

Key Factors in Distribution Agent Selection for Semiconductor Manufacturers: An Analytic Hierarchy Process Approach

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Abstract

Semiconductor products are highly specialized and capital intensive, making it difficult for manufacturers to cover all markets through self-built channels alone; distribution agents have therefore become an essential strategic tool for entering regional markets and responding rapidly to change. Combining a systematic literature review with two rounds of focus group discussions, this study applies the analytic hierarchy process (AHP) to construct a hierarchical framework of the factors influencing distribution agent selection by semiconductor manufacturers, comprising five criteria—new market development, customer maintenance, operating costs, technical knowledge, and brand control—and twenty-two sub-criteria. The results show that new market development is the most important of the five criteria. In the overall ranking of sub-criteria, regional coverage breadth is the most important

factor, followed by customer response speed and frequency, customer development capability, flexibility of sales incentive systems, and after-sales technical support capability, indicating that manufacturers place the greatest emphasis on agents' market expansion capability, customer service efficiency, and operational flexibility. Although ESG commitment currently carries a relatively low weight, tightening international sustainability regulations are expected to make it an increasingly critical differentiating factor in the medium and long term. The proposed framework provides semiconductor manufacturers with a systematic evaluation benchmark for establishing distribution channels and a reference for global market deployment strategies. In this study, thirty-one experts ($N = 31$) completed the AHP questionnaire, and all pairwise comparison matrices satisfied the consistency requirement ($C.R. \leq 0.10$). Among the five criteria, new market development carried the highest weight (0.406), followed by customer maintenance (0.286); in the overall ranking of the twenty-two sub-criteria, regional coverage breadth ranked first (global weight 0.270). Although ESG commitment currently carries the lowest weight, tightening international sustainability regulations are expected to make it an increasingly important differentiating factor. These findings suggest that semiconductor manufacturers should prioritize agents' market-expansion capability and customer-service responsiveness when selecting distribution partners.

Keywords: Global semiconductor industry, Distribution agent selection, Analytic hierarchy process (AHP), Semiconductor distribution, Brand control

1. Introduction

The global semiconductor industry is in a stage of sustained growth and rapid change. According to statistics from SEMI and related market research institutions, the global semiconductor market exceeded USD 570 billion in 2023 and is expected to surpass the trillion-dollar mark within the next decade (Hasan et al., 2024), with growth driven mainly by emerging applications such as artificial intelligence, 5G, the Internet of Things, autonomous vehicles, cloud computing, and green energy industries. Meanwhile, US-China technology competition, geopolitical conflicts, and the chip acts successively introduced by various countries have accelerated the restructuring of semiconductor supply chains (Ryu, 2025; Zheng et al., 2025). Semiconductor products are characterized by high specialization, technological intensity, and enormous capital investment; when entering different regional markets, manufacturers often cannot satisfy diverse demands through self-built channels alone, and distribution agents have consequently become a key strategic tool for semiconductor manufacturers to expand into international markets (Le et al., 2025). Through agents, firms can reduce market entry risks and costs, respond quickly to customer needs, and provide localized technical support and after-sales service. In recent years, the global semiconductor market has also placed increasing emphasis on ESG principles: whether agents comply with green supply chain requirements, promote local social responsibility, and maintain governance structures that meet compliance standards has gradually become an important consideration in channel selection (Wang, 2024; Ketterling & Germany, 2025).

Taiwan is a pivotal hub in the global semiconductor supply chain, possessing a complete

cluster of upstream, midstream, and downstream industries (Coe, 2021). Taiwan's semiconductor industry surpassed NT\$4 trillion in total output value in 2023, with its foundry market share exceeding 60% and ranking first worldwide (Jia et al., 2025). In international market expansion, however, most Taiwanese manufacturers, while enjoying advantages in manufacturing and technology, are relatively weak in marketing and brand management, resulting in heavy reliance on distribution agents to reach overseas customers (Zahoor & Lew, 2023); if agent selection lacks systematic standards, the consequences may include limited market penetration, inconsistent brand image, or excessive operating costs. Furthermore, regional markets differ significantly in regulations, culture, and ESG norms; the European Union has imposed stricter sustainability requirements on supply chains, and agents unable to meet such standards will affect manufacturers' operations and brand reputation in those regions.

Regarding the research gap, previous semiconductor channel models have centered on traditional distributors, emphasizing inventory stocking, price negotiation, and regional customer maintenance (Mönch et al., 2018), while research focusing specifically on distribution agent selection in the semiconductor industry remains insufficient. Most prior studies have concentrated on consumer electronics, fast-moving consumer goods, or traditional manufacturing, rarely addressing the high technological intensity and internationalization of the semiconductor industry; the existing literature has also seldom incorporated ESG factors into agent selection frameworks. These gaps mean that semiconductor manufacturers still rely largely on experiential judgment when formulating distribution channel strategies, lacking systematic and scientific analytical tools—hence the motivation for this study. More recent studies further underscore this gap: although recent work has examined semiconductor supply-chain resilience and channel digitalization (Jia et al., 2025; Le et al., 2025; Ghoubach & El Amine, 2025), and international marketing capability in emerging-market firms (Zahoor & Lew, 2023; Hidayati et al., 2025; Rumapea & Gerardo, 2024), none has provided a systematic, criteria-weighted evaluation model specifically for distribution agent selection in the semiconductor industry, and the integration of ESG considerations into such a model remains absent. This study addresses that gap by constructing an AHP-based evaluation framework that jointly incorporates market development, customer maintenance, operating cost, technical knowledge, brand control, and ESG sub-criteria.

This study applies the analytic hierarchy process (AHP) as its research method. The AHP is a structured multi-criteria decision-making method that decomposes complex problems into hierarchical levels and dimensions, and derives the relative weights of criteria and sub-criteria through expert pairwise comparisons, thereby integrating qualitative and quantitative analysis (Saaty, 1980). Through a literature review and the synthesis of focus group opinions, this study constructs a hierarchical framework for distribution agent selection comprising the five criteria of new market development, customer maintenance, operating costs, technical knowledge, and brand control, together with their twenty-two sub-criteria. An AHP questionnaire survey was then conducted to collect expert judgments and compute the relative weights and rankings of all key factors, so as to identify the most important

dimensions influencing distribution agent selection, provide semiconductor manufacturers with a scientific basis for decision-making under global market competition, and help firms establish systematic agent evaluation mechanisms that enhance operational efficiency and sustainable development capability.

1.1 Research Purposes

This study aims to investigate the key factors influencing distribution agent selection by semiconductor manufacturers. The research questions are as follows: (1) What are the principal factors influencing semiconductor manufacturers' selection of distribution agents? (2) What is the relative importance of the different factors in distribution agent selection?

Accordingly, the purposes of this study are: (1) to clarify the key criteria and sub-criteria influencing semiconductor manufacturers' distribution agent selection and establish a systematic analytical foundation; and (2) to identify the most critical criteria through the analysis of relative weights, thereby providing concrete references for firms in formulating channel strategies.

1.2 Research Process

The study first established the research background and purposes, collected and synthesized relevant domestic and international literature to identify the key factors influencing distribution agent selection by semiconductor manufacturers, and constructed the hierarchical framework accordingly. Next, a questionnaire was designed based on the dimensions and sub-dimensions derived from the literature review, and industry experts were invited to focus group discussions to confirm the reasonableness and completeness of the framework. Hierarchical questionnaires were then distributed to collect expert opinions, and empirical analysis was conducted to compute the weights and rankings of all dimensions and sub-dimensions. Finally, managerial implications and concrete recommendations were derived from the results as references for industry decision-makers in formulating global market expansion and agency strategies.

2. Literature Review

This chapter reviews and synthesizes the theoretical and empirical literature relevant to this study. It comprises four parts: the background of the semiconductor industry; semiconductor distributors and channel strategy; key factors in distributor selection; and the analytic hierarchy process.

2.1 Background of the Semiconductor Industry

Since its emergence in the mid-twentieth century, the semiconductor industry has become a vital engine of global technological progress and economic growth. The birth of the integrated circuit in 1960 greatly improved chip functionality and reliability (Iwai & Misra, 2022); subsequent milestones—the advent of DRAM and microprocessors and continuous process scaling—drove the popularization of personal computers, communications equipment, and consumer electronics. Entering the twenty-first century, as Moore's law gradually approaches its physical limits, the industry has shifted from process scaling toward

heterogeneous integration and system-on-chip development, while the rise of AI, 5G, IoT, autonomous driving, and green energy applications continues to increase chip demand (Oliver, 2024). According to data from the World Semiconductor Trade Statistics organization and the Semiconductor Industry Association, the global semiconductor market rebounded to USD 627 billion in 2024 and is expected to exceed USD 1 trillion by 2030 (Zhuo & Tiew, 2025). In regional terms, the Asia-Pacific region accounts for more than 60% of the global market, the United States leads in design and equipment, and Europe holds advantages in automotive electronics and industrial applications (Jia et al., 2025). The semiconductor industry is highly specialized with a clear division of labor; its value chain structure is shown in Table 1.

Table 1. The value chain structure of the semiconductor industry

Segment	Main content	Representative countries/firms
Upstream	Raw materials (silicon wafers, photoresists, gas chemicals) and production equipment (lithography, etching, and test equipment)	United States (Applied Materials); Japan (Tokyo Electron); Netherlands (ASML)
Midstream	IC design, wafer fabrication, packaging, and testing	United States: NVIDIA, Qualcomm; Taiwan: TSMC, ASE; South Korea: Samsung; Mainland China: SMIC
Downstream	Application industries, including information and communications (PCs, servers, smartphones), automotive electronics, industrial automation, and energy management	Apple, Intel, Tesla, Siemens, Schneider Electric

Taiwan plays a key role in the global semiconductor industry, with a complete upstream-midstream-downstream cluster: TSMC leads the foundry segment, Taiwan's IC design sector ranks second globally after the United States, and its packaging and testing industry has long occupied a top-three position worldwide, demonstrating the completeness and competitiveness of the industrial chain. In recent years the industry has attached growing importance to sustainable development and ESG requirements; energy-saving processes, carbon emission reduction, and green supply chains have become core strategies of leading global firms (Jiang et al., 2025). Overall, the global semiconductor industry is characterized by high technological barriers, capital intensity, international division of labor, and rapid evolution; despite repeated financial crises, chip shortages, and geopolitical challenges, it continues to demonstrate strong resilience and growth potential (Cao, 2025).

2.2 Semiconductor Distributors and Channel Strategy

In a globalized and highly competitive market environment, channel strategy has become critical to whether firms can effectively reach customers and expand markets; marketing channels are not merely paths of product flow but essential links in value creation and customer relationship building (Kalwey et al., 2025; Le Meunier-FitzHugh & Piercy, 2007; Mariam, 2025). For the semiconductor industry, products are highly technology-intensive, capital-intensive, and specialized, market demand changes rapidly, and applications are diverse, making it difficult for firms to cover global markets solely with self-built sales and service teams. Agents thus become indispensable partners: they are familiar with local regulations, culture, and customer needs (De Mooij, 2021), help manufacturers lower entry

barriers and shorten market development time, and provide pre-sales design advice and after-sales technical support through professional engineering teams, enhancing customer stickiness and long-term cooperation (Zeithaml et al., 1996).

Previous semiconductor channel models centered on traditional distributors, emphasizing inventory stocking, price negotiation, and regional customer maintenance, with relatively opaque supply chain information (Mönch et al., 2018). With cloud computing, advanced process technology, and the rapid diversification of end applications, semiconductor channels are now shifting toward technical-support-oriented channels and online real-time supply platforms; agents must possess application-side design capability, DFX technical support, resilient supply chain management, real-time inventory visibility, and cross-regional collaborative services (Sundar, 2025; Kumar, 2025). Moreover, as ESG issues gain attention, the agent's role is no longer confined to sales intermediation: firms must demonstrate capabilities in supply chain sustainability, data transparency, and compliance to satisfy international markets and brand owners (Dong et al., 2024; Badakhshan & Ivanov, 2025). Agents have become strategic partners capable of maintaining brand image, promoting corporate sustainability, and strengthening market competitiveness.

2.3 Key Factors in Distributor Selection

Based on the literature, this section defines the meanings of the five dimensions—new market development, customer maintenance, operating costs, technical knowledge, and brand control and their twenty-two sub-criteria, providing the theoretical foundation for the subsequent construction of the hierarchical framework and questionnaire design. The definitions and supporting references of all evaluation criteria and sub-criteria are summarized in Table 2.

Table 2. Definitions and supporting references of the evaluation criteria and sub-criteria for distribution agent selection

Criterion /Sub-criterion	Definition and implications	References
New market development	In the global semiconductor industry, developing new markets has always been an essential strategy for firms to sustain growth and strengthen competitiveness.	Ujam (2025)
Regional coverage breadth	Whether an agent can establish comprehensive sales and service networks across regions directly affects the speed and efficiency of market entry.	Kalwey et al. (2025); Steinberg et al. (2025)
Customer development capability	Agents with strong customer development capability help manufacturers precisely target customer groups—especially large OEMs, cloud computing providers, and emerging technology companies—and improve market penetration through long-term relationships.	Alonge et al. (2025); Zheng et al. (2025)
Local market familiarity	Agents familiar with local environments can effectively lower entry barriers, help manufacturers meet compliance requirements, adjust marketing strategies, and enhance brand trust.	Ruiz (2025); Ketterling and Germany (2025)
Customer maintenance	Customer maintenance is not only the basis of continued sales but also the key to consolidating a firm's position in highly competitive markets.	Hajar et al. (2022)
Customer response speed and frequency	Market demand changes rapidly, and customers frequently face urgent orders, design changes, or supply chain disruptions; agents	Ofobike (2025); Dzureke (2025)

	providing timely and stable responses effectively reduce customer uncertainty and increase reliance on and trust in the manufacturer.	
After-sales technical support capability	Semiconductor product adoption often requires complex testing, verification, and calibration; agents with professional engineering teams can provide immediate technical solutions during adoption and subsequent application, reducing customer risk and enhancing the manufacturer's professional brand image.	Li et al. (2025); Du et al. (2025)
Customer stickiness and loyalty	An important indicator of whether an agent can sustain long-term cooperation; highly sticky customers rarely switch suppliers for price or short-term incentives, valuing instead the trust, service, and stability of long-term relationships.	Adnan et al. (2025); Darshana (2025)
Long-term relationship maintenance capability	Emphasizes not one-off transactions but the capability to build strategic partnership relationships.	Sundar (2025); Mariam (2025)
Operating costs	One of the key factors determining whether a firm can maintain market competitiveness.	Abubakar et al. (2024)
Flexibility of sales incentive systems	Incentive systems that combine flexibility with motivational power ensure that agent teams remain active in business expansion and customer service amid rapidly changing market demand.	Cao (2025); Agrawal and Mukherjee (2025)
Agency commission structure	The reasonableness of the commission structure affects cooperation stability; overly rigid or unattractive commission systems may weaken agents' enthusiasm, affecting market penetration and customer management quality.	Meyer and Truccone (2025)
Cost controllability and predictability	Crucial for manufacturers' long-term planning; amid volatile market demand, agents offering stable and transparent cost structures facilitate financial forecasting and risk reduction.	Guo et al. (2025); Zaman (2025)
Operating expense transparency	Clear expense allocation and expenditure management allow manufacturers to grasp resource utilization effectively, reduce potential financial risks, and strengthen the foundation of trust.	Jia et al. (2025)
Logistics and inventory management efficiency	Agents demonstrating efficient logistics shorten delivery cycles and reduce inventory pressure, lowering overall operating costs and improving customer satisfaction; sound inventory management helps avoid shortages or overstock caused by unstable supply.	Ghoubach and El Amine (2025); Badakhshan and Ivanov (2025)
Technical knowledge	Semiconductor products are highly specialized and rapidly updated; agents need not only sales capability but also sufficient technical knowledge to ensure products enter the market smoothly and are effectively adopted by customers.	Cao (2025)
Frequency of professional training	Continuous professional training enables agents to keep abreast of the latest product features and application scenarios and to demonstrate expertise in customer interactions, enhancing trust and willingness to cooperate.	Thanasi-Boçe and Hoxha (2024); Bousetouane (2025)
Technical communication capability	Agents able to convey highly complex technical concepts clearly facilitate product adoption, help customers shorten learning curves, and further strengthen cooperative relationships.	Gnewuch et al. (2024); Tan et al. (2024)
Speed of grasping product updates	As semiconductor technology iterates faster, agents that quickly track and understand product updates can convey the latest information to customers in real time, avoiding competitive disadvantages caused by information gaps.	Oliver (2024)
New technology adoption capability	Agents that quickly master new technologies such as AI chips and advanced packaging and assist customers in adoption demonstrate technological foresight and establish market leadership advantages for manufacturers.	Dong et al. (2025)
Brand control	Semiconductor products are highly specialized and their value chains span multiple regions, making agents' role in brand promotion and control especially important.	Jiang et al. (2025)

TPrice stability	Agents that effectively maintain price consistency protect manufacturers' profit margins and prevent brand value erosion caused by price wars.	Majka (2024); Nagle et al. (2023)
Consistency of promotional messages	Ensures the brand conveys the same core concepts and values across regions, avoiding cognitive confusion or declining trust caused by inconsistent messaging.	De Mooij (2021)
Brand image maintenance capability	Agents that strengthen brand image through market activities and professional services enhance the manufacturer's competitive position in the market.	Kotler and Armstrong (2023)
Marketing strategy alignment	Agents highly aligned with the manufacturer's marketing strategy demonstrate stronger integration in promotional activities, customer management, and product adoption, maximizing brand benefits.	Badoyan (2025)
Brand value extension capability	Through agents' localized experience and networks, the brand can extend into more application domains and expand its influence.	Hidayati et al. (2025); Kumar (2025)
ESG commitment and sustainability practice capability	Agents demonstrating commitment to environmental protection, social responsibility, and governance transparency, and assisting manufacturers in fulfilling related commitments, enhance brand reputation in international markets and respond to investor and consumer expectations for sustainable development.	Vickneswaran (2025)

2.4 The Analytic Hierarchy Process

The analytic hierarchy process, proposed by Saaty in the 1970s and formalized as a systematic decision analysis tool in 1980 (Saaty, 1980), decomposes unstructured complex problems hierarchically into goal, criteria, and alternative levels, quantifies the relative importance of factors through expert pairwise comparisons, and computes weights using the principal eigenvector; its distinctive feature is the consistency test, which safeguards the logical rationality of expert judgments. Owing to its simple operation, clear structure, and comparable results, the AHP has become one of the most representative methods in multi-criteria decision analysis and is widely applied in business management, strategic planning, resource allocation, supply chain management, and channel decision-making. In channel selection research, the AHP can bring heterogeneous dimensions such as market expansion, service quality, cost structure, and brand governance into a single decision framework for measurement and comparison, combining expert experience with quantitative rigor; it is particularly suitable for decision contexts with highly complex evaluation dimensions such as the semiconductor industry, and this study accordingly adopts the AHP as its primary analytical method.

3. Research Methodology

This study constructs a hierarchical framework of the key factors in distribution agent selection by semiconductor manufacturers. In the first stage, a literature review and focus group discussions were used to derive five criteria and twenty-two sub-criteria as the basis of the evaluation framework; the analytic hierarchy process was then applied through an expert questionnaire survey to measure the relative importance and rankings of all criteria and sub-criteria. This chapter comprises three parts: the focus group discussion method; the hierarchical research framework; and the hierarchical questionnaire design and AHP

procedure.

3.1 Focus Group Discussions

This study adopted focus group discussion as its qualitative research method, collecting and exploring viewpoints and experiences related to the research topic through interactive small-group discussion. A typical focus group consists of approximately six to ten participants with relevant backgrounds who exchange opinions on specific topics under guided facilitation; the stimulation of group discussion elicits more diverse thinking and deeper exploration of the issues. Purposive sampling was employed: participants included agent representatives with practical experience in the semiconductor industry (A1-A4), scholars specializing in marketing management, supply chains, or international business (B1-B4), and industry association and consulting experts (C1-C2) ten participants in total ensuring that the sample covered the professional perspectives and practical experience of different roles. Two focus group sessions were held on March 15 and March 30, 2026. Interview handbooks, consent forms, and interview outlines were prepared in advance, and the sessions followed a semi-structured format; all discussions were transcribed verbatim from on-site recordings, interview notes, and observation records, and a systematic documentation mechanism was established (including session numbers, dates, source types, participant codes, and page correspondence) to ensure the completeness and traceability of the interview data. The interview outline and participants' basic information are shown in Table 3 and Table 4, respectively. Regarding participant qualification and sampling justification, experts were selected using purposive sampling on the basis of three explicit criteria: (1) at least eight years of practical or academic experience directly related to semiconductor distribution, channel management, or international marketing; (2) current or recent involvement in agent selection, channel strategy, or related decision-making; and (3) representation across three complementary role groups agents, scholars, and industry/consulting experts—so as to secure triangulation of perspectives. This design ensured content validity through expert consensus rather than statistical representativeness, which is appropriate for AHP studies that rely on informed expert judgment rather than random sampling. To ensure content validity, the initial hierarchy derived from the literature was reviewed and refined by the focus group before questionnaire development, and each criterion and sub-criterion was retained only after the group reached consensus on its relevance and clarity. Regarding ethical considerations, participation was voluntary and based on informed consent; participants were briefed on the study purpose, assured of anonymity and confidentiality, and informed of their right to withdraw at any time, and all recordings and transcripts were stored securely and used solely for research purposes.

Table 3. Focus group interview outline

No.	Interview outline	References
1	In your view, how do an agent's regional coverage breadth, customer development capability, and familiarity with the local market respectively affect channel selection and market expansion effectiveness when assisting semiconductor manufacturers in developing new markets?	Ujam (2025)
2	How does an agent's performance in customer maintenance—such as response speed and frequency, after-sales technical support, customer stickiness and loyalty, and long-term relationship maintenance—affect semiconductor manufacturers' evaluation of channel selection?	Hajar et al. (2022)
3	How does an agent's performance in operating costs—such as flexibility of sales incentive systems, reasonableness of commission structures, cost controllability and predictability, expense transparency, and logistics and inventory management efficiency—affect semiconductor manufacturers' channel selection decisions?	Abubakar et al. (2024)
4	How do an agent's technical knowledge capabilities—such as the frequency of professional training, the effectiveness of technical communication, the speed of grasping product updates, and the capability to adopt new technologies—affect semiconductor manufacturers' selection of and trust in the agent channel?	Cao (2025)
5	How do price stability, consistency of promotional messages, brand image maintenance, marketing strategy alignment, brand value extension capability, and emphasis on ESG commitment and sustainability practice affect semiconductor manufacturers' channel selection decisions and willingness to cooperate long term?	Jiang et al. (2025)

Table 4. Basic information of the focus group participants

Gender	Category	Experience	Age	Position
Male	A1: Agent	15 years	45	Regional sales director
Female	A2: Agent	10 years	38	Senior market development manager
Male	A3: Agent	20 years	50	Vice president of Greater China sales
Female	A4: Agent	8 years	36	Marketing manager
Male	B1: Scholar	12 years	42	Associate professor of business administration
Male	B2: Scholar	18 years	50	Professor of international business
Female	B3: Scholar	6 years	35	Associate professor of business administration
Male	B4: Scholar	14 years	47	Research fellow
Male	C1: Expert	22 years	52	Semiconductor association consultant
Female	C2: Expert	17 years	48	Partner, technology industry consultancy

3.2 Hierarchical Research Framework

After synthesizing the focus group opinions and the literature, this study finalized five criteria and their twenty-two sub-criteria. The sub-criteria of new market development are regional coverage breadth, customer development capability, and local market familiarity; those of customer maintenance are customer response speed and frequency, after-sales technical support capability, customer stickiness and loyalty, and long-term relationship maintenance capability; those of operating costs are flexibility of sales incentive systems, agency commission structure, cost controllability and predictability, operating expense transparency, and logistics and inventory management efficiency; those of technical knowledge are frequency of professional training, technical communication capability, speed of grasping product updates, and new technology adoption capability; and those of brand control are price

stability, consistency of promotional messages, brand image maintenance capability, marketing strategy alignment, brand value extension capability, and ESG commitment and sustainability practice capability. The hierarchical framework of this study is shown in Figure 1.

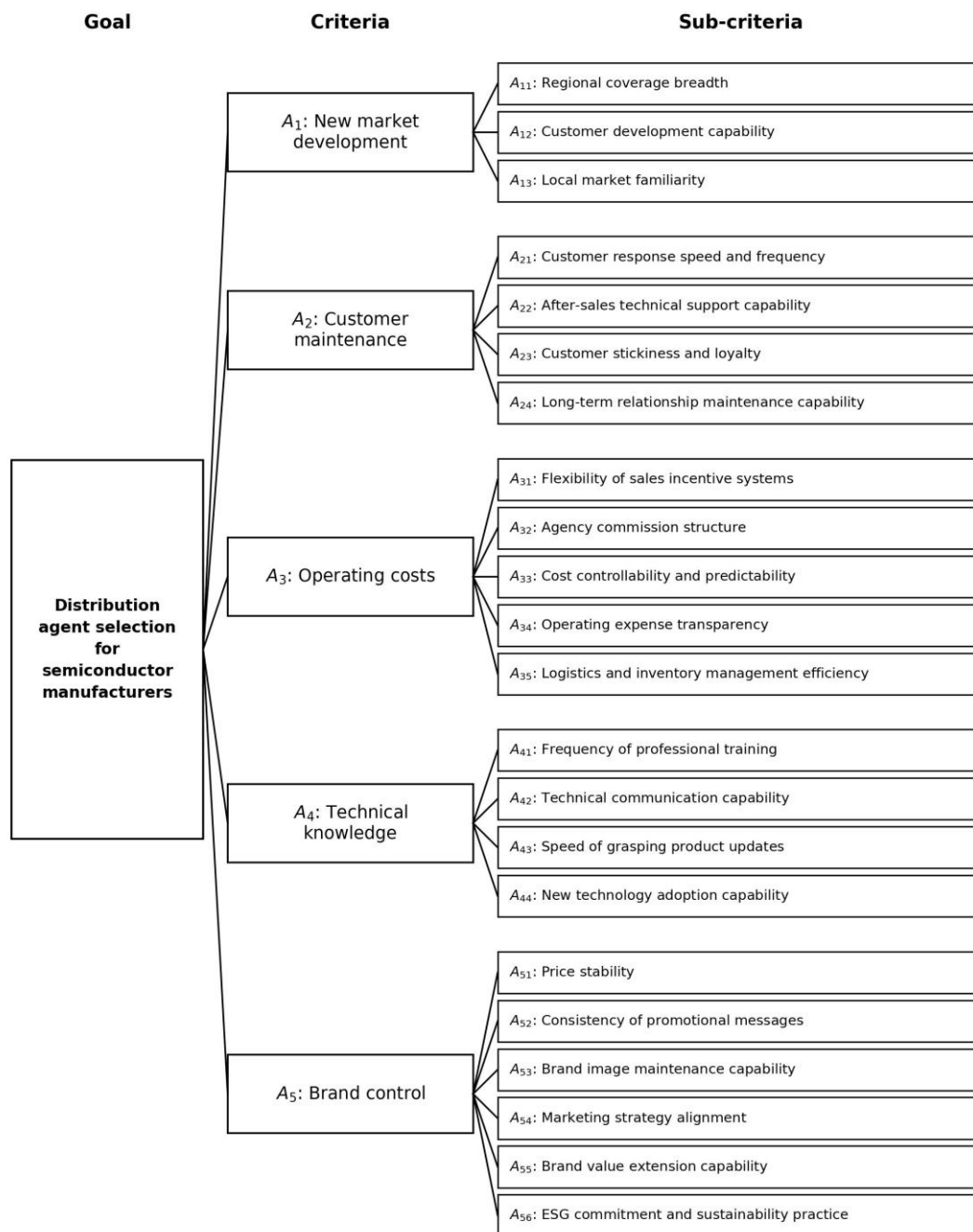


Figure 1. The hierarchical framework of the key factors in distribution agent selection

3.3 Hierarchical Questionnaire Design and the AHP Procedure

The questionnaire adopted pairwise comparisons to evaluate the relative importance of the

criteria. Respondents selected the degree of importance on the 1-9 rating scale proposed by Saaty (1980), as shown in Table 5; to improve judgment accuracy and efficiency, respondents first ranked the importance of the criteria before conducting pairwise comparisons, using the ranking as a reference.

Table 5. The AHP evaluation scale

Scale	Definition	Explanation
1	Equal importance	The two elements contribute equally to the objective.
3	Moderate importance	Experience and judgment slightly favor one element.
5	Strong importance	Experience and judgment strongly favor one element.
7	Very strong importance	One element is favored very strongly over another.
9	Extreme importance	The evidence favoring one element is of the highest possible order.
2, 4, 6, 8	Intermediate values	Compromise judgments between adjacent scale values.

The core procedure of the AHP is as follows: after hierarchical decomposition of the problem, pairwise comparison matrices are established using the 1-9 scale; approximate weights of the elements are obtained by normalizing the geometric means of the matrix rows, from which the maximum eigenvalue $\lambda_{\max}$ is computed (Saaty, 1980). To prevent inconsistent judgments from generating erroneous weight information, the AHP tests judgment consistency using the consistency index (C.I.) and the consistency ratio (C.R.), where $C.I. = (\lambda_{\max} - n) / (n - 1)$ and $C.R. = C.I. / R.I.$, with R.I. being the random index whose value increases with matrix order; a C.R. of 0.10 or below indicates acceptable consistency (Saaty, 1980). This study adopted $C.R. \leq 0.10$ as the acceptance standard, and an AHP questionnaire analysis tool was used to compute the relative weights and rankings of all criteria and sub-criteria. In terms of questionnaire development and reliability, the pairwise-comparison questionnaire was developed directly from the literature-based and focus-group-validated hierarchy, ensuring content validity; judgment reliability was assessed through the consistency ratio, and a C.R. of 0.10 or below was taken to indicate that expert judgments were logically consistent and therefore reliable. Matrices exceeding this threshold were returned to the respondents for re-evaluation, so that only judgments meeting the consistency criterion were retained for weight computation.

4. Results and Discussion

This chapter presents the empirical results in three parts: the analysis of the focus group discussions; the AHP analysis; and an integrated discussion.

4.1 Analysis of the Focus Group Discussions

Before the formal questionnaire survey, two rounds of focus group discussions were conducted with agent representatives, scholars, and industry experts to examine in depth the importance and applicability of the five dimensions and their sub-criteria. After collating, synthesizing, and comparing the content of the two sessions and extracting participants' common views and differences, the five dimensions and twenty-two sub-criteria were finalized as the basis for the hierarchical questionnaire design and AHP weight analysis. The findings for each dimension are summarized as follows.

Regarding new market development, participants generally agreed that an agent's regional coverage, customer development capability, and local market familiarity all directly affect channel selection and market expansion effectiveness: agents with complete regional networks and customer development capability help firms quickly reach target customers and improve market penetration, while those familiar with local regulations and market institutions reduce the operating risks of entering new markets and enhance governance transparency. Overall, agents that combine market expansion capability with ESG sustainability concepts further improve the success rate of channel strategy and market deployment.

Regarding customer maintenance, participants generally held that agents maintaining timely and stable response speed and frequency, together with complete after-sales technical support, improve customer satisfaction and product adoption efficiency; customer stickiness, loyalty, and sustained interaction form the essential foundation for channel stability and cooperative value. The more complete an agent's customer maintenance capability, the stronger its channel value, cooperation stability, and long-term competitive advantage, which also helps firms implement ESG sustainability concepts in market operations.

Regarding operating costs, participants generally considered that flexible sales incentive systems and reasonable commission structures enhance the motivation of sales teams and market development efficiency; cost controllability and predictability facilitate long-term operational planning and risk reduction; and expense transparency together with logistics and inventory management efficiency improve supply chain performance and lower overall operating costs. Agents that balance incentive design, cost control, and supply chain efficiency—while implementing the governance and responsibility management emphasized by ESG—become an important basis for semiconductor manufacturers' channel evaluation.

Regarding technical knowledge, participants generally agreed that continuous professional training and sound technical communication capability enhance customers' understanding of and trust in product adoption; the ability to quickly grasp product update information and convey it to customers is essential to maintaining market competitiveness; and agents capable of adopting new technologies more easily establish long-term cooperative and trusting relationships. The stronger an agent's technical expertise, the higher the manufacturer's evaluation of its channel value and cooperative trust, which also helps firms balance sustainable operation with technological innovation.

Regarding brand control, participants generally held that agents maintaining price stability and ensuring promotional messages consistent with the manufacturer's brand strategy help preserve market order and enhance brand trust; brand image maintenance and marketing strategy alignment effectively strengthen brand positioning; and extending brand value through local resources and market networks, while fulfilling ESG commitments and sustainability practices, further enhances the firm's reputation and long-term cooperative foundation in international markets.

4.2 AHP Analysis

4.2.1 Descriptive Statistics of the Sample

The main respondents were agents, scholars, engineers, and experts involved in semiconductor distribution channel selection, and 31 valid questionnaires were collected. The sample comprised 17 men (54.8%) and 14 women (45.2%); ages concentrated in the 45-54 bracket (58.1%); 58.1% held bachelor or college degrees and 41.9% graduate degrees; unit supervisors formed the largest position group (71.0%); and respondents with more than 21 years and with 11-15 years of work experience each accounted for 38.7%, indicating that most respondents are professionals with managerial backgrounds and rich practical experience, providing representativeness and expertise for the questionnaire, as shown in Table 6.

Table 6. Descriptive statistics of the sample

Variable	Category	Frequency (n)	Percentage (%)
Gender	Male	17	54.8
	Female	14	45.2
Age	30-40	10	32.3
	45-54	18	58.1
	55-65	3	9.7
Education	Bachelor / college	18	58.1
	Graduate or above	13	41.9
Position	Business owner	4	12.9
	Department manager	5	16.1
	Unit supervisor	22	71.0
Work experience	11-15 years	12	38.7
	16-20 years	7	22.6
	Over 21 years	12	38.7
Annual income (NT\$10,000)	101-150	17	54.8
	151-200	7	22.6
	201-250	7	22.6

4.2.2 Weights and Ranking of the Main Criteria

According to the AHP results, new market development obtained the highest weight (0.406) among the five main criteria, ranking first and indicating that firms attach the greatest importance to an agent's capability to expand new markets and develop potential customers; customer maintenance ranked second (0.286), showing that customer relationship maintenance and service quality are also important considerations; operating costs ranked third (0.164), indicating that cost control and operational efficiency still exert considerable influence on channel selection; technical knowledge weighted 0.101, ranking fourth; and brand control weighted 0.044, ranking fifth, as shown in Table 7. Overall, semiconductor manufacturers emphasize factors that directly affect performance and channel effectiveness, such as market development and customer management, when selecting distribution channels.

Table 7. Weights and ranking of the main criteria

Rank	Code	Criterion	Weight
1	A ₁	New market development	0.406
2	A ₂	Customer maintenance	0.286
3	A ₃	Operating costs	0.164
4	A ₄	Technical knowledge	0.101
5	A ₅	Brand control	0.044

4.2.3 Weights of the Sub-criteria within Each Dimension

Under new market development, regional coverage breadth obtained the highest local weight (0.664; global weight 0.270), indicating that manufacturers value most whether an agent possesses extensive market coverage; customer development capability followed (0.240), with local market familiarity last (0.096), as shown in Table 8.

Table 8. Weights and ranking of the sub-criteria under new market development

Rank	Code	Sub-criterion	Local weight
1	A ₁₁	Regional coverage breadth	0.664
2	A ₁₂	Customer development capability	0.240
3	A ₁₃	Local market familiarity	0.096

Under customer maintenance, customer response speed and frequency weighted highest (0.502), showing that manufacturers value most whether an agent can respond to customer needs quickly and continuously; it was followed by after-sales technical support capability (0.229), customer stickiness and loyalty (0.161), and long-term relationship maintenance capability (0.107), as shown in Table 9, indicating that this dimension emphasizes service immediacy and technical support capability.

Table 9. Weights and ranking of the sub-criteria under customer maintenance

Rank	Code	Sub-criterion	Local weight
1	A ₂₁	Customer response speed and frequency	0.502
2	A ₂₂	After-sales technical support capability	0.229
3	A ₂₃	Customer stickiness and loyalty	0.161
4	A ₂₄	Long-term relationship maintenance capability	0.107

Under operating costs, flexibility of sales incentive systems weighted highest (0.475), followed by agency commission structure (0.266), cost controllability and predictability (0.143), operating expense transparency (0.074), and logistics and inventory management efficiency (0.042), as shown in Table 10, indicating that manufacturers emphasize incentive design and the reasonableness of cooperative cost structures.

Table 10. Weights and ranking of the sub-criteria under operating costs

Rank	Code	Sub-criterion	Local weight
1	A ₃₁	Flexibility of sales incentive systems	0.475
2	A ₃₂	Agency commission structure	0.266
3	A ₃₃	Cost controllability and predictability	0.143
4	A ₃₄	Operating expense transparency	0.074
5	A ₃₅	Logistics and inventory management efficiency	0.042

Under technical knowledge, frequency of professional training weighted highest (0.568), followed by technical communication capability (0.275), with speed of grasping product updates and new technology adoption capability tied third (0.078 each), as shown in Table 11, indicating an emphasis on agents' continuous training and technical communication capability.

Table 11. Weights and ranking of the sub-criteria under technical knowledge

Rank	Code	Sub-criterion	Local weight
1	A ₄₁	Frequency of professional training	0.568
2	A ₄₂	Technical communication capability	0.275
3	A ₄₃	Speed of grasping product updates	0.078
4	A ₄₄	New technology adoption capability	0.078

Under brand control, price stability weighted highest (0.450), showing that manufacturers value most whether agents can maintain stable market prices to prevent price competition from eroding brand value; it was followed by consistency of promotional messages (0.213), brand image maintenance capability (0.154), marketing strategy alignment (0.092), and brand value extension capability (0.058); ESG commitment and sustainability practice capability ranked sixth (0.033), indicating that although sustainability factors are receiving growing attention, their influence remains relatively low compared with price and brand management, as shown in Table 12.

Table 12. Weights and ranking of the sub-criteria under brand control

Rank	Code	Sub-criterion	Local weight
1	A ₅₁	Price stability	0.450
2	A ₅₂	Consistency of promotional messages	0.213
3	A ₅₃	Brand image maintenance capability	0.154
4	A ₅₄	Marketing strategy alignment	0.092
5	A ₅₅	Brand value extension capability	0.058
6	A ₅₆	ESG commitment and sustainability practice capability	0.033

4.2.4 Overall Priority Ranking

Weighting the local weights of the sub-criteria by the weights of the five main criteria yields the overall priority ranking of the twenty-two sub-criteria, as shown in Table 13. Regional coverage breadth obtained the highest global weight (0.270), followed by customer response

speed and frequency (0.144), customer development capability (0.097), flexibility of sales incentive systems (0.078), and after-sales technical support capability (0.065), indicating that in distribution agent selection semiconductor manufacturers place the greatest emphasis on agents' market networks and regional deployment capability, the immediacy of customer service, and the completeness of technical support.

Table 13. Overall priority ranking of the criteria and sub-criteria for distribution agent selection

Overall rank	Code	Sub-criterion	Criterion	Global weight
1	A ₁₁	Regional coverage breadth	New market development	0.270
2	A ₂₁	Customer response speed and frequency	Customer maintenance	0.144
3	A ₁₂	Customer development capability	New market development	0.097
4	A ₃₁	Flexibility of sales incentive systems	Operating costs	0.078
5	A ₂₂	After-sales technical support capability	Customer maintenance	0.065
6	A ₄₁	Frequency of professional training	Technical knowledge	0.057
7	A ₂₃	Customer stickiness and loyalty	Customer maintenance	0.046
8	A ₃₂	Agency commission structure	Operating costs	0.044
9	A ₁₃	Local market familiarity	New market development	0.039
10	A ₂₄	Long-term relationship maintenance capability	Customer maintenance	0.031
11	A ₄₂	Technical communication capability	Technical knowledge	0.028
12	A ₃₃	Cost controllability and predictability	Operating costs	0.023
13	A ₅₁	Price stability	Brand control	0.020
14	A ₃₄	Operating expense transparency	Operating costs	0.012
15	A ₅₂	Consistency of promotional messages	Brand control	0.009
16	A ₄₄	New technology adoption capability	Technical knowledge	0.008
17	A ₄₃	Speed of grasping product updates	Technical knowledge	0.008
18	A ₃₅	Logistics and inventory management efficiency	Operating costs	0.007
19	A ₅₃	Brand image maintenance capability	Brand control	0.007
20	A ₅₄	Marketing strategy alignment	Brand control	0.004
21	A ₅₅	Brand value extension capability	Brand control	0.003
22	A ₅₆	ESG commitment and sustainability practice capability	Brand control	0.001

4.3 Integrated Discussion

Synthesizing the focus group results, the literature review, and the AHP analysis clarifies the key considerations of semiconductor manufacturers in distribution agent selection. In the new market development dimension, regional coverage breadth and customer development capability are the most important factors, echoing the participants' views; related research likewise indicates that in a globalized competitive environment, expanding markets through agents effectively reduces market entry costs and risks (Rath et al., 2024; Ruiz, 2025; Sheth, 2011; Watson et al., 2018). In the customer maintenance dimension, customer response speed and frequency and after-sales technical support capability carry higher importance, consistent with Hajar et al. (2022), Du et al. (2025), Dzreke (2025), and Gnewuch et al. (2023), who identify service quality and technical support capability as key factors in maintaining long-term customer relationships in high-technology industries. In the operating cost

dimension, flexibility of sales incentive systems and agency commission structure are the main influencing factors, consistent with Agrawal and Mukherjee (2025), Meyer and Truccone (2025), Guo et al. (2025), and Misra and Nair (2011). In the technical knowledge dimension, frequency of professional training and technical communication capability carry higher weights, reflecting the critical role of agents' technical capability in customer adoption and cooperative relationships given the high specialization of semiconductor products. In the brand control dimension, price stability is the most important factor; related research also indicates that pricing strategy and brand image management are important factors for maintaining competitive advantage (Kotler & Armstrong, 2023; Li et al., 2025; Nagle et al., 2023; Steinberg et al., 2025; Zhang et al., 2024). Moreover, from a sustainability perspective, considerations of compliant operation, supply chain transparency, and responsible governance are gradually being integrated into all dimensions, indicating that ESG thinking is progressively permeating distribution channel decision-making.

Based on long-term observation of semiconductor industry practice, this study offers the following extended observations. First, the combined weight of new market development and customer maintenance approaches seventy percent, indicating that the industry has come to regard agents as an extension of corporate globalization rather than mere sales conduits; the strategic value of distribution channels should be elevated to the level of strategic partnership. Second, although the technical knowledge dimension carries a relatively low weight, as advanced processes continue to progress and AI and high-performance computing applications flourish, customers' requirements for agents' technical consulting, design support, and system integration capabilities will rise substantially, and the importance of this dimension will become increasingly prominent with industrial transformation. Third, while ESG commitment and sustainability practice capability currently carries a low weight, against the backdrop of the EU Carbon Border Adjustment Mechanism, international climate disclosure norms, and domestic sustainability reporting requirements coming into force, agents' ESG performance will directly affect manufacturers' supply chain compliance and brand reputation, and will inevitably become a key differentiating factor in distribution agent selection in the medium and long term. Fourth, semiconductor distribution channels are undergoing a structural transformation from traditional distribution agency toward value co-creation: beyond basic functions, agents must be able to assist customers with demand forecasting, technical support, and sustainable supply chain management as value-added services. Semiconductor manufacturers are therefore advised to adopt systematic, multi-dimensional evaluation frameworks in formulating agency strategies and to incorporate the strategic implications of ESG, technological enablement, and long-term cooperation. A deeper interpretation of why certain criteria carry higher weights is warranted. The dominance of new market development (0.406) and regional coverage breadth (global weight 0.270) reflects that, in a capital-intensive and export-oriented industry, an agent's ability to open and cover regional markets directly determines revenue realization—a pattern consistent with prior evidence that market-expansion capability reduces entry cost and risk in international channels (Abubakar et al., 2024; Watson et al., 2018; Zahoor & Lew, 2023). The high weight of customer response speed echoes service-quality findings in high-technology channel research (Hajar et al., 2022; Du et al., 2025), where responsiveness and technical

support are decisive for long-term relationships. Particularly noteworthy is that ESG commitment received the lowest weight (0.033 within brand control; global weight 0.001). This does not imply that sustainability is unimportant; rather, it indicates that, at the current stage, practitioners still prioritize market and cost performance over sustainability in agent selection. Given the tightening of international sustainability regulation—such as the EU Carbon Border Adjustment Mechanism, the Corporate Sustainability Due Diligence Directive, and mandatory climate-disclosure regimes—this low weight is likely to rise over the medium to long term, and agents' ESG performance may become a key differentiating and even qualifying factor in future distribution decisions. This forward-looking gap between current low prioritization and rising regulatory pressure is itself an important managerial signal identified by this study.

Compared with conventional supplier- or channel-selection models—which typically emphasize cost, quality, delivery, and service (as in classic vendor-evaluation frameworks) or focus on traditional distributor stocking and pricing functions (Mönch et al., 2018)—the framework proposed here makes two theoretical contributions. First, it is tailored to the semiconductor industry's distinctive requirements by foregrounding market development and technical-knowledge dimensions that generic supplier models underweight. Second, it explicitly incorporates ESG commitment as an evaluation sub-criterion, extending traditional channel-selection theory toward sustainability-aware decision-making. In this respect, the study advances beyond descriptive weight ranking to offer a reusable, criteria-weighted decision architecture that other capital-intensive, export-oriented industries can adapt.

5. Conclusions and Recommendations

5.1 Conclusions

Taking distribution agent selection by semiconductor manufacturers as its subject, this study combined a literature review, focus group discussions, and the analytic hierarchy process to construct an evaluation framework comprising five criteria and twenty-two sub-criteria, and analyzed the relative importance of all criteria and sub-criteria through an expert questionnaire.

The results show that among the five criteria, new market development is the most important consideration in semiconductor manufacturers' distribution agent selection, followed in order by customer maintenance, operating costs, technical knowledge, and brand control. This indicates that manufacturers give top priority to whether an agent possesses market expansion and new customer development capabilities, and secondarily to performance in customer service and relationship maintenance. Among the sub-criteria, regional coverage breadth ranks first overall, showing that manufacturers value most whether an agent possesses an extensive market network and regional deployment capability; customer response speed and frequency and after-sales technical support capability also rank near the top, indicating that beyond market development, the semiconductor industry is highly concerned with the immediacy and completeness of agents' customer service and technical support. These findings are in line with previous studies emphasizing the primacy of market-expansion and customer-service capabilities in international channel selection (Hajar et al., 2022; Watson et

al., 2018; Zahoor & Lew, 2023), while extending that literature by quantifying the relative weights of these factors in the specific context of semiconductor distribution.

The focus group results further show that participants generally regard semiconductor distribution channel selection as extending beyond the sales function: what matters is whether an agent can integrate multiple capabilities spanning market expansion, customer maintenance, cost control, technical support, and brand coordination. In addition, as global firms increasingly emphasize sustainable development and ESG concepts, firms have begun to consider agents' performance in compliant operation, supply chain management, and corporate governance when selecting channels. Although brand control and sustainability practice carry relatively low overall weights, they nevertheless reflect that firms have gradually incorporated sustainable operation and responsible supply chains into their evaluations beyond market competition; as the importance of sustainability issues continues to rise, the influence of these factors on distribution channel decisions is likely to increase. Overall, the evaluation framework and analytical results constructed in this study provide an important reference for semiconductor manufacturers in distribution channel selection and partner evaluation, helping firms improve channel decision quality and market competitiveness while attending to long-term sustainable development goals.

5.2 Managerial Implications

To translate these findings into practice, this study proposes a four-step Agent Selection Decision Framework that firms can apply directly. Step 1 (Weighting): adopt the AHP weights derived here as an initial scoring template, assigning 40.6% to new market development, 28.6% to customer maintenance, 16.4% to operating costs, 10.1% to technical knowledge, and 4.4% to brand control, then adjusting these weights to the firm's strategic priorities. Step 2 (Scoring): rate each candidate agent on the twenty-two sub-criteria, giving greatest attention to the highest-weighted items—regional coverage breadth, customer response speed, and customer development capability. Step 3 (Screening): treat ESG commitment as a forward-looking gate that, while currently low-weighted, is flagged for rising importance, so that agents with credible sustainability practices are preferred where scores are otherwise close. Step 4 (Review): re-evaluate weights periodically as international sustainability regulations tighten and as advanced-node and AI-driven demand raises the importance of technical-knowledge criteria. This framework converts the weight rankings into a repeatable, auditable selection procedure rather than a one-off judgment.

In market expansion strategy, firms should give priority to evaluating agents' regional coverage and customer development capabilities. This study shows that new market development is the most important criterion, with regional coverage breadth and customer development capability ranked highest within it, indicating that an agent's ability to rapidly establish sales networks in specific regions, expand target customer groups, and assist entry into emerging markets directly affects the effectiveness of market deployment; firms may further evaluate agents' performance in local environmental regulatory compliance, social relationship building, and compliance governance, so that market expansion strategy balances growth with sustainable development.

In customer relationship management, firms should emphasize agents' customer response efficiency and after-sales technical support capability (Ofobike, 2025; Darshana, 2025). Because semiconductor products are highly technical and involve long-term cooperation, agents that respond quickly to customer needs, provide complete technical support, and maintain stable cooperation enhance customer satisfaction and loyalty; in channel management, firms should establish agent service performance evaluation mechanisms that incorporate response timeliness, problem-solving capability, and customer relationship maintenance as key management indicators. In cost and operations management, firms should attend to the reasonableness and transparency of agents' incentive systems, commission structures, and cost control: an agent's incentive design and cooperative cost structure affect its enthusiasm for promoting products and the stability of cooperation. Firms should clearly define commission systems, incentive mechanisms, and expense allocation principles before cooperation, and establish transparent cost monitoring and logistics management systems to reduce operational risk and improve cooperative efficiency.

In technical capability and brand governance, firms should require agents to establish continuous professional training mechanisms and strengthen technical communication capabilities to cope with the rapid iteration of semiconductor products; at the same time, they should maintain brand image and market order through price management, consistency of promotional messages, and coordinated marketing strategy. Looking ahead, as international sustainability regulations successively take effect, firms are advised to incorporate agents' ESG commitment and sustainability practice capability into cooperation evaluations and periodic audits, deploying responsible supply chain management early to strengthen long-term competitive advantage.

5.3 Research Scope and Limitations

The scope of this study focuses on distribution agent selection in the semiconductor industry, with participants covering agent representatives, scholars, and industry experts. Several limitations should be noted. First, the AHP relies on expert judgments, and the results may be constrained by respondents' subjective assessments and background differences. Second, the sample size is limited and centers on the industrial context of the Taiwanese market, so the findings may not be fully generalizable to other regional markets or industries. Third, the semiconductor industry environment and international regulations (such as chip acts, the CBAM, and national ESG disclosure requirements) continue to change rapidly, so the conclusions are time-sensitive. Finally, distribution channel decisions may also be affected by firm size, product line characteristics, and existing channel relationships, which this study did not individually control.

5.4 Suggestions for Future Research

Regarding research subjects, future studies may extend to semiconductor manufacturers of different sizes or to other high-technology industries (such as optoelectronics and communications equipment) to compare differences in the criterion weights of distribution agent selection across industries, thereby improving the external validity of the findings. Regarding methods, future research may combine fuzzy AHP, ANP, DEMATEL, or structural

equation modeling to explore possible interactions and causal structures among the criteria, moving beyond weight rankings to reveal the interdependencies among dimensions.

Regarding topical depth, as ESG regulations and supply chain due diligence requirements continue to strengthen, future research may conduct longitudinal tracking of the ESG commitment and sustainability practice dimension to examine how its weight changes across policy stages; it may also further investigate the influence of emerging capabilities—such as digital channel platforms, real-time inventory visibility, and AI-based demand forecasting—on distribution channel value and selection decisions (Bousetouane, 2025; Tan et al., 2024; Thanasi-Boçe & Hoxha, 2024), so as to construct a more complete and forward-looking theoretical system for distribution channel evaluation.

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Author contributions

Ching-Hsing Chang and Ya-Ting Lin were responsible for the study design, data collection, and drafting of the manuscript. Wen-Tsung Wu (corresponding author) supervised the research, developed the analytical framework, and revised the manuscript. Chun-Hsien Wang contributed to the methodology and the interpretation of the results. All authors read and approved the final manuscript.

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