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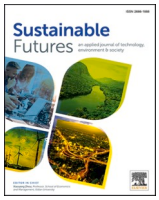

Consumer trust in sustainable seafood certification agencies: A comparative study across twelve markets

Airong Zhang [a,*], Christina Maxwell [a], Peggy Schrobback [b], Francesco Tacconi [b], Shang-Ho Yang [c], Kiyokazu Ujiie [d], Man-Keun Kim [e], Thanh Mai Ha [f,g], Ningning Feng [h], Lintang Wardyani [i], Caroline Saunders [j], Meike Guenther [j], Nagaraj Samala [k], Hwa-Nyeon Kim [l]

[a] Health and Biosecurity, Commonwealth Scientific and Industrial Research Organisation (CSIRO), Australia
[b] Agriculture and Food, Commonwealth Scientific and Industrial Research Organisation (CSIRO), Australia
[c] Graduate Institute of Bio-Industry Management, National Chung Hsing University, Taiwan
[d] Faculty of Life and Environmental Sciences, University of Tsukuba, Japan
[e] Department of Applied Economics, Utah State University, USA
[f] Department of Economics, the Swedish University of Agricultural Sciences, Uppsala, Sweden
[g] Vietnam National University of Agriculture, Vietnam
[h] Institute of Brain and Education Innovation, East China Normal University, China
[i] Kaleka, Denpasar, Indonesia
[j] Agribusiness & Economics Research Unit, Lincoln University, New Zealand
[k] School of Innovation and Management (SoIM), India
[l] Department of Applied Economics, Jeju National University, South Korea

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ABSTRACT

Global seafood consumption has increased steadily over the past decade, making it the most traded animal protein worldwide. To meet growing demand, seafood production must expand. Yet, this growth poses significant environmental risks, including habitat loss, water pollution, and species depletion. Ensuring sustainable production is therefore critical, with certification schemes playing a key role in communicating sustainability to consumers. However, consumer trust in these certifications varies widely. This study investigates consumer trust in four types of certification agencies for seafood imported from developed countries: Exporting country government agencies, exporting country certification agencies, international certification agencies, and local certification agencies. An online survey (N = 12,222) was conducted across 12 markets: Australia, mainland China, Hong Kong (China), India, Indonesia, Japan, New Zealand, Singapore, South Korea, Taiwan, the USA, and Vietnam. The results indicated that sustainability certifications are valued across all markets, with particularly elevated importance observed in comparatively lower-income markets as indicated by GDP per capita (mainland China, India, Indonesia, Vietnam), where trust in all certification types was notably higher. Conversely, Japan and Taiwan exhibited the lowest trust levels. Within-market analysis identified three distinct trust preference groups: the Local Preference Group (Australia, Japan, USA, New Zealand, Singapore), the International Preference Group (Indonesia, Hong Kong, Taiwan, Vietnam), and the Equal Preference Group (mainland China, India, South Korea). These findings offer actionable insights for seafood businesses, importers, and exporters to tailor certification strategies to market-specific trust patterns, ultimately supporting the promotion of sustainable seafood consumption globally.

1. Introduction

Global seafood consumption has risen steadily, driven by population growth, higher incomes, and its promotion as a healthy dietary choice [1,2]. Meeting projected demand by 2050 will require a 57% increase in production compared to 2018 levels [3]. Although seafood is essential for global food security and public health, concerns about overfishing, habitat degradation, and food fraud continue to undermine trust in its

* Corresponding author.
E-mail address: airong.zhang@csiro.au (A. Zhang).

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sustainability [4–7].

In response, global initiatives such as the FAO's Blue Transformation promote sustainable fisheries [1,1]. Growing consumer awareness has increased demand for sustainable seafood and interest in eco-labels, which help align market incentives with environmental goals [8,9]. As sustainability cannot be verified at the point of purchase [10], certification schemes provide assurance [11]. However, trust in these schemes varies, and not all eco-labels are viewed as equally credible [12]. Despite the proliferation of certification schemes, little research has explored consumer trust in certifying agencies.

Seafood is the most traded animal protein globally, valued at USD 164 billion in 2021 [13]. The diversity of seafood products means that countries may be both major exporters and importers, exposing consumers to a range of certification schemes. For example, in 2022, both China and the Netherlands ranked among the top ten exporters and importers [14]. In Australia, while much domestic production is exported, around 62% of seafood consumed is imported [15]. This complexity means consumers often rely on certifications when purchasing imported seafood. Yet, little is known about which types of agencies (i.e., governmental, private, international, or domestic) inspire the most consumer trust across different markets.

This study addresses these gaps by examining consumer trust in different types of certification agencies for imported seafood across twelve markets: Australia, mainland China, Hong Kong (China), India, Indonesia, Japan, New Zealand, Singapore, South Korea, Taiwan, the USA, and Vietnam. These markets differ substantially in their level of economic development, as reflected in their 2024 GDP per capita [16,17]: India (US$2,696), Vietnam (US$4,717), Indonesia (US$4,925), China (US$13,303), Japan (US$32,476), South Korea (US$33,121), Taiwan (US$34,059), New Zealand (US$48,747), Hong Kong (US$54,107), Australia (US$64,407), the USA (US$85,809), and Singapore (US $90,674). They also vary culturally, with Australia, New Zealand, the USA typically characterised as individualist societies, while the Asian markets are generally described as collectivist and hierarchical [18]. In addition, these markets differ in their roles in international seafood trade, with 2023 global rankings in trade value as follows: the USA (1st in imports, 14th in exports), China (2nd, 1st), Japan (3rd, 23rd), South Korea (9th, 24th), Hong Kong (China) (14th, 38th), Vietnam (18th, 3rd), Taiwan (22nd, 27th), Australia (23rd, 37th), Singapore (26th, 64th), Indonesia (42nd, 15th), New Zealand (60th, 32nd), and India (65th, 6th) [19].

Further, previous research highlights the importance of country of origin in consumer choices [2,20]. To control for product origin (i.e., developed countries vs developing countries), this study focuses on seafood imported from developed countries, using Australia as an example. Hence, by isolating the product origin (a developed country) and product type (seafood), it provides a comparative analysis of how trust in certifying agencies varies across both high- and low-income economies.

2. Literature review

2.1. Seafood sustainability certification agencies

Although numerous eco-labelling schemes exist, they can confuse consumers due to differing claims and varying definitions of sustainability. For example, seafood certification initiatives differ in scope—some certify wild-caught seafood, others aquaculture; some focus on specific species, while others prioritise by-catch protection such as turtles and dolphins [21]. Certifications also differ by type: first-party (e.g. producer self-declaration), second-party (e.g. affiliated organisations such as trade associations), and third-party (e.g. independent bodies like non-profits or governments). Agencies may be private, non-profit, or governmental, and operate internationally or domestically [21].

International examples include the Marine Stewardship Council (MSC), Aquaculture Stewardship Council (ASC), Friend of the Sea (FOS), and Naturland. MSC, established in 1997, is widely recognised for certifying wild-caught seafood, with over 400 certified fisheries [22]. ASC, launched in 2010, serves as the aquaculture counterpart [23]. Naturland began in Germany as an organic certifier and later expanded to wild-caught seafood [24], while FOS covers both wild-capture and aquaculture. These labels are operated by international agencies.

Some countries also maintain national certification schemes, often to reduce the cost of international certification, better align with local practices, or support domestic economies [25]. These include both industry and government-led initiatives. Examples of national industry certifications are KRAV (Sweden), Iceland Responsible Fisheries, and Japan's Marine Eco-Label. These are managed by local or exporting country agencies.

Government schemes include Hong Kong's AFCD Accredited Fish Farm Scheme (aquaculture), France's Pêche Durable (wild-caught), Indonesia's LSPro IndoGAP (CBIB) and SHTI (aquaculture and wild-caught), and Vietnam's VietG.A.P (aquaculture). These are operated by importing or exporting government agencies.

Certification typically involves a formal request, preparation for assessment, and an audit comparing production against defined standards. These standards vary but generally address stock preservation (wild-caught), responsible feeding (aquaculture), sustainable fishing methods, by-catch management, and social responsibility. Certifiers draft a decision and seek stakeholder feedback. If approved, fisheries undergo regular monitoring to ensure compliance. Most schemes also provide guidance on applying eco-labels to consumer-facing products.

2.2. Trust in certification agencies

As consumers cannot directly verify the sustainability of products, they must rely on certification schemes. Trust in these eco-labels is therefore essential for influencing purchasing decisions. A lack of trust in certification has been identified as a barrier to sustainable food consumption [26], while higher trust levels are linked to increased purchases of organic and sustainable products, including rice [27], organic food generally [28], and willingness to pay price premiums [29]. In seafood, trust in eco-labels influences their use as decision-making tools and consumers' willingness to pay more [2].

Despite this relationship, consumer confidence in eco-labels is mixed. For example, fewer than half of German respondents in one study trusted sustainable seafood labels [30], whereas most Italian respondents expressed trust in canned tuna certification [12]. A 21-country study by GlobeScan and MSC found that consumers aware of the MSC label tended to trust it [31].

While eco-labels can help address concerns about sustainability claims, consumers are selective. Issues such as counterfeit labels and corporate greenwashing contribute to mistrust [32]. Consequently, trust varies across label types. Research shows that consumers often trust government-provided labels more than private or international ones, for example, when purchasing milk [33] or seafood [34]. In Denmark, the domestic organic label attracted more confidence than international or exporting country labels [35]. In Vietnam, concern about shrimp aquaculture's environmental impact increased purchases of shrimp certified by the local VietG.A.P label, but not by ASC, GlobalG.A.P, or Naturland [36]. However, concerns about local certification counterfeiting led Vietnamese consumers to prefer foreign certifiers for vegetables [37,38]. Similarly, Chinese consumers trusted international certifiers from high-income countries more than local schemes for organic tomatoes [39], general organic food [40], and pork [41].

These findings suggest that trust in eco-labels depends on both the certifying agencies and its origin. Differences in trust exist not only within countries but also across markets.

2.3. Differences in trust in certification agencies between markets

Research has identified cross-market differences in consumer trust in

certification. For example, Danish consumers reported higher trust in organic labelling, regardless of certifying agencies, than those in Sweden, the UK, and the USA [42]. In a five-country study, Japanese participants showed the lowest trust in certification across products such as milk, honey, oil, and wine, while Chinese participants reported the highest [43]. The same study found that consumers in China and Thailand considered their own governments' labels more trustworthy than those in Germany, Japan, and the USA, although this difference was not statistically tested. Within the European Union, French and Spanish consumers expressed the highest trust in their governments for organic labelling, whereas Italian and Polish consumers preferred EU certification and reported low trust in their national governments [44–46].

These findings suggest that consumer trust in certification agencies varies across countries. Some consumers place greater trust in domestic government labels, while others favour international or regional schemes. Understanding these preferences is important for the effective implementation of seafood eco-labelling across different markets.

2.4. Current study and its contribution

As shown in previous sections, trust in food sustainability certification agencies varies across and within countries, depending on the product's origin and the certifying agency. These differences may stem from interactions between what the product is, where it is produced (domestic or imported), and who certifies it (domestic or international agencies). To better understand consumer trust, it is important to isolate these factors. This study addresses this by examining trust in certification agencies (who), while holding constant the product type (seafood) and origin (imported from developed countries). We expected that there would be differences in consumer trust across the four certifier types based on empirical findings and established trust theory. Perceived competence (i.e., the ability to ensure standards), integrity (i.e., adherence to ethical principles), and identification (i.e., shared values or local relevance) are key antecedents of trust in certifying bodies [47,48]. For example, international agencies may be seen as more competent due to global standards, while local agencies may benefit from identification and perceived alignment with local interests. Government agencies might be trusted for integrity but sometimes viewed with scepticism if perceived as lacking independence. These theoretical distinctions provide a rationale for expecting systematic differences in trust across certifier types.

Both high- and low-income economies tend to prefer eco-labels certified by high-income countries, although for different reasons. In low-income economies, this preference is driven by concerns about food safety and the rigour of certification standards [37,38]. In contrast, in high-income economies, trust in national certification procedures and ethnocentric preferences for domestic products play a more prominent role [40]. For instance, German consumers showed stronger trust in their own organic certifiers and production standards than foreign ones, indicating higher ethnocentrism compared to Chinese consumers [40]. Despite these patterns, most research on trust in sustainability certification has focused on Europe and other developed regions [2]. For seafood, it is important to examine trust in Asian markets, where food safety concerns are more prominent [49,50], and which represent a significant share of the global seafood trade [51]. This study addresses this gap by comparing consumer trust in certification agencies across twelve markets, including both high- and low-income economies. We hypothesised that consumers in low-income economies would exhibit greater trust in eco-labels certified by high-income countries due to concerns about food safety and certification rigour, whereas consumers in high-income economies would show greater trust in domestic certification agencies, reflecting ethnocentric preferences and confidence in national standards.

Further, we investigated the perceived importance of sustainable certification. While both trust in certification agencies and the perceived importance of certification influence consumer decisions, they are distinct constructs. Trust is a cognitive evaluation of an agency's competence and integrity, while importance reflects an attitudinal judgement about the value of certification in purchasing [47,52]. Including both constructs enables a more nuanced understanding of consumer attitudes. It can also highlight situations where high trust in a certifier does not necessarily lead to uptake if certification itself is not regarded as important. We expected that the perceived importance of sustainable certification would differ across different markets, reflecting variations in regulatory requirements and consumer expectations.

In summary, this research contributes to the literature in two key ways. First, it reveals cross-market differences in trust in certification agencies and consumer perceived importance of sustainable certification. Second, it identifies within-market differences. These insights can help seafood importers, exporters, and marketers better understand consumer trust in sustainability certification and develop culturally informed strategies to promote sustainable seafood consumption.

3. Method

3.1. Participants and procedure

Data were collected via an online survey across twelve markets: Australia, mainland China, Hong Kong, India, Indonesia, Japan, New Zealand, Singapore, South Korea, Taiwan, the USA, and Vietnam. The survey was administered by Kantar Australia, a specialised market research company, between December 2023 and February 2024 using its global network and participant database. Kantar employed an AI-powered fraud detection tool—Qubed to manage survey fraud at both the member sign-up stage as well as survey completion stage [53]. The project team, which included consumer researchers from all markets except Singapore, co-developed the survey questionnaire to ensure contextual relevance. Professional translators translated the survey into local languages where necessary, with project team members reviewing the translations for accuracy.

Quota sampling was used to ensure age and gender representation in the five most populated cities in each market, except for one city in the USA which was not among the top five. Participants who did not purchase seafood or were not responsible for grocery shopping were excluded. The final sample comprised 12,222 participants. This study was granted ethics approval by CSIRO's Social Science Human Research Ethics Committee (approval number: 18321).

Table 1 presents participant demographics by market.

3.2. Measures

To ensure a shared understanding of sustainable seafood, participants were shown the definition from Seafood Watch [54]: "*Sustainable seafood comes from wild capture or farming operations that minimise harmful environmental impacts, assure good and fair working conditions, and support livelihoods and economic benefits throughout the entire supply chain.*" They were also informed: "*By looking at a seafood product, it is impossible to tell whether it is produced sustainably or not. It needs to be certified by a third party.*"

Importance of sustainable certification was measured with one item that examined participant perceived importance of sustainability certification: "For your seafood purchasing decision, how important is it for seafood products to have a sustainability certification (e.g., identified through labels)?" (1 = Not important at all, 5 = Very important).

Trust in sustainable seafood certification agencies. Participants were instructed: "For seafood imported from developed countries such as Australia/New Zealand and Norway [for survey in Australia], we would like to know how much confidence you have for each of the following types of certification providers." Four separate items were presented to characterise distinct certifying agencies: Exporting Country Government Agencies, Exporting Country Certification Agencies, International

Table 1
Participant demographics by market.

	Market (%)											
Variable	AU	CN	HK	ID	INDO	JP	NZ	SK	SG	TW	US	VN
Gender												
Female	52.4	51.5	54.3	48.7	51.3	49.6	51.5	50.2	50.3	49.8	51.1	57.9
Male	47.6	48.5	45.7	51.3	48.7	50.4	48.5	49.8	49.7	50.2	48.9	42.1
Age												
18-24	12.1	9.9	9.9	17.8	13.1	8.3	14.5	10.6	11.3	10.2	13.3	14.8
25-34	21.6	20.6	17.6	25.2	23.7	15.3	22.9	18.9	19.8	18.4	19.9	28.9
35-44	20.5	20.4	20.8	21.5	22.0	19.9	21.3	18.4	20.2	22.0	21.5	23.3
45-54	18.8	31.4	20.5	17.0	18.8	24.4	17.0	20.9	19.7	20.1	17.4	17.5
55-64	16.6	15.7	21.9	11.7	18.5	20.8	14.9	21.3	19.8	20.6	17.4	10.7
65+	10.5	2.0	9.4	6.8	3.9	11.4	9.3	9.9	9.1	8.7	10.5	4.9
Education												
Below high school	2.8	0.3	5.9	1.2	0.9	6.2	2.9	2.4	3.3	4.8	1.3	0.8
High school or technical school	28.5	5.8	17.2	4.3	20.3	29.5	25.4	16.0	14.4	13.1	20.5	7.5
Vocational education or training	21.3	9.4	11.5	3.3	7.6	3.9	18.9	7.9	13.8	9.0	13.2	9.7
Bachelor degree	38.1	71.3	60.7	42.5	65.9	54.5	36.2	63.3	48.9	57.9	45.9	77.4
Postgraduate degree	9.2	13.2	4.6	48.7	5.3	6.0	16.6	10.4	19.6	15.3	19.1	4.6
Sub-sample size (N)	1020	1054	1016	1000	1035	1021	1017	931	1029	1026	1054	1019

Note. AU = Australia, CN = mainland China, HK = Hong Kong, ID = India, INDO = Indonesia, JP = Japan, NZ = New Zealand, SK = South Korea, SG = Singapore, TW = Taiwan, US = United States of America, VN = Vietnam.

Certification Agencies, and Local Certification Agencies. Participants rated their confidence in each from 1 (Not confident at all) to 5 (Completely confident).

4. Results

4.1. Descriptive analyses for demographics

Exploratory analyses were conducted to examine demographic differences in key variables across the twelve markets. Spearman's rho was used to assess associations with age and education (Table 2), while independent t-tests were used for gender comparisons (Table 3).

Age showed inconsistent relationships with the focal variables across markets. In Singapore, Australia, Indonesia, Japan, and the USA, younger participants reported higher importance and confidence. In contrast, older participants in India and Vietnam showed stronger associations. Age was largely unrelated to these variables in mainland China, Hong Kong, New Zealand, South Korea, and Taiwan.

Education was generally positively associated with all key variables, suggesting that higher education levels correspond with greater perceived importance of sustainability certification and higher confidence in certifying agencies. This pattern held across most markets, except for South Korea and Taiwan.

Gender differences also varied. In Hong Kong and Vietnam, women reported higher importance and confidence, whereas in Japan and the USA, men expressed greater confidence in certifying agencies.

Together, these results indicate demographic differences in the key variables. Therefore, age, education, and gender were controlled for in subsequent analyses.

4.2. Importance of sustainability certification

A one-way ANCOVA was conducted to assess differences in perceived importance of sustainable seafood certification across markets, controlling for age, gender, and education. The analysis revealed significant variation between markets, $F(11, 12200) = 124.37$, $p < .001$. Sidak post-hoc comparisons using estimated marginal means were subsequently performed, with results shown in Fig. 1. Importance of sustainable certification was highest in lower-income markets (India, Indonesia, Vietnam, mainland China), lowest in Japan and New Zealand, and moderate in the remaining markets.

4.3. Between-markets trust differences in certification agencies

A series of one-way ANCOVAs were conducted to examine differences in consumer confidence across twelve markets in four types of sustainability certifying agencies for seafood imported from developed countries, controlling for age, gender, and education. Sidak post-hoc comparisons using estimated marginal means were performed, with results shown in Fig. 2.

Table 2
Spearman's rho correlation matrix of age and education with focal variables.

Predictor		Market											
		AU	CN	HK	ID	INDO	JP	NZ	SK	SG	TW	US	VN
Importance of Sustainability Certification	A	-.08*	.01	.02	.08*	-.09**	-.02	-.03	.08*	-.20***	.08*	-.26***	.18***
	E	.13***	.09**	.17***	.24***	.07*	.07*	.07*	.05	.25***	-.02	.10**	.34***
Confidence in Exporting Government Agencies	A	-.05	.09**	-.01	.12***	-.06†	-.06	.04	.03	-.10***	-.02	-.23***	.14***
	E	.14***	.08*	.14***	.28***	.12***	.12***	.15***	.03	.20***	-.02	.14***	.26***
Confidence in Exporting Country Agencies	A	-.09**	.03	.01	.07*	-.03	-.10**	-.01	-.03	-.06*	-.06	-.26***	.10**
	E	.14***	.08*	.10**	.21***	.13***	.10**	.15***	-.003	.14***	.02	.17***	.19***
Confidence in International Agencies	A	-.09**	.03	-.02	.09**	-.05	-.11***	.04	-.06†	-.11***	-.13***	-.28***	.13***
	E	.17***	.17***	.19***	.23***	.15***	.12***	.16***	.11**	.18***	.09**	.15***	.21***
Confidence in Local Agencies	A	-.003	-.05	.12***	-.08*	-.23***	-.11***	.02	.01	-.03	.02	-.17***	.15***
	E	.10**	.08*	.11***	.18***	.000	.06*	.09**	.05	.09**	-.09**	.18***	.18***

Note. Where A = Age and E = Education. AU = Australia, CN = mainland China, HK = Hong Kong, ID = India, INDO = Indonesia, JP = Japan, NZ = New Zealand, SK = South Korea, SG = Singapore, TW = Taiwan, US = United States of America, VN = Vietnam. All variables measured on 5-point Likert scales with higher scores indicating higher importance and confidence. * $p < .05$, ** $p < .01$, *** $p < .001$,
† $p < .06$

Table 3
Independent t-tests on focal variables by gender and market.

		Importance of Sustainability Certification		Confidence in Exporting Government agencies		Confidence in Exporting Country Agencies		Confidence in International Agencies		Confidence in Local Agencies	
Market	Gender	M (*SD*)	t	M (*SD*)	t	M (*SD*)	t	M (*SD*)	t	M (*SD*)	**t**
AU	M	3.55 *(1.01)*	-0.86	3.25 *(1.09)*	2.10*	3.24 *(1.09)*	2.39*	3.36 *(1.11)*	3.02**	3.85 *(1.05)*	2.50*
	F	3.60 *(0.97)*		3.10 *(1.12)*		3.08 *(1.10)*		3.15 *(1.14)*		3.68 *(1.09)*	
CN	M	4.04 *(0.83)*	-3.09**	3.82 *(0.96)*	-1.77	3.78 *(0.92)*	-3.72***	4.14 *(0.83)*	-3.04**	4.18 *(0.87)*	-1.93†
	F	4.19 *(0.73)*		3.93 *(0.92)*		3.99 *(0.88)*		4.29 *(0.75)*		4.28 *(0.84)*	
HK	M	3.57 *(0.88)*	-7.95***	3.55 *(0.89)*	-4.56***	3.52 *(0.96)*	-4.51***	3.83 *(0.99)*	-3.96***	3.36 *(1.10)*	-5.80***
	F	4.01 *(0.90)*		3.82 *(0.10)*		3.80 *(0.96)*		4.07 *(0.95)*		3.76 *(1.11)*	
ID	M	4.17 *(0.87)*	-3.13**	3.89 *(1.04)*	-1.71	3.90 *(1.01)*	-0.85	4.07 *(0.98)*	-0.93	4.07 *(1.07)*	-1.32
	F	4.33 *(0.79)*		4.00 *(1.06)*		3.96 *(1.02)*		4.13 *(0.95)*		4.16 *(1.04)*	
INDO	M	4.16 *(0.80)*	-2.25*	3.93 *(0.86)*	-2.00*	3.97 *(0.86)*	-2.14*	4.17 *(0.88)*	-1.51	4.06 *(0.92)*	1.84
	F	4.27 *(0.78)*		4.05 *(0.92)*		4.08 *(0.89)*		4.25 *(0.83)*		3.95 *(0.91)*	
JP	M	3.10 *(1.08)*	-1.21	2.94 *(0.99)*	3.24**	2.92 *(0.99)*	3.00**	3.10 *(1.05)*	2.98**	3.29 *(1.08)*	2.74**
	F	3.18 *(0.90)*		2.75 *(0.88)*		2.75 *(0.88)*		2.92 *(0.94)*		3.11 *(0.98)*	
NZ	M	3.33 *(1.03)*	-1.38	3.12 *(1.10)*	2.06*	3.17 *(1.12)*	2.22*	3.23 *(1.11)*	3.12**	3.72 *(1.08)*	0.37
	F	3.42 *(1.03)*		2.98 *(1.07)*		3.02 *(1.05)*		3.02 *(1.08)*		3.70 *(1.11)*	
SK	M	3.47 *(0.90)*	-1.96†	3.09 *(0.92)*	1.48	3.07 *(0.93)*	0.22	3.44 *(1.01)*	1.73	3.43 *(0.99)*	2.44*
	F	3.58 *(0.82)*		3.00 *(0.94)*		3.06 *(0.91)*		3.33 *(0.96)*		3.28 *(0.97)*	
SG	M	3.75 *(1.00)*	-0.45	3.71 *(0.98)*	1.75	3.67 *(1.03)*	1.82	3.86 *(0.99)*	1.22	4.13 *(0.97)*	1.13
	F	3.78 *(1.01)*		3.61 *(0.93)*		3.56 *(0.94)*		3.79 *(0.94)*		4.06 *(0.94)*	
TW	M	3.64 *(0.90)*	-1.24	2.99 *(0.98)*	1.15	3.03 *(1.00)*	1.66	3.42 *(1.05)*	1.89†	2.64 *(1.16)*	-1.14
	F	3.71 *(0.80)*		2.92 *(0.99)*		2.93 *(0.96)*		3.30 *(0.98)*		2.73 *(1.12)*	
US	M	3.78 *(0.95)*	0.73	3.53 *(1.12)*	3.58***	3.56 *(1.09)*	3.89***	3.60 *(1.08)*	3.41***	4.03 *(1.00)*	4.35***
	F	3.74 *(1.00)*		3.28 *(1.15)*		3.29 *(1.19)*		3.36 *(1.21)*		3.74 *(1.15)*	
VN	M	3.97 *(0.87)*	-5.40***	3.95 *(0.86)*	-2.89**	3.90 *(0.95)*	-2.75**	4.14 *(0.85)*	-1.39	3.83 *(1.03)*	-3.51***
	F	4.26 *(0.81)*		4.12 *(0.90)*		4.06 *(0.85)*		4.21 *(0.85)*		4.05 *(0.92)*	

Note. M = Male, F = Female. AU = Australia, CN = mainland China, HK = Hong Kong, ID = India, INDO = Indonesia, JP = Japan, NZ = New Zealand, SK = South Korea, SG = Singapore, TW = Taiwan, US = United States of America, VN = Vietnam. All variables measured on 5-point Likert scales with higher scores indicating higher importance and confidence.
* $p < .05$, ** $p < .01$, *** $p < .001$, †$p < .06$

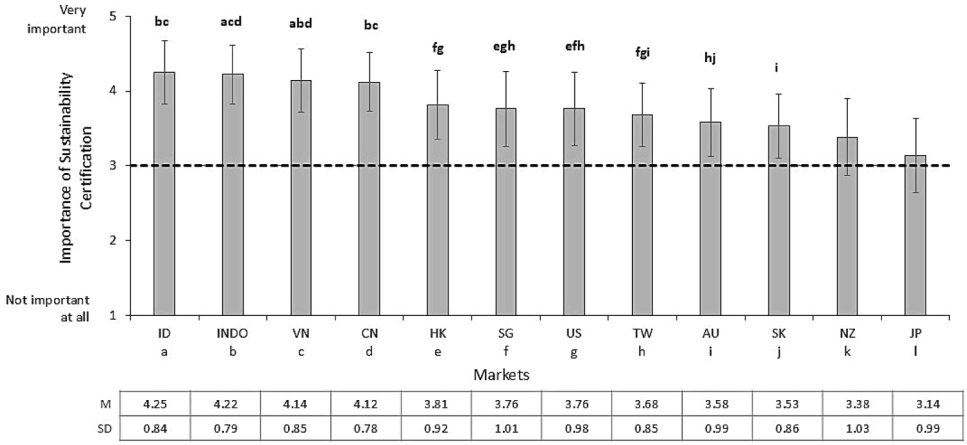


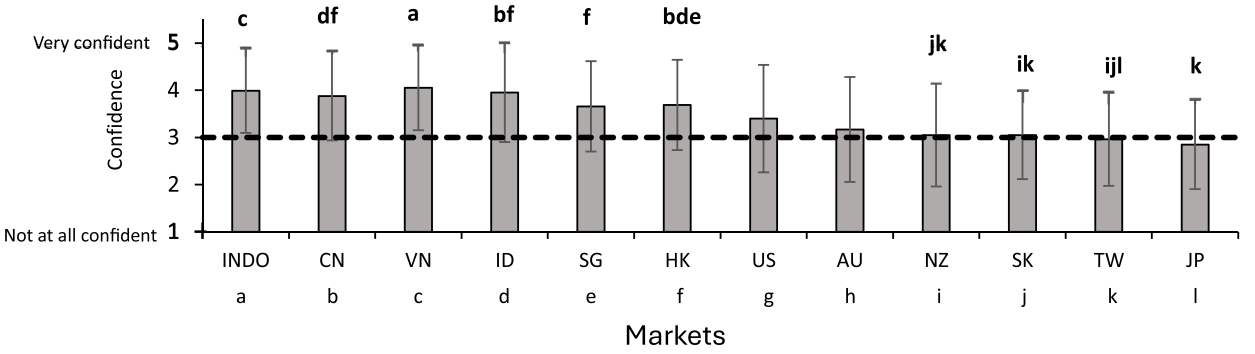
Fig. 1. Mean importance of sustainability certification by market. *Note.* AU = Australia, CN = mainland China, HK = Hong Kong, ID = India, INDO = Indonesia, JP = Japan, SK = South Korea, NZ = New Zealand, SG = Singapore, TW = Taiwan, US = United States of America, VN = Vietnam. Importance of sustainability certification was measured on a 5-point Likert scale with higher scores indicating greater perceived importance by respondents. The error bars represent standard deviation. Letters indicate non-significant (*ns*) differences from corresponding markets (i.e., [a] indicates *ns* difference from market a, [b] indicates *ns* difference from market b, …, [l] indicates *ns* difference from market l). M for mean, and SD for standard deviation.

Significant differences were found in confidence towards Exporting Government Certification Agencies, $F(11, 12200) = 180.52$, $p < .001$ (Fig. 2a); Exporting Country Certification Agencies, $F(11, 12200) = 172.51$, $p < .001$ (Fig. 2b); International Certification Agencies, $F(11, 12200) = 184.03$, $p < .001$ (Fig. 2c); and Local Certification Agencies, $F(11, 12200) = 184.73$, $p < .001$ (Fig. 2d).

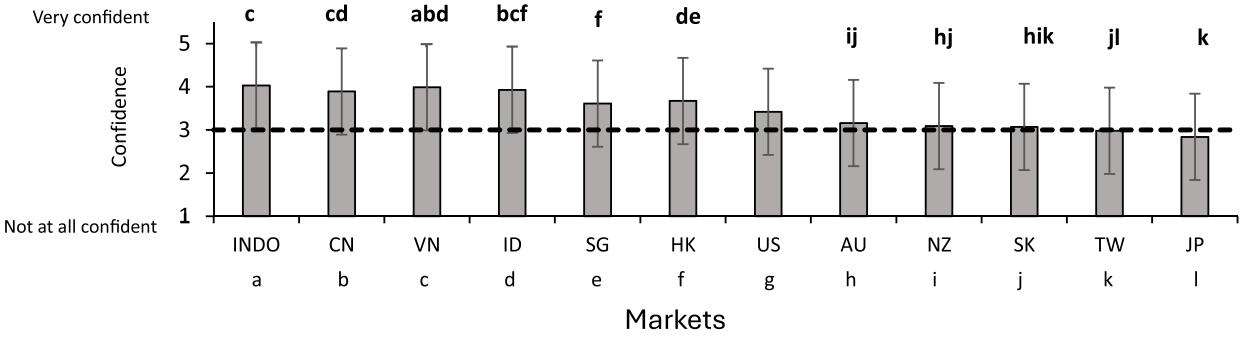
The results indicate regional clustering across the twelve markets. Overall, markets clustered into three distinct groups: a high-trust cluster (Indonesia, mainland China, Vietnam, and India), a consistently low-trust cluster (Japan, Taiwan, South Korea), and a mid-trust cluster comprising the remaining markets.

4.4. Within-market trust differences in certification agencies

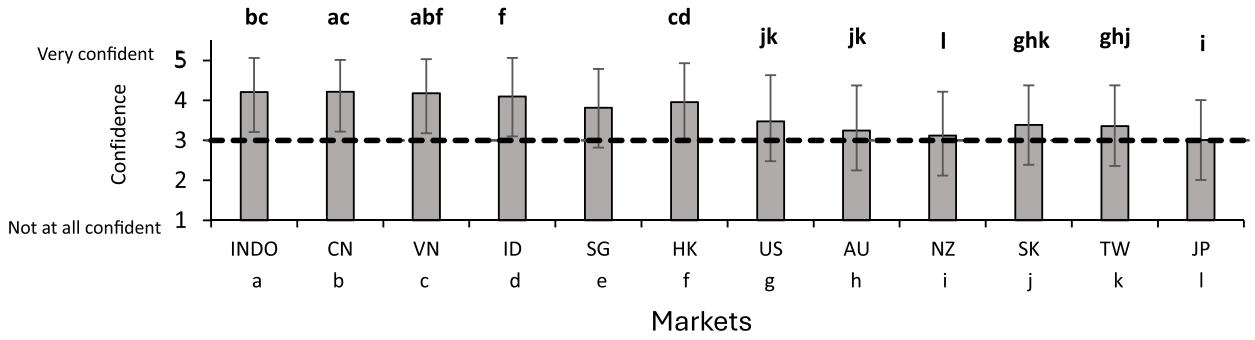
To explore within-market differences in confidence across the four types of certification agencies, paired t-tests were conducted. Preference groups were assigned based on statistically significant differences in mean confidence scores. Markets in which Local Certification Agencies received the highest scores were classified as 'Local Preference'; those in which International Certification Agencies scored highest were classified as 'International Preference'; and those in which confidence scores for Local and International agencies did not differ significantly, but both exceeded those of exporting country agencies, were classified as 'Equal Preference'. Applying this rule-based classification yielded three distinct



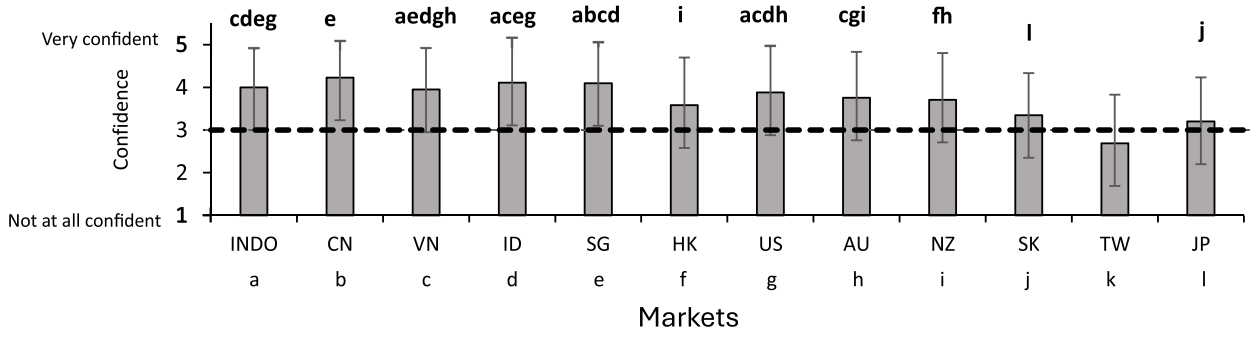
a. Confidence in Exporting Government Certification Agencies



b. Confidence in Exporting Country Certification Agencies



c. Confidence in International Certification Agencies



d. Confidence in Local Certification Agencies

Fig. 2. Mean confidence in certifying agencies by market. *Note.* AU = Australia, CN = mainland China, HK = Hong Kong, ID = India, INDO = Indonesia, JP = Japan, SK = South Korea, NZ = New Zealand, SG = Singapore, TW = Taiwan, US = United States of America, VN = Vietnam. All variables were measured on a 5-point Likert scale with higher scores indicating greater confidence. The dotted line indicates the mid-scale point. The error bars represent standard deviation. Letters indicate non-significant differences from corresponding markets (i.e., a indicates ns difference from market a, b indicates ns difference from market b…l indicates ns difference from market l).

market groups (Table 4):

- *Local Preference*: Australia, Japan, the USA, New Zealand, and Singapore showed the highest confidence in Local Certification Agencies, followed by International Certification Agencies. Both types of exporting country agencies were rated lowest.
- *International Preference*: Indonesia, Hong Kong, Taiwan, and Vietnam expressed the greatest confidence in International Certification Agencies, followed by both types of exporting country agencies. Local Certification Agencies were rated least trusted.
- *Equal Local and International Preference*: Mainland China, India, and South Korea rated both Local and International Certification Agencies equally high, with lower confidence in both types of exporting country agencies.

5. Discussion

This study examined consumer trust in four types of sustainability certification agencies for imported seafood from developed countries across twelve markets: Local Certification Agencies, International Certification Agencies, Exporting Country Certification Agencies, and Exporting Country Government Agencies. The findings reveal cross-market and within-market variations in both the perceived importance of certification and levels of trust in certifying agencies. This study advances the sustainable seafood literature by addressing an important gap in understanding consumer trust in certification agencies across diverse markets. Despite growing interest in sustainable seafood, relatively few studies have examined trust in certification, particularly outside Europe. This gap is especially consequential considering recent global incidents of greenwashing and mislabelling, which risk undermining consumer confidence in sustainability claims [55,56].

First, sustainability certification was generally viewed positively in seafood purchasing decisions across all markets (Fig. 1). Notably, participants from lower-income economies (India, Indonesia, Vietnam, and mainland China) placed the greatest importance on certification. This may reflect a halo effect, where eco-labels influence perceptions of product safety [57]. In other words, consumers may interpret sustainably produced food as indicative of heightened safety standards for the seafood product. Indeed, Lim et al [57] found that many consumers perceive Marine Stewardship Council and Sustainably Sourced as indicators of safer products, and this perception significantly increases willingness to pay for eco-labelled food. Given that safety concerns are prioritised in many lower-income economies [49,40], it is likely that the higher regard for sustainability certification by participants from India, Indonesia, Vietnam, and mainland China reflect underlining concerns over food safety. In contrast, Japanese respondents were more neutral, possibly reflecting the country's historically moderate adoption of sustainability certifications. Research indicates that while global eco-label schemes such as the Marine Stewardship Council (MSC) have proliferated internationally, uptake in Japan remains slow [58]. Sustainability is also not strongly promoted by institutions or producers [59], and retailers rarely enforce sourcing codes for certified seafood [60].

Second, Trust in certification agencies varied across markets, forming discernible clusters (Fig. 2). Participants from lower-income economies (i.e., mainland China, Indonesia, India, and Vietnam) reported the highest trust in all four types of agencies, while Japanese respondents reported the lowest. These results align with prior research showing low trust in certification labels among Japanese consumers and higher trust among Chinese consumers [43]. Participants from Taiwan, South Korea, New Zealand, and Australia also expressed relatively low trust in most of agencies. These patterns suggest that, beyond income levels, trust in certification agencies may be influenced by contextual dimensions, such as regulatory histories, consumer activism around food safety, and broader cultural or political expectations of institutional oversight.

Third, significant differences emerged in trust across agency types within markets (Table 4). In general, participants did not distinguish between the trustworthiness of Exporting Country Government Agencies and Exporting Country Certification Agencies. Further, these two certifying agencies tended to be the least trusted options in nearly all 12 markets, contradicting earlier findings that government eco-labels were more trusted than private or international ones [33,34]. This may reflect that consumers may regard the certification agencies from exporting countries as having a conflict of interest, not being independent, or not having sufficiently rigorous certification standards [35,40].

Finally, three trust preference groups were identified. The *Local Preference Group* (Australia, Japan, USA, New Zealand, Singapore) trusted Local Certification Agencies most. The *International Preference Group* (Indonesia, Hong Kong, Taiwan, Vietnam) favoured International Certification Agencies. The *Equal Preference Group* (mainland China, India, South Korea) trusted both equally. These patterns partly align with previous research. For example, consumers in high-income economies often prefer domestic certification due to perceived higher standards [40]. However, Hong Kong and Taiwan showed the opposite trend, and South Korea did not differentiate. Meanwhile, Indonesian and Vietnamese participants' trust in international agencies supports findings that low-income economies often perceive international agencies as more credible because of perceived higher standards [29,37,38,40].

A notable exception was mainland China, where participants trusted

Table 4
Three groups of markets by ranked mean confidence in certification agencies.

Local Preference Group					International Preference Group				Equal Local and International Preference Group		
AU	JP	US	NZ	SG	INDO	HK	TW	VN	CN	ID	SK
1st	**1st**	**1st**	**1st**	**1st**	**1st**	**1st**	**1st**	**1st**	**1st**	**1st**	**1st**
LCA	**LCA**	**LCA**	**LCA**	**LCA**	**ICA**	**ICA**	**ICA**	**ICA**	**LCA**	**LCA**	**LCA**
(3.76)	**(3.20)**	**(3.88)**	**(3.71)**	**(4.10)**	**(4.21)**	**(3.96)**	**(3.36)**	**(4.18)**	**(4.23)**	**(4.11)**	**(3.35)**
2nd	2nd	2nd	2nd	2nd	2nd	2nd	2nd	2nd	**1st**	**1st**	**1st**
ICA	ICA	ICA	ICA	ICA	ECGA	ECGA	ECGA	ECGA	**ICA**	**ICA**	**ICA**
(3.25)	(3.01)	(3.48)	(3.12)	(3.82)	(3.99)	(3.69)	(2.96)	(4.05)	**(4.22)**	**(4.10)**	**(3.39)**
3rd	3rd	3rd	2nd / 3rd	3rd	2nd	2nd	2nd	3rd	2nd	2nd	2nd
ECGA	ECGA	ECGA	ECCA	ECGA	ECCA	ECCA	ECCA	ECCA	ECGA	ECGA	ECGA
(3.17)	(3.05)	(3.40)	(3.09)	(3.66)	(4.03)	(3.67)	(2.98)	(3.99)	(3.88)	(3.95)	(3.05)
3rd	3rd	3rd	3rd	4th	2nd	3rd	3rd	3rd	2nd	2nd	2nd
ECCA	ECCA	ECCA	ECGA	ECCA	LCA	LCA	LCA (	LCA	ECCA	ECCA	ECCA
(3.16)	(3.09)	(3.42)	(3.05)	(3.61)	(3.21)	(3.58)	2.69)	(3.95)	(3.89)	(3.93)	(3.07)

Note. Confidence was measured on a 5-point scale with lower scores indicating lower confidence. Ranking is based on significance testing at $p < .05$. The magnitude of Cohen's *d* effect sizes for differences in preferences varied across markets, ranging from medium (in AU, NZ, TW), small (in JP, US, SG, INDO, HK, VN, CN, SK), to very small (in ID). AU = Australia, CN = mainland China, HK = Hong Kong, ID = India, INDO = Indonesia, JP = Japan, SK = South Korea, NZ = New Zealand, SG = Singapore, TW = Taiwan, US = United States of America, VN = Vietnam. ECCA = Exporting Country Certification Agencies, ECGA = Exporting Country Government Agencies, ICA = International Certification Agencies, LCA = Local Certification Agencies.

Local and International Certification Agencies equally. This contrasts with literature suggesting a preference for foreign certification due to perceived superior quality and safety standard [29,39,40]. However, Yang et al. [61] found that Chinese consumers who trusted organic labels preferred domestic organic tea labels over foreign (Japanese and USA) ones, indicating that product type and familiarity may influence certification preferences. Given China's significant role in global seafood production and trade, participants may have greater confidence in domestic certification for seafood products [50,62]. Further, the equal trust may also reflect intersecting policy, cultural, and market dynamics. Following major food safety incidents, government-led reforms have strengthened inspection, traceability, and certification systems, thereby rebuilding public confidence in domestic oversight [48,63]. Growing consumer ethnocentrism and national pride further encourage trust in local certifications alongside international ones [64]. Additionally, the rise of regulated e-commerce platforms featuring verified and government-endorsed food labels has familiarised consumers with domestic certification schemes [65]. Collectively, these factors may help explain why Chinese consumers exhibit similar levels of trust in both local and international certifiers.

These findings have significant theoretical and policy implications. Theoretically, they contribute to the literature on global trust and sustainability communication. The clear clustering of trust preferences (i.e., local, international, and equal preference groups) provides empirical support for emerging work highlighting that trust in food systems is highly contingent on cultural norms, governance expectations, and perceived institutional legitimacy [48]. Notably, the observation that Chinese consumers exhibit equal levels of trust in both local and international certification agencies highlights the dynamic and context-dependent nature of trust, shaped by intersecting policy reforms, cultural identity, and market channels. These results point to the need for an expanded framework for global trust in sustainable certification, one that integrates institutional context, consumer psychology, and the influence of recent policy reforms.

Additionally, the decoupling between the perceived importance of certification and trust in certifiers in some markets highlights that sustainability communication must consider both cognitive (i.e., trust in the certifier) and attitudinal (i.e., importance placed on certification) pathways. This distinction advances understanding of on how consumers process and respond to complex sustainability cues in global markets.

The results also carry direct implications for seafood exporters, policymakers, and certification agencies, highlighting the importance of aligning certification strategies and communication approaches with the trust dynamics of target markets. In local-preference markets (e.g., Australia, Japan, USA), exporters may benefit from partnering with trusted domestic certification bodies or pursuing co-labelling strategies that foreground local credibility. In international-preference markets (e.g., Taiwan, Vietnam, Hong Kong), emphasising globally recognised certifications along with transparent audit processes may be most effective. In equal-preference markets (e.g., mainland China, India, South Korea), dual certification or joint verification strategies could leverage both global legitimacy and domestic familiarity. Policymakers can also enhance trust by investing in public education about certification standards, traceability, and auditing systems, as evidence shows that consumer knowledge of eco-labels is a strong driver of trust [66]. For certification bodies, the results suggest that trust-building efforts should focus on communicating how certification decisions are made. Given the well-established link between trust and knowledge of eco-labels and certification systems [12,66,67], interventions that provide clear, accessible information about certification standards and processes are likely to enhance consumer trust in eco-labels (e.g., [29]).

5.1. Limitations and future directions

While this study provides important insights into consumer trust in seafood certification across diverse markets, several limitations should be acknowledged, which also points to avenues for future research.

First, while this study broadened the geographic scope of trust research beyond Europe, especially given Asia's central role in global seafood trade, it did not examine deeper drivers underlying cross-market difference in trust. Goven differences in cultural context and economic development, the underlying causes may differ across markets. For example, consumers in many Asian countries tend to prioritise food safety, freshness, and product quality over sustainability attributes or eco-labels [68–70]. Future research should investigate the factors driving trust differences across markets, including demographic characteristics, food safety concerns, awareness of certification schemes, and political and institutional influences [27,30]. Although age, gender, and education were included as covariates in the main analyses, the exploratory findings revealed meaningful cross-market patterns that warrant further investigation. For example, education was consistently associated with higher levels of trust and greater perceived importance of certification, aligning with theories of sustainability literacy, showing that more educated consumers are better equipped to understand and evaluate sustainability claims [71]. Future research could explicitly model demographic variables as moderators rather than covariates to better capture their interpretive and explanatory roles.

In addition, while this study identified either local or international agencies as the most trusted certifiers depending on the market, future research should examine which specific schemes (e.g., government, private, non-profit, or brand-led) are most trusted within each market. Prior studies reported mixed consumer preferences for domestic government versus non-government labels [39,41,45,61,72], similar variation may exist for international certification schemes.

Second, this study employed a single-item measure of trust in certification agencies to minimise respondent fatigue that could arise from repeating multi-item scales across four agency types. Although this measure demonstrated strong reliability and validity comparable to multi-item scales capturing dimensions such as competence, benevolence, and integrity [73], it may not fully capture the full multidimensionality of trust. Future research could unpack these dimensions to inform more targeted trust-building strategies. Additionally, trust is inherently dynamic and can fluctuate in response to media coverage, food safety incidents, or changes in certification visibility. The cross-sectional design of this study captures trust at a single point in time and therefore may not reflect such temporal shifts. Future research should examine how trust evolves over time, particularly in response to real-world events that may amplify or erode confidence in different certification types.

Third, because trust and perceived importance are inherently subjective constructs, this study relied on self-reported measures. However, this approach may introduce common-method bias and inflate within-market consistency. Future research could address this by incorporating behavioural or experimental measures, temporally separating scales, or applying statistical controls [74].

Further, this study did not assess consumers' understanding of sustainability certification and certification agencies. Although a definition was provided during the survey and the survey underwent translation and expert review in each country, subtle differences in meaning or familiarity with certification systems could influence responses. Future research should explore how consumers interpret certification, certification agencies, and their value. This could clarify the foundations of trust and inform communication strategies to promote sustainable seafood consumption. It may also address concerns about eco-label saturation, as consumers often feel overwhelmed by the number of labels and their differing standards [75].

Finally, this study focused on imports from developed countries to control for country-of-origin effects, trust dynamics may differ substantially for seafood imported from developing economies. Consumers tend to stereotype a country's environmental image and competency based on its level of economic development, shaping their trust in the

safety and quality of food imported from the country [20,76]. They may assume weaker regulatory oversight, lower environmental standards, and greater food safety risks when evaluating products from less economically developed countries. Consequently, consumers may rely more heavily on internationally recognised certifiers to mitigate these perceived risks. Future research should examine trust in certification for seafood originating from developing countries, which could provide valuable insights for both the seafood industry and exporters in these regions to engage more effectively with consumers regarding their sustainable production practices.

6. Conclusion

Sustainability certifications are increasingly vital in the seafood industry, helping fisheries demonstrate environmental responsibility and meet consumer expectations. However, the growing number of certifications and greenwashing can confuse consumers and erode confidence in certified products. This study examined consumer trust in seafood sustainability certification across twelve culturally diverse markets, revealing that trust in certifying agencies is more nuanced than the existing literature has suggested. The findings of the current study underscore that understanding how consumers evaluate the trustworthiness of different certifiers is essential for developing effective market strategies. These findings have practical implications for the seafood industry in developing bespoke strategies for target markets to build a competitive advantage. By incorporating these insights into their marketing strategies, seafood importers, exporters, and marketers can better align their efforts with consumer trust dynamics and cultural differences, ultimately promoting sustainable seafood consumption more effectively.

CRediT authorship contribution statement

Airong Zhang: Writing – review & editing, Writing – original draft, Supervision, Software, Resources, Project administration, Methodology, Investigation, Funding acquisition, Formal analysis, Data curation, Conceptualization. **Christina Maxwell:** Writing – review & editing, Writing – original draft, Software, Methodology, Formal analysis, Conceptualization. **Peggy Schrobback:** Writing – review & editing, Methodology, Investigation, Conceptualization. **Francesco Tacconi:** Writing – review & editing, Methodology, Conceptualization. **Shang-Ho Yang:** Writing – review & editing, Investigation, Conceptualization. **Kiyokazu Ujiie:** Writing – review & editing, Methodology, Investigation. **Man-Keun Kim:** Writing – review & editing, Methodology, Investigation. **Thanh Mai Ha:** Writing – review & editing, Investigation. **Ningning Feng:** Writing – review & editing, Investigation. **Lintang Wardyani:** Writing – review & editing, Investigation. **Caroline Saunders:** Writing – review & editing, Investigation. **Meike Guenther:** Writing – review & editing, Investigation. **Nagaraj Samala:** Writing – review & editing, Investigation. **Hwa-Nyeon Kim:** Writing – review & editing, Investigation.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Data availability

The authors do not have permission to share data.

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