dimensions, incorporating expert feedback to refine the questionnaire structure. In the second round, experts were provided with statistical summaries and qualitative feedback from the first round, allowing them to reassess and refine their evaluations. The third round aimed to achieve statistical convergence, with experts reaching a consensus on the final set of core competencies.

To ensure the reliability and significance of expert responses, mean scores, and standard deviation analyses were applied. Higher mean scores indicated more remarkable agreement on the importance of specific competencies, while lower standard deviation values confirmed consistency among expert opinions. Additionally, Kolmogorov-Smirnov (K-S) and Kruskal-Wallis (K-W) statistical tests were conducted to validate the level of consensus achieved in each round.

2.11. Finalized Competency Framework for BEV Sales Personnel

As a result of this structured Delphi process, the study successfully developed a comprehensive competency framework for BEV sales personnel, integrating technical expertise, customer relationship management, marketing strategies, and data-driven sales analysis. The framework is a practical guideline for recruitment, workforce training, and sales performance evaluation, ensuring that BEV sales professionals are well-equipped to navigate the rapidly evolving electric vehicle market.

The findings from this study provide valuable insights for automotive manufacturers, dealership managers, and policymakers, supporting the strategic development of BEV sales teams in alignment with sustainability goals and digital transformation trends.

2.12. Experiment Implementation

This study was conducted in two phases: expert content validity review and Delphi survey rounds to refine the core competency indicators for BEV sales personnel.

2.12.1. Expert Content Validity Review

The initial Delphi questionnaire draft was sent to five experts on February 26, 2024, for content validation. Experts were asked to assess the questionnaire's clarity, relevance, and comprehensiveness. After receiving feedback by March 15, 2024, the responses were analyzed, and necessary modifications were made to develop the final Delphi survey.

2.12.2. Delphi Survey Process

Delphi panel members were selected after consulting with the research advisor after the expert review. After obtaining their consent, the Delphi survey was conducted in three iterative rounds between March and April 2024. Each round involved distributing the questionnaire, collecting responses, and performing statistical analysis on mode, mean, and standard deviation to measure consensus. Each iteration refined the competency framework based on expert feedback until a stable consensus was reached. The final results formed the validated competency indicators for BEV sales personnel in Tables 4 and 5.

Table 4. Survey Implementation Schedule for Ethical Questionnaire.

Survey Round	Survey Dispatch Date	Survey Collection Date
First Round	March 16, 2024	March 30, 2024
Second Round	April 1, 2024	April 12, 2024
Third Round	April 14, 2024	April 24, 2024

[1] Source: Compiled from this study.

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Table 5. Survey Response Collection Status.

Survey Round	Surveys Sent	Surveys Collected	Response Rate
First Round	15	15	100%
Second Round	15	15	100%
Third Round	15	15	100%

[1] Source: Compiled from this study.

2.13. Statistical Analysis and Data Processing

2.13.1. Data Analysis Approach

This study conducted a three-round Delphi survey using SPSS 20.0 statistical software to analyze the collected data. The analysis focused on calculating the arithmetic mean, mode, and standard deviation to assess the degree of consensus among experts. The reliability and validity of the questionnaire were examined to ensure the accuracy and consistency of the results. To quantify expert opinions, a five-point Likert scale was used, ranging from "very important" (5 points) to "very unimportant" (1 point). Statistical tests, including Kolmogorov-Smirnov (K-S) one-sample test and Kruskal-Wallis (K-W) one-way ANOVA, were applied to verify the consistency of expert responses across different competency indicators.

2.13.2. Arithmetic Mean (M) and Importance Evaluation

The arithmetic mean (M) was used to measure the central tendency of expert ratings, reflecting the perceived importance of each competency indicator. Higher mean values indicate a greater extent, while lower values suggest reduced relevance. Following statistical guidelines, a mean score above 4.5 was classified as "very important," scores between 3.5 and 4.5 as "important," and scores below 3.5 as "not important". This study identified the most critical competencies for BEV sales personnel by ranking indicators based on their mean scores.

2.13.3. Standard Deviation (SD) and Consensus Measurement

Standard deviation was used to determine the variability of expert responses. A higher SD indicates a more significant divergence in expert opinions, whereas a lower SD suggests a strong consensus on a given competency indicator. The progression from the second to the third round of the Delphi survey was analyzed to assess whether expert opinions became more stable over time. A decreasing SD value across rounds signified increasing agreement and validation of the competency indicators.

2.13.4. Mode (Mo) and Expert Agreement

The mode representing the most frequently chosen response for each competency indicator was analyzed to determine the most widely accepted expert opinion. If the mode value for a given competency consistently appeared at the higher end of the Likert scale, it confirmed the broad expert agreement on the indicator's importance. This measure helped further validate the prioritization of key competencies.

2.13.5. Kolmogorov-Smirnov (K-S) Test for Expert Consistency

To ensure the statistical reliability of the Delphi results, the Kolmogorov-Smirnov (K-S) one-sample test was performed. This test examined whether expert ratings exhibited a uniform distribution, indicating consensus. The indicator was deemed inconsistent and excluded from the final competency framework if the p-value was more significant than 0.05 ($p > 0.05$). Conversely, if the p-value was below 0.05 ($p < 0.05$), it confirmed a substantial level of expert agreement on that competency indicator.

2.13.6. Kruskal-Wallis (K-W) Test for Group Consistency

The Kruskal-Wallis (K-W) one-way ANOVA was conducted to assess whether expert opinions varied significantly across professional backgrounds. If the p-value exceeded 0.05 ($p > 0.05$), it indicated

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no significant difference between expert groups, validating a unified competency framework. However, if the p-value was below 0.05 ($p < 0.05$), it suggested a lack of consensus among expert groups, and the competency indicator in question was considered for removal.

Through these rigorous statistical validation techniques, this study ensured that the final competency indicators for BEV sales personnel were both statistically sound and practically relevant. The findings provide a structured and reliable competency framework, supporting training programs, performance evaluations, and strategic workforce development in the BEV sector.

3. Results

This study employs a three-round Delphi survey to establish a consensus on the core competency indicators for BEV sales personnel. The first round gathers expert evaluations on the importance of various competency dimensions, sub-dimensions, and detailed indicators. In the second round, experts review the statistical results from the first round, allowing them to refine their assessments and adjust their rankings based on group feedback. The third and final round focuses on achieving consensus, ensuring the identified competencies are relevant and statistically validated. This iterative process enhances the reliability of the findings and ensures that the final competency framework aligns with industry needs and expert insights.

3.1. The First round of the Delphi Test

3.1.1. Overview of the First-Round Survey

The first round of the Delphi survey was conducted from March 16 to March 30, 2024, with 15 questionnaires distributed and fully completed by all 15 experts. This round aimed to gather initial expert evaluations on the core competency indicators for BEV sales personnel, covering four dimensions, 20 sub-dimensions, and 72 indicators. Using SPSS 20.0, statistical analyses were performed to calculate the mode, arithmetic mean, and standard deviation, assessing the level of agreement among experts. The summarized results of this round are presented in Table 6.

Table 6. Statistical Analysis of the First-Round Survey Indicator Constructs.

Indicator Constructs	Count	Mean	Standard Deviation
A. Professional Ability	5	4.60	0.507
B. Professional Knowledge	5	4.67	0.488
C. Professional Attitude	5	4.53	0.510
D. Personal Traits	4	4.00	0.756

[1] Source: Compiled from this study.

3.1.2. Analysis of Core Competency Dimensions

The first round established four dimensions, evaluated by experts on a five-point Likert scale ranging from "very important" (5) to "very unimportant" (1). The statistical results indicate a high level of agreement among experts, as shown in Table 6.

- "Professional Knowledge" received the highest rating (M = 4.67, SD = 0.488), highlighting its critical role in BEV sales.
- "Professional Skills" and "Professional Attitude" were also rated highly, with means of 4.60 and 4.53, respectively, confirming their importance.
- "Personal Traits" received a slightly lower mean score of 4.00, suggesting it is valued but not as critical as the other dimensions.

The standard deviations for all dimensions were below 0.8, indicating consistent expert agreement. The mode for all indicators ranged between 4 and 5, reinforcing the consensus among experts regarding their significance. Given the strong alignment in expert evaluations, no modifications were suggested for the competency framework at this level.

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3.1.3. Evaluation of Sub-Competency Dimensions

The 20 sub-dimensions further categorized the core competencies into more specific areas, covering aspects such as sales techniques, communication, customer service, product knowledge, and time management in Table 7. Key findings include:

- "Communication and Coordination" (M = 4.93, SD = 0.258) was rated as the most important sub-competency, emphasizing the critical need for BEV sales professionals to effectively convey information and build relationships with customers.
- "Consumer Behavior" (M = 4.53, SD = 0.640) and "Automobile Brand and Performance Knowledge" (M = 4.67, SD = 0.488) were also rated highly, indicating that understanding customer psychology and vehicle specifications is essential for successful BEV sales.
- "Automobile Insurance Knowledge" (M = 3.09, SD = 0.302) received the lowest rating, suggesting that while insurance knowledge is relevant, it is not a primary concern for sales personnel.

The results indicate that most sub-competency dimensions met or exceeded the importance threshold (M >= 3.5), and no major disagreements were found among experts.

Table 7. Statistical Analysis of the First-Round Survey Secondary Indicator Constructs.

Secondary Indicator Constructs	Count	Mean	SD
A-1 Sales Skills	5	4.60	0.507
A-2 Communication and Coordination Skills	5	4.93	0.258
A-3 Data Collection and Analysis Skills	4	4.07	0.458
A-4 Vehicle Key Point Skills	3	3.53	0.743
A-5 Customer Complaint Identification and Resolution Skills	5	4.33	0.724
A-6 Vehicle Function Operation Explanation Skills	4	4.20	0.561
A-7 Contract Review and Signing Skills	4	3.87	0.640
B-1 Potential Customer Marketing Knowledge	4	3.80	0.561
B-2 Consumer Behavior	5	4.53	0.640
B-3 Vehicle Brand Capability Knowledge	5	4.67	0.488
B-4 Vehicle Insurance Knowledge	3	3.09	0.302
B-5 Vehicle Maintenance Knowledge	4	4.13	0.352
B-6 Vehicle Operation Manual Application Knowledge	4	4.27	0.594
B-7 After-Sales Service Process Knowledge	5	4.60	0.507
C-1 Work Attitude	5	4.80	0.414
C-2 Learning Attitude	5	4.80	0.414
C-3 Service Attitude	4	4.20	0.414
D-1 Emotional Management	5	4.47	0.516
D-2 Time Management	4	3.93	0.594
D-3 Communication and Expression	5	4.80	0.414

[1] Source: Compiled from this study.

3.1.4. Analysis of Detailed Competency Indicators

72 indicators were evaluated across the four dimensions and 20 sub-dimensions at the most granular level. The findings further validated expert agreement:

- Most competency indicators received a mode of 4 or 5, with mean scores above 3.5, confirming their perceived importance.
- Standard deviations remained below 1.0, indicating minimal variability in expert responses.
- Highly rated competencies included:
  - "Explaining BEV Features and Performance" (M = 4.93, SD = 0.258)
  - "Understanding BEV Charging Technology" (M = 4.80, SD = 0.414)
  - "Maintaining a Professional and Responsible Work Attitude" (M = 5.00, SD = 0.000)
- Lower-rated competencies included:
  - "Understanding Automobile Insurance Policies" (M = 3.60, SD = 0.843)

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- "Managing Stress and Seeking Emotional Support" (M = 3.93, SD = 0.594)
- "Utilizing Digital Marketing Tools" (M = 4.00, SD = 0.756)

Despite minor variations in individual competency ratings, no experts suggested modifications to the questionnaire, confirming the suitability and coherence of the competency framework.

3.1.5. Summary of First-Round Delphi Results

The first round of the Delphi survey successfully established a strong expert consensus on the core competency dimensions, sub-dimensions, and detailed indicators for BEV sales personnel. Key findings include:

- All four dimensions were validated with high mean scores and strong expert agreement.
- 19 out of 20 sub-dimensions were rated important (M >= 3.5), except for automobile insurance knowledge.
- Most indicators received high ratings, with minimal disagreement among experts (SD < 1.0).
- No modifications were suggested for the questionnaire, indicating that the competency framework was well-structured and aligned with industry needs.

The results of this round provide a solid foundation for the second-round Delphi survey, where experts will re-evaluate the indicators to refine and enhance the framework further.

3.2. The Second round of the Delphi Test

The second round of the Delphi test, conducted from April 1 to April 12, 2024, involved 15 experts evaluating in Table 8 four main competency dimensions, 20 sub-dimensions in Table 9, and 72 specific indicators. Using SPSS 20.0 for statistical analysis, the results showed strong expert consensus.

Table 8. Statistical Analysis of the Second-Round Survey Indicator Constructs.

Indicator Constructs	Count	Mean	Standard Deviation
A. Professional Ability	5	4.67	0.488
B. Professional Knowledge	5	4.73	0.458
C. Professional Attitude	5	4.60	0.507
D. Personal Traits	4	4.07	0.704

Data Source: Compiled by this research.

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Table 9. Statistical Analysis of the Second-Round Survey Secondary Indicator Constructs.

Secondary Indicator Constructs	Count	Mean	SD
A-1 Sales Skills	5	4.60	0.516
A-2 Communication and Coordination Skills	5	4.93	0.352
A-3 Data Collection and Analysis Skills	4	4.07	0.458
A-4 Vehicle Handover Skills	3	3.67	0.799
A-5 Customer Issue Identification and Resolution Skills	5	4.33	0.724
A-6 Vehicle Function Operation Explanation Skills	4	4.27	0.617
A-7 Contract Review and Signing Skills	4	3.80	0.775
B-1 Potential Customer Marketing Knowledge	4	3.80	0.561
B-2 Consumer Behavior	5	4.60	0.640
B-3 Vehicle Brand Performance Knowledge	5	4.67	0.458
B-4 Vehicle Insurance Knowledge	3	3.18	0.405
B-5 Vehicle Maintenance and Care Knowledge	4	4.13	0.414
B-6 Vehicle Manual Application Knowledge	4	4.27	0.594
B-7 After-Sales Service Workflow Knowledge	5	4.60	0.507
C-1 Work Attitude	5	4.80	0.414
C-2 Learning Attitude	5	4.80	0.414
C-3 Service Attitude	4	4.20	0.458
D-1 Emotional Management	5	4.47	0.516
D-2 Time Management	4	4.00	0.535
D-3 Communication and Expression	5	4.73	0.488

Data Source: Compiled by this research.

For the four main competency dimensions—Professional Ability, Professional Knowledge, Professional Attitude, and Personal Traits—the mode ranged from 4 to 5, the mean exceeded 4, and the standard deviation remained below 0.8. These results indicate minimal variance and high agreement among experts, with no suggested modifications, confirming the indicators' consistency and applicability.

The 20 sub-dimensions covered sales, communication, customer service, automotive knowledge, and management skills. Most sub-dimensions had a mode of 3 to 5 and a mean above 3.5, except for Automobile Insurance Knowledge (B-4), which had a mean of 3.18. The standard deviation remained below one across all indicators, signifying stable expert opinions. Given the absence of suggested revisions, the indicators are considered valid and suitable for application.

3.3. Comparison of Expert Opinion Consistency Between the First and Second Delphi Rounds

Expert opinion consistency can be assessed by analyzing changes in standard deviation. A higher standard deviation indicates more significant disagreement, while a lower value reflects consensus. As shown in Table 4-8, the standard deviation in the second round was generally lower than in the first, except for eight specific indicators that showed slight increases. Among 72 indicators, 50 remained unchanged, while 14 had lower standard deviations than in the first round. The overall standard deviation average decreased from 0.524 in the first round to 0.520 in the second, indicating increased expert agreement.

Notably, the B-4 "Automobile Insurance Knowledge" indicator remained consistently unimportant across both rounds. Experts noted that advancements in technology allow consumers to easily purchase car insurance online, compare rates, and complete transactions without the assistance of sales personnel. However, after discussion, the experts decided to retain this indicator for further evaluation in the third round of the Delphi survey.

3.4. The Third round of the Delphi Test

This study conducted the third round of the Delphi questionnaire from April 14 to April 24, 2024, distributing 15 questionnaires and receiving 15 valid responses in Table 10. Using SPSS 20.0

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for statistical analysis, expert opinions were evaluated across four main competency categories, 20 subcategories in Table 11, and 72 specific indicators.

Table 10. Statistical Analysis of the Third-Round Survey Indicator Constructs.

Indicator Constructs	Count	Mean	Standard Deviation
A. Professional Skills	5	4.67	0.488
B. Professional Knowledge	5	4.87	0.352
C. Professional Attitude	5	4.60	0.507
D. Personal Traits	4	4.13	0.743

Data Source: Compiled by this research.

3.4.1. Competency Dimensions

Experts rated four main competency dimensions: Professional Skills, Professional Knowledge, Professional Attitude, and Personal Traits. The results showed that all dimensions had a mode of 4 or 5, an average score above 4, and a standard deviation below 0.8, indicating strong consensus. No experts suggested modifications, confirming the validity and consistency of the indicators.

3.4.2. Subcategory Analysis

Among the 20 subcategories, most received mode ratings of 3 to 5, with an average score above 3.5, except for Automobile Insurance Knowledge (3.18), which was considered less critical. The Vehicle Handover Skills (3.73, SD = 0.884) had the highest variance, reflecting mixed expert opinions. Experts cited Tesla's shift to "zero-contact" vehicle delivery due to COVID-19 as a key reason for differing perspectives.

3.4.3. Detailed Indicator Analysis

The 72 specific indicators were rated similarly, with most receiving mode values of 4 or 5. A few indicators related to data collection, industry trends, and competitor analysis showed slightly lower scores, suggesting they are less critical in practice. However, the results confirm expert consensus on key competencies required in the automotive sales and service industry. The third round of the Delphi test demonstrated strong expert agreement on the competency framework, with no further modifications suggested. The findings confirm the appropriateness and reliability of the selected indicators.

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Table 11. Statistical Analysis of Competency Indicators from the Third Delphi Round.

Competency Indicator	Mode	Mean	SD
A-1 Sales Skills	5	4.60	0.507
A-2 Communication Coordination Skills	5	4.80	0.561
A-3 Data Collection and Analysis Skills	4	4.07	0.458
A-4 Vehicle Handover Skills	3	3.73	0.884
A-5 Customer Complaint Judgment and Resolution	5	4.33	0.724
A-6 Vehicle Function Operation Explanation	4	4.20	0.561
A-7 Contract Review and Signing Skills	4	3.87	0.743
B-1 Potential Customer Behavior Knowledge	4	3.80	0.561
B-2 Consumer Behavior	5	4.47	0.617
B-3 Vehicle Brand Performance Knowledge	5	4.60	0.632
B-4 Vehicle Insurance Knowledge	3	3.18	0.405
B-5 Vehicle Maintenance and Repair Knowledge	4	4.13	0.352
B-6 Vehicle Operation Manual Application Knowledge	4	4.27	0.594
B-7 After-Sales Service Procedures Knowledge	5	4.60	0.507
C-1 Work Attitude	5	4.80	0.414
C-2 Learning Attitude	5	4.80	0.414
C-3 Service Attitude	4	4.13	0.352
D-1 Emotional Management	5	4.47	0.516
D-2 Time Management	4	4.00	0.535
D-3 Communication and Expression	5	4.73	0.458

This table presents the mode, mean, and standard deviation for various competency indicators based on expert consensus.

4. Discussion

Based on a three-round Delphi survey, expert opinions reached a consensus regarding the core competencies required for sales personnel in the pure electric vehicle industry. This section presents a comprehensive analysis based on the third-round survey results, categorized into four dimensions, 20 sub-dimensions, and 58 indicators.

4.1. Importance of Four Dimensions for Pure EV Sales Personnel

Experts unanimously agree on four-dimensional constructs for pure electric vehicle (EV) sales personnel. They are ranked by importance based on average scores: Professional Knowledge, Professional Skills, Professional Attitude, and Personal Traits. The first three are deemed "very important," while Personal Traits are considered "important." This underscores that professional knowledge, skills, and attitude are essential for sales personnel in this field.

4.2. Importance of 20 Sub-Dimensions for Pure EV Sales Personnel

It indicates that pure EV sales personnel should possess 20 sub-dimensions at the second level. Based on average scores, seven indicators are considered "very important," while twelve are classified as "important." Only the "B-4 Automotive Insurance Knowledge" indicator falls below the "important" level. The top three most essential competencies identified are "Communication and Coordination Skills," "Work Attitude," and "Learning Attitude," highlighting the critical role of both interpersonal and professional attributes in EV sales.

4.3. Importance of 58 Indicators for Pure EV Sales Personnel

It indicates that pure EV sales personnel should possess 58 indicators at the third level. Among these, 35 indicators are classified as "very important," while 22 are considered "important." Only one indicator, A-3-1—"Proficiency in computer documentation systems and EV subsidy application processes to enhance work efficiency"—did not reach the "important" level. In terms of importance ranking, the top indicators include B-5-2—"Ability to clearly explain vehicle warranty coverage, including part replacements and repairs," B-7-3—"Ability to provide customers with after-sales support information, including customer service hotlines, emergency assistance, and roadside support," C-1-

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1—"Ability to work independently with a strong sense of responsibility," and C-2-1—"Ability to value customer needs and opinions while providing professional advice." The importance of each indicator is ranked based on average scores.

5. Conclusions

This study primarily explores the core competency indicators for sales personnel in the pure electric vehicle (EV) industry. The findings provide a basis for automotive sales centers to train new sales staff, select and promote outstanding employees to managerial positions, and help current EV sales personnel assess their competencies.

To achieve this objective, the study first gathered relevant domestic and international literature and journal sources to analyze the essential competency indicators required for EV sales personnel. Expert reviews were conducted to validate the content, followed by a Delphi survey involving three groups of experts from different professional backgrounds. Through three rounds of surveys, the study identified the core competency indicators for EV sales personnel and assessed the importance of each indicator. The conclusions and recommendations from this research aim to assist EV sales centers in talent recruitment, pre-employment training, and future research in this field.

Through the three rounds of the Delphi survey, a structured framework of core competencies for EV sales personnel was established. The competency framework consists of three levels:

- First level: 4 Dimension
- Second level: 20 Sub-Dimension
- Third level: 58 Indicators

5.1. Dimension for Pure EV Sales Personnel

Based on the Delphi survey results, the four dimensions were evaluated as follows:

- Three domains—Professional Knowledge, Professional Skills, and Professional Attitude—were rated as "very important."
- The fourth domain—Personal Traits—was rated as "important."
- Among them, Professional Knowledge received the highest average score of 4.87, indicating its paramount significance.

Experts unanimously agreed that Professional Knowledge is the most crucial competency for EV sales personnel. This includes an in-depth understanding of various brands and models of EVs, such as vehicle specifications, performance, range, charging times, and safety features. Additionally, knowledge of market trends, competitor strategies, government policies, and subsidies is essential. Such knowledge enables sales personnel to position products effectively, provide valuable recommendations to customers, and confidently address their concerns. In summary, Professional Knowledge is critical for improving sales performance and instrumental in building customer trust and driving the growth of the EV market. Experts collectively ranked it as the top competency indicator.

5.2. Sub-Dimensions for Pure EV Sales Personnel

Analysis of the study results shows that experts considered the following sub-competencies as the most essential:

- Top 3 sub-dimensions: Communication and Coordination Skills, Work Attitude, and Learning Attitude.
- Second-tier important competencies: Sales Techniques, Knowledge of Automotive Brands and Performance, and Knowledge of After-Sales Service Procedures
- Third-tier important competencies: Consumer Behavior Understanding and Emotional Management.

Communication and Coordination Skills, Work Attitude, and Learning Attitude were the most critical sub-competencies. Effective communication is vital in automotive sales, as it involves un-

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derstanding customer needs and guiding them toward suitable vehicle choices. Additionally, sales personnel must coordinate with various departments (e.g., finance, service, and logistics) to ensure smooth transactions. A positive and proactive work attitude enhances customer experience and trust, ultimately increasing sales success.

Moreover, continuous learning is essential, given the rapid advancements in EV technology and industry trends. Sales personnel must stay updated on new developments and integrate them into their strategies to maintain competitiveness and meet diverse customer needs.

These three competencies play a pivotal role in establishing long-term customer relationships, enhancing service quality, and improving sales efficiency, ultimately contributing to increased profitability for companies. They are crucial for individual success and the success of the entire sales team and organization.

5.3. Indicators for Pure EV Sales Personnel

The study findings indicate that among the 58 indicators:

- 35 items were rated as "very important."
- 22 items were rated as "important."

The most highly rated competency items included:

- B-5-2: Ability to clearly explain the vehicle's warranty coverage, including replacement parts and repair policies.
- B-7-3: Ability to provide after-sales support information, such as customer service hotlines, emergency assistance, and roadside support.
- C-1-1: Ability to work independently with a strong sense of responsibility.
- C-2-1: Ability to prioritize customer needs and opinions, providing professional advice accordingly.

Statistical analysis confirms that Professional Knowledge remains the most critical competency among the four dimensions, followed by Professional Skills, Professional Attitude, and Personal Traits. Within these domains, the top-ranking specific competency items reflect the need for sales personnel to possess technical knowledge and demonstrate strong professional abilities and customer-centric attitudes.

5.4. Comprehensive Conclusion

This study systematically identifies the core competencies required for EV sales personnel, emphasizing the critical role of Professional Knowledge, Professional Skills, and Professional Attitude in achieving sales success. Key competencies such as communication, work ethic, and adaptability are indispensable for fostering strong customer relationships and staying competitive in the evolving EV market.

The findings provide actionable insights for:

- Automotive sales centers: Enhancing recruitment strategies and refining training programs.
- Training institutions: Developing targeted pre-employment training curricula.
- Future researchers: Using this competency framework as a foundation for further EV sales and professional development studies.

By equipping EV sales personnel with the right competencies, companies can improve sales performance, enhance customer satisfaction, and drive the adoption of electric vehicles in the market.

5.5. Suggestions

Our team explores the key competency indicators for sales personnel in the pure electric vehicle (EV) sector, identifying "knowledge," "skills," and "attitude" as the three core pillars of sales success. Among these, "communication and coordination skills," "work attitude," and "learning attitude" are proven to be the most critical sub-dimensions. Additionally, knowledge of after-sales service

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procedures and an understanding of automotive brand performance are essential factors in enhancing customer satisfaction and sales performance.

5.5.1. Recommendations for Automotive Sales Centers

Given that pure EV sales personnel should focus on the three key areas of "knowledge," "skills," and "attitude," with particular emphasis on "communication and coordination skills," "work attitude," and "learning attitude," training programs should prioritize communication skills, foster a positive work ethic, and cultivate a mindset of lifelong learning. Research suggests that job competency is closely tied to an individual's core skills for the role. Therefore, it is recommended that HR departments refer to this study's findings to design pre-employment training programs, continuously updating sales personnel's knowledge and skills to maintain competitiveness. This approach will help develop EV sales professionals with expertise in sales, management, and interpersonal skills.

5.5.2. Recommendations for Pure EV Sales Personnel

The high scores for "communication and coordination skills," "work attitude," and "learning attitude" (average score of 4.80) indicate their essential role in sales. Additionally, "sales techniques," "automotive brand performance knowledge," and "after-sales service knowledge" (average score of 4.60) are also deemed highly important. Given the nature of sales, personnel must build customer trust through effective communication and coordination with internal and cross-departmental teams. Based on this study's findings, sales professionals should assess their competencies and seek further training or internal company workshops to enhance their skills. Strengthening these abilities will help secure strong sales performance in the highly competitive pure EV market.

5.5.3. Recommendations for Future Researchers

- Scope of Research: This study focuses on sales personnel at automotive sales centers. However, large-scale dealerships and brand headquarters also play significant roles. Future studies should explore sales teams at regional automotive sales centers to determine whether the competency indicators identified in this study apply across different organizational levels.
- Research Participants: The Delphi method used in this study involved professionals such as sales center directors, managers, sales specialists, and sales assistants. Future researchers may consider including personnel from major automotive brands and executives at different levels to provide broader perspectives, enriching the study's depth.
- Research Application: This study evaluates indicator importance based solely on mean scores. It is recommended that future research employ the Analytic Hierarchy Process (AHP) to analyze weightings, providing companies with a more refined reference for talent selection and promotion. The competency framework developed in this study can serve as a benchmark for evaluating sales personnel. Conducting surveys among sales teams based on these competencies will help individuals understand their current skill levels and address areas for improvement. Additionally, considering the UN's 2030 Sustainable Development Goals (SDGs)—including climate action, affordable clean energy, and responsible consumption—future research could explore how integrating these elements into sales strategies impacts consumer decision-making.

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Abbreviations

The following abbreviations are used in this manuscript:

BEV	Battery Electric Vehicle
K-S	Kolmogorov-Smirnov one sample test
K-W	Kruskal-Wallis one-way analysis of variance by ranks
CSR	Corporate Social Reponsability
CRM	customer relationship management
SD	Standard Deviation
SDGs	Sustainable Development Goals

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