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Factors Influencing Seaweed Consumption: The Role of Values, Self-Identity, Norms and Attitudes

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Abstract

To mitigate climate change and ecological degradation, societies must change how they produce and consume food. In 2013, the Food and Agriculture Organization of the United Nations (FAO) highlighted the need to use alternative food sources to reach a more sustainable food system. In this context, seaweed has excellent potential as its production does not need fertilizers and does not engender freshwater pollution. Seaweeds are also good for limiting carbon emissions as seaweed captures and stores CO_2.

Seaweed consumption is not new. In Asia (for example, China, Japan and Korea), seaweed's taste and health qualities make it a very popular ingredient in Asian food culture and traditions. In Europe, seaweed remains unfamiliar to consumers; however, in recent years, an increasing amount of new seaweed food products and an increase in the consumption of seaweed food have revealed a trend towards higher consumer acceptance regarding seaweed.

Yet, there has been little research regarding consumers' behavior towards seaweed as food. This dissertation provides three articles with the overall aim of improving the theoretical and empirical understanding of the consumption of seaweed food products within different theoretical frameworks (e.g. norm activation model (NAM), value-attitude-behavior (VAB)) and analytical procedures (e.g. structural equation analysis and cluster analysis). This thesis is structured around five research objectives. The first objective is to explain and predict seaweed consumption using an extended version of the NAM (Paper 1). The second objective (Paper 2) is to explore and extend the VAB theoretical framework (the relationship between values, beliefs, attitudes and behaviors) in the context of seaweed food products. The third objective (Papers 1 and 2) aims to explore whether and how perceived behavioral control and consumer food innovativeness influence the strength of the relationship between attitude/intention and behavior. The fourth objective (Paper 3) is to identify and discuss seaweed consumers' profiles or characteristics based on their identity and value. The final aim (Section 2.5) is to explore cross-cultural differences in personal norms, attitudes, intentions and behavior towards seaweed food products between Norway and the UK.

Design/methodology/approach: This thesis is based on two data sets from two online surveys. The first survey was conducted in Norway in 2020 and resulted in a sample of 426 adults. The second survey was conducted in the UK in 2022 and resulted in a sample of 1,110 adults. Both samples were representative of gender, age and region.

We applied confirmatory factor analysis (CFA) and structural equation modeling (SEM) to achieve the first three goals. To identify consumer profiles (Objective 4), a cluster analysis and ANOVA were conducted. Finally, a two-sample t-test was performed to explore cross-cultural differences between Norway and the UK (Objective 4). All the analyses were performed using STATA statistical software.

Summary of the findings: The first research objective aims to explain seaweed food consumption using the norm activation framework. Paper 1's findings confirmed the robustness of an extended norm activation model to explain the intention of consuming seaweed. The results showed a positive relationship between awareness of health consequences and intention to eat seaweed, and between ascription of responsibility and intention. Intention and food innovativeness are both predictors of seaweed consumption. The findings suggest that consumers are motivated to consume seaweed food products if they believe these products have positive health consequences. In addition, the results indicated that environmental consideration plays a vital role in the formation of intention.
The second research objective aims to expand our understanding of the factors affecting seaweed food consumption, directly and indirectly, using the VAB framework. In Paper 2, an extended version of the VAB theory, assessing the influence of hedonistic values and perceived uniqueness versus biospheric values and perceived naturalness, was tested. Norwegian consumers had a positive attitude towards seaweed consumption, and they perceived seaweed as unique and natural. Both perceived uniqueness and naturalness triggered a positive response towards seaweed foods from the public.

Moreover, consumers with hedonistic values were more likely to have positive attitudes towards seaweed consumption when they perceived seaweed as unique. Similarly, consumers with biospheric values were more likely to have positive attitudes towards seaweed consumption when seaweed products were perceived as natural. Consumers with biospheric values were more likely to consume seaweed than those with hedonistic values. This finding indicated that most Norwegian consumers form their attitudes towards seaweed consumption according to biospheric values and health considerations.

In Papers 1 and 2, we explored whether and how perceived behavioral control and consumer food innovativeness influence the strength of the relationship between attitude/intention and seaweed consumption behavior. The findings in Paper 1 indicated that consumer food innovativeness positively moderates the relationship between intention and seaweed

consumption, suggesting that innovative food consumers are more likely to consume seaweed food. Moreover, Paper 2 showed that the relationship between attitude and consumption is stronger when consumers feel it is easy to consume seaweed food products.

For the fourth research objective (Paper 3), we identified and explored seaweed consumers' profiles and characteristics based on their values and self-identity. Then we investigated how knowledge, personal norms, intentions, attitudes and consumption of seaweed foods vary between these groups. The results revealed how environmental, altruistic and health-related values and identity can effectively segment consumers into homogeneous groups. We identified three consumer groups: progressive, traditional and egoistic. Consumers in these groups show differences in their propensity to consume seaweed foods and their knowledge, personal norms, attitudes and intentions regarding seaweed food products. The so-called "progressive consumers" perceived themselves as food-innovative and healthy, and valued the environment and their well-being highly. They were more inclined to consume seaweed food products.

For the fifth and final research objective, we compared personal norms, attitudes, intentions and behavior towards seaweed food products between Norway and the UK. The results underlined that Norwegian respondents were willing to eat seaweed products more frequently than respondents from the UK. Norwegian consumers perceived seaweed as healthier, more natural, tastier, more unique, newer, safer and more accessible than their UK counterparts. In both countries, respondents equally perceived seaweed foods as expensive and smelly. Thus, extra efforts would be needed to introduce seaweed food products to UK consumers than to Norwegian consumers. For both countries, marketers should highlight their seaweed products' health and environmental characteristics to increase consumer acceptance, given consumers' concerns about their health and the environment.

Table of Contents

Part 3.

Paper 1: Govaerts, F., & Olsen, S. O. (2022). Exploration of seaweed consumption in Norway using the norm activation model: The moderator role of food innovativeness. *Food Quality and Preference*, *99*, 104511.

Journal metrics (2023):

- Impact Factor: 6.345
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Paper 2: Govaerts, F., & Olsen, S. O. (2023). Consumers' values, attitudes and behaviours towards consuming seaweed food products: The effects of perceived naturalness, uniqueness, and behavioural control. *Food Research International*, *165*, 112417.

Journal metrics (2023):

- Impact Factor: 7.425
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Paper 3: Govaerts, F., & Olsen, S. O. (2023). Consumer values and self-identity as a basis for identifying segments of consumers of seaweed in the UK. Submitted to *Food Quality and Preference.*

Journal metrics (2023):

- Impact Factor: 6.345
- CiteScore: 10
- Publisher: Elsevier
- Acceptance rate: 18%

Part 1

1 Introduction, Background and Purpose

1.1 Introduction

The United Nations predicts that the world population will increase by two billion people over the next 30 years, rising from 7.7 billion to 9.7 billion by 2050. This dramatic increase challenges the global food system to feed the future world population. At the same time, global food production is already experiencing the negative impacts of climate change. According to the Intergovernmental Panel on Climate Change (IPCC), climate change will increasingly put pressure on food production and access due to an increased frequency, intensity and severity of droughts, floods and heatwaves, and a continuing sea level rise will increase the risks to food security (IPCC, 2022).

Simultaneously, we must reduce our global food system's ecological footprint and preserve natural resources for future generations. Today's global food system is responsible for around 40% of greenhouse gases, including through deforestation, transport and processing (IPCC, 2022).

As concerns about our food system grow, increased attention has been given to finding new sources of food that are pro-environmental and nutritious. In this search for new food, seaweed has raised enthusiasm among scientists, industry and environmentalists. Indeed, seaweed cultivation has a positive impact on the ecosystem as it helps maintain biodiversity, provides coastal protection and improves water quality (Sondak & Chung, 2015). Seaweeds are fast-growing organisms that capture CO_2 and produce O_2, which can be used to store carbon. However, when used as a component of animal feed or food products, CO_2 is regenerated during respiration, and no carbon uptake occurs (Sondak & Chung, 2015). Moreover, unlike agriculture, which puts pressure on land and water, seaweed farming does not consume fresh water, fertilizers or pesticides.

In addition to its environmental qualities, seaweed is a highly nutritional food source. Depending on the type, seaweed can be a good source of proteins and amino acids. Red seaweed, for example, is a good source of protein as it can contain up to 47% (Pereira, 2016). This characteristic makes seaweed a potentially cheap and sustainable alternative protein source. Moreover, seaweed is naturally rich in polyunsaturated fatty acids (omega-3 and -6), which can prevent cardiovascular disease and cancers. Finally, seaweed contains fiber and can

provide a wide range of minerals (for example, iodine, iron and calcium) and vitamins (A, D, E and K).

The first written record of seaweed consumption dates to 500 B.C. in China (Pereira, 2016). In East Asia, countries like China, Japan and Korea have a long tradition of cultivating and consuming seaweed. In Western countries, however, there is historically no important seaweed culinary culture. Seaweed has been used as a fertilizer and animal feed, and its consumption by humans has often been limited to periods of famine. In Norway, for example, records reveal the use of seaweed in the diet during the Viking age when crossing the sea. Today, however, seaweed has almost disappeared from the traditional Norwegian diet. Most Western consumers generally remain unfamiliar with seaweed as a food source.

Asian immigration to Western countries has, however, contributed to bringing seaweed food products to parts of the world where it is consumed very little or not at all. Hence, today, we can easily eat dishes with seaweed in Asian restaurants. Various seaweed products like snacks and salads are also available in international food stores[1].

The consumption of seaweed, either raw, dried or as an ingredient in other food products, is increasing (Birch, Skallerud, & Paul, 2019). In Europe, the seaweed food market is projected to be worth €600–1,800 million in 2030 and will significantly benefit from the strong growth in plant-based diets (Vincent, Stanley, & Ring, 2020). However, few studies have explored the motivational foundations of seaweed consumption among Western consumers. According to Birch et al. (2019), consumer acceptance varies depending on the level of education, the degree of adventurousness and the neophobia of the consumer. Other research has also examined and underlined the influence of food neophobia towards seaweed food (Losada-Lopez, Dopico, & Faína-Medín, 2021; Wendin & Undeland, 2020). According to Blikra et al. (2021), the main reason for consumer skepticism towards seaweed is the lack of knowledge regarding its nutritional value and health benefits.

This thesis aims to extend established knowledge about seaweed consumption behavior and choice. It combines theories within consumer food consumption behavior/choice and social psychology. The first paper applies the norm activation theory (Schwartz, 1977) to explain

[1] This thesis does not focus on a specific seaweed species, product or cultivation. In other words, we study seaweed consumption as other studies have studied meat/seafood consumption (including a large variety of species and products).

and predict seaweed food consumption. Then, in the second paper, the authors use the value-attitude-behavior framework (Homer & Kahle, 1988) to explore further the factors affecting seaweed consumption. The third paper segments seaweed consumers based on their values, identity and personal norms (Ruepert et al., 2016). Finally, the thesis explores the differences in consumers' attitudes, intentions and consumption of seaweed food products between Norway and the UK. The thesis also combines different methodological approaches, such as structural equation modeling (SEM), cluster analyses and descriptive statistics, in order to provide theoretical and empirical contributions and a more comprehensive understanding of the motivations to consume seaweed in Norway and the UK.

1.2 Theoretical and Methodological Approaches for Explaining the Motivation for Food Consumption

Several review studies have been presented over the years focusing on what motivates individuals to accept, buy, choose or consume food (Chen & Antonelli, 2020; Enriquez & Archila-Godinez, 2022; Khan & Pandey, 2023; Kushwah, Dhir, Sagar, & Gupta, 2019; Symmank et al., 2017). Many factors can influence consumers' food choices. Among them, we can cite food-intrinsic factors (taste, smell, price and other features specific to the product), food-extrinsic factors (information, social environment, physical environment), and factors related to the individual such as psychological factors (beliefs, attitudes, values, norms, personal traits, etc.), and cultural and sociodemographic factors (culture, country, age, income, education, etc.) (Chen & Antonelli, 2020).

Food behavior is complex, and various theoretical approaches have been used to explain and predict it. These theories offer a holistic understanding of how different factors influence our (food) behavior and how these factors are structured and interact with each other. The most widely used theoretical frameworks that explain and predict consumer behavior are the theory of planned behaviour (TPB: Ajzen, 1991; Yuriev, Dahmen, Paillé, Boiral, & Guillaumie, 2020), value-attitude-behavior hierarchy (VAB: Homer & Kahle, 1988; Jacobs, Petersen, Hörisch, & Battenfeld, 2018), the norm activation model (NAM: Caracciolo et al., 2016; Schwartz, 1977), the value belief norm model (VBN: Kaiser & Stead 2002; Stern, 2000), goal-framing theory (Lindenberg & Steg, 2013), Schwartz's value theory (SVT: Schwartz, 1992), time perspective theories (Kooij, Kanfer, Betts, & Rudolph, 2018; Milfont, Wilson, & Diniz, 2012), social dilemma theories (Khachatryan, Joireman, & Casavant, 2013) and protection motivation theory (PMT: Tunner, Day, & Crask, 1989). Several of these theories

are integrated and validated against each other to understand associations, causal relationships and predictive ability, and/or to extend the breadth and depth of theoretical knowledge about antecedents and consequences of individuals' attitude, engagement and consumption behavior (e.g. Zhang, Grunert, & Zhou, 2020).

However, no model is perfect or manages to explain all the variations of behavior. For instance, studies have underlined a gap between intention and behavior (Echegaray & Hansstein, 2017; ElHaffar, Durif, & Dubé, 2020; H. Wang & Mangmeechai, 2021). Other studies have underlined a similar gap between attitude towards behavior and behavior (ElHaffar et al., 2020; Padel & Foster, 2005; Tung, Shih, Wei, & Chen, 2012; Yamoah & Acquaye, 2019; Y. Zhang, Bai, Mills, & Pezzey, 2021). For this reason, this thesis aims to address these two gaps in Papers 1 and 2.

1.2.1 Exploring Consumer Behavior toward Seaweed

In recent years there has been an increase in interest regarding seaweeds as a food source in the Western diet. In the literature, few studies have focused on seaweed from the consumer behavior perspective. These studies have used different factors to study seaweed food consumption in different countries. In total, we retrieved 12 papers focusing on seaweed from a consumer perspective in the last 10 years.

Grahl, Strack, Weinrich, and Mörlein (2018) investigated the acceptance of three food products (pasta, sushi and jerky) containing seaweed across France, Germany and the Netherlands. They found that products that consumers were most familiar with were the most widely accepted. Of the three products, pasta was preferred by the consumers. In France, Germany and the Netherlands, another study also examined consumers' acceptance of meat substitutes based on seaweed (Weinrich & Elshiewy, 2019). The study emphasized the importance of meat consumption habits, as consumers used to eating meat daily were unwilling to substitute meat with seaweed, whereas people with a low meat consumption habit were more favorable towards seaweed as a meat substitute. The authors underline the importance of health benefits and price as factors of meat substitutes based on seaweed (Weinrich & Elshiewy, 2019).

In a study published in 2019, Lucas, Gouin, and Lesueur (2019) explored the determinants of seaweed consumption and preferences in France. The authors identified attitude as a strong influencing factor in seaweed consumption, based on survey data. Birch et al. (2019) profiled

Australian consumers likely to eat seaweed products in the future. This study used logistical regression analysis and found that seaweed consumers were adventurous and health-conscious people with higher education. Moreover, they found that people intend to eat seaweed for environmental and health symbolic reasons and underlined food neophobia as an important barrier to seaweed consumption.

In a pilot study, a survey conducted by Wendin and Undeland (2020) also showed that the Swedish had a positive attitude towards consuming seaweed for environmental reasons. Young Swedish men were the most enthusiastic about including seaweed in snacks and fast food. Finally, snacks and bread with seaweed were the food categories about which consumers were most positive (Wendin & Undeland, 2020).

Palmieri and Forleo (2020, 2022) conducted two studies on Italian consumer behavior. The first study focused on classifying consumers based on their shared characteristics (Palmieri & Forleo, 2020). Their segmentation approach was based on factors relating to consumers' general eating habits, their neophobia, and their perceptions of, and attitudes towards, edible seaweed. They found that seaweed environmental and health characteristics and seaweed availability are important drivers of consumption. Their second article explored the factors most capable of impacting Italian consumers' willingness to eat seaweed. They found that information about seaweed, previous experiences and a positive disposition toward seaweed are crucial factors capable of improving consumer acceptance (Palmieri & Forleo, 2022).

A study published in 2021 was the first to investigate German consumers' responses to different seaweed cultivation systems (Weickert, Grahl, & Weinrich, 2021). The results showed no significant influence of the cultivation system on consumers' acceptance of seaweed. They also found that providing information about the cultivation system did not influence consumers' acceptance of seaweed products. The authors underlined that informing consumers about seaweed's nutritional and environmental properties is likely to affect consumer acceptance of seaweed food products more than informing them about the cultivation method.

Losada-Lopez et al. (2021) found a negative effect of neophobia on consumers' interest in eating seaweed in restaurants before and after consumption. However, the study showed no significant influence of neophobia on consumers' perception of three seaweed attributes: health, wellness and naturalness. This study also investigated whether neophobia negatively

affects consumers' perceived health, wellness and naturalness attributes and consumers' beliefs in a chef's presentation of a seaweed dish. The results showed no significant influence of neophobia on perceived attributes and chefs' presentations (Losada-Lopez et al., 2021).

Consumer emotional response and intention to eat bread, fish fillet, cheese, noodles, yogurt and sausage containing seaweed were studied by Moss and McSweeney (2021). The study found that Canadians were most positive towards bread, which they also had the highest intention to consume. However, they disliked yogurt and seaweed sausage (Moss & McSweeney, 2021).

A recent study (Young, Paul, Birch, & Swanepoel, 2022) looked at the factors influencing the consumption of seaweed food products among young adults in Australia. They found that nutrition, health benefits and taste were the main drivers. At the same time, a lack of accessibility, unaffordability and a lack of diversity were the major barriers to seaweed consumption. They also found that snacks and home-prepared meals were the most widely consumed seaweed products among young Australian adults. Similarly, in the UK., Embling et al. (2022) found that taste and familiarity were strong drivers of seaweed consumption.

Table 1 *. A Summary of Previous Work on Consumers' Seaweed Preferences, Acceptance, Attitudes, Motivations and Consumption*

Author(s), year	Scope and conceptualization	Method	Key findings
Grahl et al., 2018	Explore consumer acceptance of familiar vs. unfamiliar seaweed food products in France, Germany and the Netherlands.	Interviews, survey, mixed-method approach, ANOVA	Pasta was the most widely preferred product due to consumer familiarity with pasta.
Weinrich & Elshiewy, 2019	Explore consumer preferences for meat substitutes containing seaweed in France, Germany and the Netherlands.	Survey, conjoint analysis	Underlined the importance of health benefit and price as factor influencing consumer acceptance of meat substitutes containing seaweed.
Lucas et al., 2019	Explore the determinants of seaweed consumption and label preference in France.	Survey, multinomial probit model	Identified attitude as an important predictor of seaweed consumption and label preference.
Birch et al., 2019	Explore who are likely to eat seaweed in Australia, using health consciousness, responsibility and food safety concerns, neophobia, symbolic food consumption and snacking behavior.	Survey, binary logistic regression	Identified education, familiarity, food neophobia, the symbolic value of food consumption, health consciousness and snacking behavior as significant predictors of the likelihood of eating seaweed products.
Wendin & Undeland, 2020	Investigate consumers' attitudes and preferences toward different categories of seaweed as food in Sweden.	Survey, descriptive statistics	Consumer showed positive attitudes towards seaweed. Snacks are the preferred seaweed products. Seaweed products were the most popular among young men.

Author(s), year	Scope and conceptualization	Method	Key findings
Palmieri & Forleo, 2020	Explore consumer eating habits, neophobia, attitudes and perceptions of seaweed and profile consumers in Italy.	Survey, principal component analysis and cluster analysis	Identified seaweed environmental and health characteristics and seaweed availability as important drivers of consumption.
Palmieri & Forleo, 2022	Investigate the importance of information on consumers' acceptance of eating seaweed in Italy.	Survey, factor analysis, logistic regression	Identified information about seaweed, previous experiences and a positive disposition towards seaweed as crucial factors.
Weickert et al., 2021	Investigate consumer evaluation of the potential of seaweed cultivation systems together with information.	Survey, structural equation modeling	Showed the importance of nutritional and environmental qualities in consumer acceptance of cultivation systems in combination in Germany.
Losada-Lopez et al., 2021	Explore the influence of neophobia, perceived wellness, health and naturalness on interest in eating seaweed in Spain.	Survey and tasting session	Neophobia affected intention to consume seaweed. No influence of neophobia on health, wellness and naturalness perception.
Moss & McSweeney, 2021	Evaluate consumer emotional responses to seaweed food products in Canada.	Survey, ANOVA	Underlined the influence of hunger status, food neophobia and lifestyle on their emotional response.
Young et al., 2022	Explore the motivations that drive young Australians to eat seaweed.	Survey, content analysis, descriptive statistics	Identified nutritional and taste qualities as the main drivers. Identified price, accessibility and diversity as barriers to seaweed consumption in Australia.
Embling et al., 2022	Explore the consumer acceptability of seaweed-based food products in the UK.	Survey, MANOVA	Emphasized the importance of taste and familiarity as factors in the acceptability of seaweed-based food products.

In summary, these recent studies provide a background to the factors influencing seaweed consumption in Western countries. Among these factors, this short review emphasizes the importance of food neophobia, familiarity, knowledge, and nutritional, environmental and health motivations as factors of seaweed acceptance.

This thesis goes further in the analyses by using salient factors related to seaweed's environmental and health attributes. Further, this thesis uses psychological and cognitive factors (such as values, norms, self-identity, knowledge, attitude and intention) to better represent how the different factors influence seaweed consumption and how the factors are structured and interact with each other in the decision-making process. Finally, this thesis contributes to the existing theoretical literature in explaining individual and consumers' intention and (food) behavior by using the norm activation model (NAM) (Schwartz, 1977) and the value-attitude-behavior (VAB) framework (Homer & Kahle, 1988).

1.2.2 Theoretical Frameworks Focusing on Sustainable Consumption: The Role of Values and Personal Norms

The cultivation of seaweed is considered sustainable and environmentally friendly (Pereira, 2016; Sondak & Chung, 2015), but in Western countries, seaweed is still new and unfamiliar to Western consumers. Thus, consumers' lack of knowledge and awareness about seaweed's environmental and health benefits may be a consumption barrier. The NAM framework is relevant for studying seaweed food consumption as it suggests that beliefs, knowledge and awareness activate personal norms (Schwartz, 1977). In the area of sustainability and environmental theories, the value-attitude-behavioral (VAB) framework (Vaske & Donnelly, 1999) is frequently used to explain a multitude of pro-environmental intentions such as car use (Nordlund, Jansson, & Westin, 2018), energy saving (Song, Zhao, & Zhang, 2019), clothing consumption reduction (Joanes, 2019), organic food consumption (Shin, Im, Jung, & Severt, 2018) and general pro-environmental behavior (Han, 2014; Han, Hwang, Kim, & Jung, 2015; Onwezen, Antonides, & Bartels, 2013). In an experimental study, Steg and Groot (2010) confirmed that the NAM variables are causally related. As the NAM has successfully explained multiple pro-environmental behaviors, we believe it is a relevant framework for explaining seaweed consumption.

In addition to norms, environmental values and attitudes are considered the most salient motives for consuming food with environmental and health attributes (Aertsens, Verbeke, Mondelaers, & van Huylenbroeck, 2009; Kushwah et al., 2019). Values are assumed to be an essential motivational factor for forming beliefs and influencing people's attitudes towards (sustainable) behaviors (De Groot & Steg, 2008; Milfont, Duckitt, & Wagner, 2010; Stern, 2000). Therefore, the VAB model is a highly relevant framework for understanding whether and how values are associated with consumers' expectations, attitudes and behavior towards seaweed. Similarly to the NAM, the VAB model is theoretically robust and is one of the leading theories in pro-environmental and sustainable behavior. The VAB theory proposes a straightforward causal chain where behavior results from attitude. The more positive the attitude towards the behavior, the more likely you will engage in that behavior. Attitude depends on people's values. The VAB framework has also been used to study general food consumption (e.g. Hayley, Zinkiewicz, & Hardiman, 2015; Hölker, von Meyer-Höfer, & Spiller, 2019; Shin, Moon, Jung, & Severt, 2017) and sustainable food consumption (S. C. Grunert & Juhl, 1995; Sadiq, Rajeswari, Ansari, & Danish Kirmani, 2021; Sharma & Jha, 2017).

Moreover, this dissrtation also uses elements of the theory of planned behavior (Ajzen, 1991) to extend the NAM and the VAB model. The TPB is probably the most widely used theory to explain and predict food behavior such as the consumption of ethical foods (O'Connor, 2017), and organic and green foods (Carfora et al., 2019), food waste (Stancu, Haugaard, & Lähteenmäki, 2016) and new sustainable food products (Mancini, Moruzzo, Riccioli, & Paci, 2019; Onwezen, van den Puttelaar, Verain, & Veldkamp, 2019). The TPB assumes that behavior results from the intention to engage in a specific behavior. The stronger consumers' intention, the more likely they are to engage in that behavior. The intention depends on attitudes towards behavior, subjective norms related to behavior and perceived behavior control.

1.2.3 Self-Identity and Values as Segmentation Base

Throughout this thesis, we use two approaches to understand and explain consumer behavior: the variable-centered approach and the person-centered approach. The variable-centered approach assumes "that all individuals from a sample are drawn from a single population for which a single set of 'averaged' parameters can be estimated" (Morin, Bujacz, & Gagné, 2018, p. 804). This approach is the most frequently used in social sciences (Howard & Hoffman, 2018) and consists of methods such as single or multiple regression, confirmatory factor analysis (CFA) and structural equation modeling (SEM). The person-centered approach considers "the possibility that the sample might include multiple subpopulations characterized by different sets of parameters" (Morin et al., 2018, p. 804). The person-centered approach is growing in popularity among researchers as it complements the more traditional variable-centered approach (M. Wang & Hanges, 2011). Person-centered approaches determine and describe the optimal number of groups in a sample to generate the most accurate summary of the people in the sample using methods such as latent profile analyses, latent class analyses and cluster analyses.

In marketing, consumer segmentation is an essential concept based on the conviction that people differ and that a particular product will not appeal to everyone (K. G. Grunert, 2019; Wedel & Kamakura, 2000). Consumer segmentation aims to identify and reduce a heterogeneous consumer group into smaller, homogeneous groups with similar needs and motives (Wedel & Kamakura, 2000). The choice of variables used as a segmentation base is crucial to identify the different consumer groups. Various variables have been used in the food behavior literature. Among these variables, values have been used as a base for

segmentation (Brunsø et al., 2021; Legendre, 2021). Values are universal and motivate behavior across different domains and situations (Schwartz, 1992), and thus also affect buying behavior.

Other less abstract psychographic variables have been used as segmentation bases like attitude (Palmieri & Forleo, 2020), character traits (Nystrand & Olsen, 2021) and self-identity (Hustvedt & Dickson, 2009; Quaye, Mokgethi, & Ameyibor, 2021). This thesis extends the literature on segmentation in the food domain (K. G. Grunert, 2019) by combining personal values theory (Schwartz, 2012) and self-identity (Stryker & Burke, 2000) in the context of consumer food research. The combination of using personal values and self-identity is scarce in consumer studies (Trudel, 2018), but there is a growing tendency to integrate value theories with self-identity theories in, for example, sustainable behavior (Bouman, van der Werff, Perlaviciute, & Steg, 2021; H. Wang & Mangmeechai, 2021; Zeiske, Venhoeven, Steg, & van der Werff, 2021).

Self-identity theories such as the value-identity-personal (VIP) norms (van der Werff & Steg, 2016) argue that some behaviors, such as pro-environmental ones, can be explained by the extent to which the behavior signifies something about who people are (symbolic meaning of a behavior). Environmental behavior is influenced by how people see themselves and the values guiding their lives (Gatersleben, Murtagh, & Abrahamse, 2014; Sparks & Shepherd, 1992; Van der Werff, Steg, & Keizer, 2013b). Self-identity and values have been successful in explaining energy conservation (Zeiske et al., 2021), organic food consumption (Hansen, Sørensen, & Eriksen, 2018), health behavior (Quaye et al., 2021), and environmental preferences and behavior (Van der Werff et al., 2013b; Van der Werff, Steg, & Keizer, 2013a). Thus, as self-identity and values are essential factors influencing behavior, Paper 3 segments UK consumers based on their self-identity and values.

1.3 Research Aims and Conceptual Framework of the Thesis

The overall aim of this dissertation is to improve the theoretical and empirical understanding of factors influencing consumer consumption of seaweed food products within different theoretical frameworks (e.g. NAM and VAB), the person-centered approach and analytical procedures (e.g. structural equation analysis and cluster analysis). To reach this goal, we defined five specific research objectives to explore, discuss and explain seaweed consumption in a Norwegian and UK empirical comparaison:

a. To explain and predict seaweed consumption using an extended version of the norm activation framework (NAM).
b. To explore and extend the VAB theoretical framework (the relationship between values, beliefs, attitudes and behaviors) in the context of seaweed food products.
c. To explore whether and how perceived behavior control and consumer food innovativeness influence the strength of the relationship (gap) between attitude/intention and seaweed consumption behavior.
d. To identify and discuss seaweed consumers' profiles or characteristics based on their identity and values.
e. To explore cross-cultural differences in personal norms, attitudes, intention and behavior towards seaweed food products between Norway and the UK.

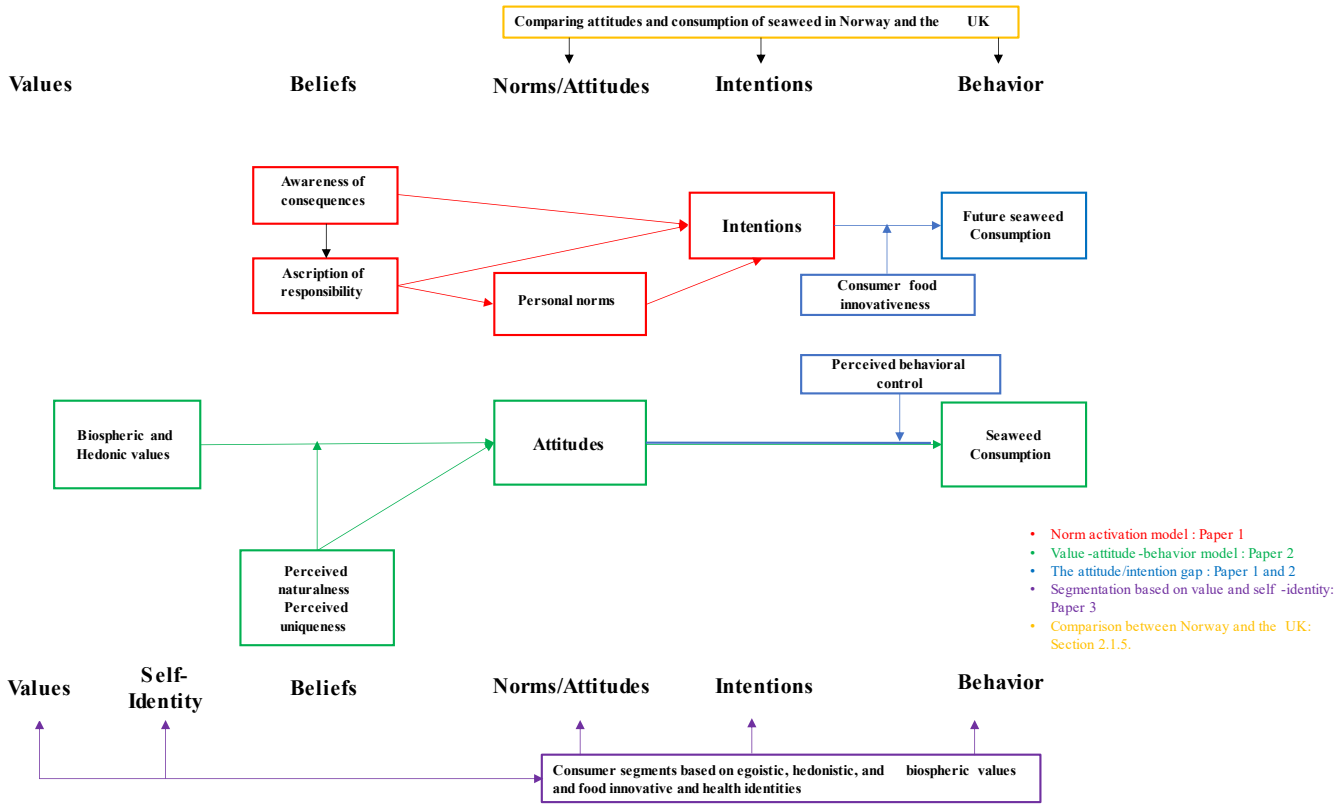

Figure 1. *The Conceptual Framework*

Figure 1 gathers in an overall model the theories used throughout this thesis with a view to better understanding consumer behavior. Hence, the norm activation model (Schwartz, 1977) (Figure 1 in red) and the values-attitude-behavior framework (Homer & Kahle, 1988) (Figure 1 in green) form the backbone of the overall model. In this thesis, we have extended the

models by adding salient variables such as specific beliefs (perceived uniqueness and naturalness) and personal traits (consumer innovativeness) (Figure 1 in blue).

Moreover, attitude and intention are central predictors of behavior; however, there remains a substantial proportion of unexplained variance in attitude-behavior and intention- behavior relationships (Cooke & Sheeran, 2004). Papers 1 and 2 use consumer food innovativeness and perceived behavior control as moderators to increase the consistency between intention/attitudes and behavior.

In Paper 3, we use the value-identity-personal norms theory (Ruepert et al., 2016) as the theoretical ground for the segmentation analysis. We argue that seaweed consumers may be classified depending on their values and identity (Figure 1 in purple).

Finally, this thesis explores the differences and similarities in consumer personal norms, attitudes, intentions and consumption of seaweed food products in Norway and the UK (Figure 1 in yellow). The following sections will discuss the models and constructs of this thesis in more specific and contextual terms.

1.3.1 The Norm Activation Model (NAM) and its Extensions

The norm activation model (NAM) was developed by Schwartz (1977) to explore altruistic behavior. The NAM has been successful in explaining various types of intentions and behaviors, such as transport behavior (De Groot, Steg, & Dicke, 2008; He & Zhan, 2018; Nordlund et al., 2018), eco-friendly tourism behavior (Han et al., 2015; Han, Hwang, Lee, & Kim, 2019; Kiatkawsin & Han, 2017), food consumption (Liu, Zheng, & Cao, 2021; Shin et al., 2018) and other pro-environmental behaviors (Joanes, 2019; Kiatkawsin, Sutherland, & Lee, 2020). Studies have extended the NAM, adding causal relationship to the variables (Onwezen et al., 2013; Steg & Groot, 2010; X. Zhang, Liu, & Zhao, 2018). Other studies have also merged the NAM with other models, such as the TPB (J. J. Kim & Hwang, 2020; Rezaei, Safa, Damalas, & Ganjkhanloo, 2019; Shin et al., 2018).

The NAM is a sequential linear model, which argues that behaviors follow from actions of personal norms. Personal norms form the core construct of the model (1.2.4.2) and refer to the feeling of responsibility for the negative consequences of not acting pro-socially (De Groot & Steg, 2009). Hence, personal norms guide individuals according to what they find morally acceptable (Schwartz, 1992). Personal norms are powerful factors that influence people's pro-environmental intentions and behavior (Schultz et al., 2016). Indeed, research shows that the

stronger one's personal norm towards a pro-environmental behavior, the stronger one's intention/behavior related to this norm (Aertsens et al., 2009; Joanes, 2019; Onwezen et al., 2013). Intention indicates how hard people are willing to try and how much effort they are planning to exert to perform a behavior (eat seaweed in this case) in the future (Ajzen, 1991).

The NAM framework argues that two factors activate the personal norm in the model: awareness of consequences and ascription of responsibility. Awareness of consequences is the level of consciousness of the potential repercussions of a performed action (Schwartz, 1977). In Paper 1, we argue that consumers are willing to consume environmentally friendly foods, like seaweed, not just for environmental and social consequences but for better quality, health and other, more "egoistic" benefits (Kushwah et al., 2019). Thus, Paper 1 refers to awareness of health consequences, as seaweed is considered to have positive health consequences (O'Connor, 2017; Pereira, 2016). The second main factor, the ascription of responsibility, indicates a person's feelings of responsibility for the consequences of a behavior (Schwartz, 1977). In the context of seaweed food consumption, this dissertation refers to the ascription of responsibility as the feeling of obligation to reduce environmental problems (e.g. climate change and pressure on land resources) by consuming seaweed.

Paper 1 contributes to the food behavior literature by using the basic and linear NAM framework, extends the linear model with an alternative model in the context of novel/unfamiliar sustainable food and predicts future seaweed consumption behavior from intention in a Norwegian context. Moreover, our study modifies and extends the traditional NAM framework by including a prospective research design (predicting behavior) and is the first study to investigate the moderating effect of food innovativeness on the relationship between intention and prospective behavior (see Section 1.4.3).

Other models based on the NAM framework can be found, like the value-identity-personal norms model (VIP) (van der Werff & Steg, 2016). Like the NAM, the VIP theory argues that feelings of moral obligation influence (pro-environmental) behavior to engage in a (pro-environmental) behavior. In addition, the VIP theory argues that personal norms are influenced by self-identity (see 1.2.5). Finally, self-identity is, in turn, influenced by values. Based on the VIP framework, Paper 3 integrates values and self-identity as a basis for segmentation and includes personal norm as a profiling variable. Thus, the third paper explores values and self-identity associated with personal norms but does not fully test the traditional linear structure of the VIP theory.

1.3.2 Value-Attitude-Behavior Framework (VAB) with Extensions

The value-attitude-behavior (VAB) framework was developed by Homer and Kahle (1988) and proposed a causal model integrating values, attitudes and behavior. The VAB model has been successfully applied to explore a variety of pro-environmental behaviors, such as green purchases (Cheung & To, 2019), eco-tourism (Han et al., 2019), environmental preservation (Vaske & Donnelly, 1999) and other pro-environmental behaviors (Cheung & To, 2019; Jacobs et al., 2018; M. J. Kim & Hall, 2021; Sharma & Jha, 2017). The VAB framework has never been used to explore the antecedents of seaweed consumption.

The VAB model is straightforward and posits the existence of a hierarchical influence from the more abstract cognitions (values) to mid-range cognition (beliefs and attitudes) to a specific behavior (Homer & Kahle, 1988). The model assumes that values directly influence attitudes and indirectly influence behavior through attitudes.

In the VAB approach and other approaches such as the theory of reasoned action (Fishbein & Ajzen, 2010), attitude is a central factor in predicting and explaining a given behavior. Fishbein and Azjen (2010, p. 76) define attitude as a "latent disposition or tendency to respond with some degree of favorableness or unfavorableness to a psychological object. The attitude object can be any discriminable aspect of an individual's world, including a behavior." In other words, attitudes reflect the extent to which engaging in a behavior is evaluated positively or negatively. Paper 2 contributes to the existing food behavior literature (Aertsens et al., 2009; Govzman et al., 2021; Hughner, McDonagh, Prothero, Shultz, & Stanton, 2007) by explaining seaweed consumption with an extended VAB perspective. The following paragraphs will discuss this research issue in more detail.

Hedonistic and biospheric values

Values are defined as "desirable trans-situational goals varying in importance, which serve as a guiding principle in the life of a person or other social entity" (Schwartz, 1992, p. 21). Thus, values are stable beliefs and can be thought of as accumulated global attitudes influencing context-specific attitudes and behavior (Homer & Kahle, 1988; Stern, 2000). Moreover, values are general beliefs that differ from attitudes, beliefs and norms as they do not apply to specific situations. Values serve as guiding principles, which are crucial in understanding many behaviors, as consumers are not likely to act in opposition to their values. Consumers behave in a certain way to attain a value-related goal. Moreover, values are ordered in a system of value priorities, meaning that independently of the context, each one of us

prioritizes some values over others. Hence, in a situation where competing values are activated, people will act according to the value that is considered most important.

Finally, it is important to mention multiple value theories (for example, social value orientation and Schwartz's value theory). This dissertation uses the Schwartz value theory and its latest development. Schwartz has elaborated a set of 56 values organized into four higher-order values forming a circular structure in which adjacent values reflect congruent motivations, and opposing values reflect incompatible motivations. The four higher-order values form two fundamental conflicts: self-enhancement versus self-transcendence and openness to change versus conservation. Self-enhancement values are the higher-order value orientation for valuing power, achievement and hedonism. These values are incompatible with self-transcendence values that emphasize concern for others. Openness to change relates to readiness for new experiences. These values conflict with conservation values, which emphasize preserving the status quo (Schwartz, 1992).

De Groot & Steg, (2008) and Steg, Perlaviciute, van der Werff, and Lurvink, (2014) showed that two self-enhancement (egoistic and hedonistic) values and two self-transcendence (altruistic and biospheric) values are particularly relevant in explaining pro-environmental beliefs, norms, attitudes, intentions and actions. Hedonistic values define pleasure or sensuous gratification for oneself as their defining goal (Schwartz, 1992), while egoistic values focus on the costs/benefits of choices that can influence people's achievement, wealth and power. Biospheric values focus on pro-environmental decisions based on a concern for preserving the ecosystem and the biosphere (De Groot & Steg, 2008). Altruistic values are value types reflecting the concern for society and other people.

However, other studies have suggested that egoistic, hedonic and biospheric values are the most salient dualistic values in understanding pro-environmental food attitudes and behavior (Balundė, Perlaviciute, & Steg, 2019; Steg, Perlaviciute, et al., 2014; Thelken & de Jong, 2020). Thus, this dissertation limits (Papers 2 and 3) its focus to the effect of egoistic, hedonistic and biospheric values.

Using values presents a key advantage in studying behavior. Contrary to other concepts like attitudes, beliefs and norms, there is a limited number of values. Moreover, the abstractness of values makes it a practical instrument for describing and explaining similarities and differences between people regardless of nationality, culture, etc. Furthermore, the causal

influence of pro-environmental values on attitudes and sustainable food behaviors has been reliably documented (De Groot & Steg, 2008; Homer & Kahle, 1988; Katt & Meixner, 2020; Steg, Bolderdijk, Keizer, & Perlaviciute, 2014; Stern, 2000). This makes values a relevant starting point for changing behaviors. Thus, Paper 2 explores the relationship between values and attitudes towards seaweed consumption. Paper 3 uses values as a pertinent variable to segment seaweed consumers.

Perceived uniqueness and naturalness as salient beliefs/attributes

In this dissertation, we extend the traditional VAB model by including the influence of beliefs about attributes on people's attitudes (see Figure 1 in green). Beliefs are states of opinion believed to be true based on direct observation, outside information or inference processes. Beliefs about attributes reflect the information people have about the performance of a given behavior (Ajzen, 2011). According to Fishbein and Ajzen (2010), when salient beliefs are formed, they provide the basis for attitudes, leading to intentions and behavior. Paper 2 focuses on perceived uniqueness and naturalness as salient beliefs influencing attitudes towards seaweed consumption.

Choosing perceived uniqueness and naturalness is based on the salient characteristics of seaweed. Perceived uniqueness is used because seaweed remains new to Western consumers, and seaweed presents unusual and unique flavors and textures(Figueroa, Farfán, & Aguilera, 2021). Finally, buying seaweed food products in Norway remains challenging, as they are available only in high-end or international stores.

Food is perceived as unique when it is highly differentiated from other products of the category "based on sensory, image, functional and emotional characteristics that consumers positively value" (Cardello et al., 2016, p. 24). However, product characteristics not only define the concept of uniqueness but can also be defined in terms of consumer responses. Hence, a unique product is also characterized by consumers as unusual, novel or unfamiliar (Jaeger et al., 2017). Food perceived as unique also evokes positive emotions (Favalli, Skov, & Byrne, 2013) and is associated with high quality (Jaeger et al., 2017).

Food perceived as natural is associated with healthiness and is perceived as minimally processed and organic (Román, Sánchez-Siles, & Siegrist, 2017; Rozin, 2005). Moreover, consumers perceive natural food as healthier than conventional food (Michel & Siegrist,

2019; Román et al., 2017). This dissertation defines perceived naturalness as the "belief that seaweed food products are safe, healthy, organically grown and natural/no additives."

In Paper 2, we study the effect of these two perceived attributes on the formation of attitudes towards seaweed food products. We argue that if consumers believe that seaweed food products are natural and unique, they should form positive attitudes towards seaweed consumption. Moreover, we explore the potential indirect influence of perceived naturalness and uniqueness on the relationship between values and attitudes. Hence, we argue that if people believe that seaweed is produced sustainably and naturally, consumers with biospheric values are more likely to have a favorable attitude towards seaweed consumption. Similarly, we argue that as people believe that seaweed food products are unique, consumers with hedonistic values are more likely to have a favorable attitude towards seaweed consumption.

1.3.3 The Gap between Attitude/Intention and Behavior: Moderating Issues

The NAM (Schwartz, 1977), VAB (Homer & Kahle, 1988) and TPB (Fishbein & Ajzen, 2010) start from the premise that the achievement of a behavior is preceded by positive attitudes, norms and intentions towards that behavior. However, despite having positive attitudes or intentions towards a given behavior, people do not always perform the intended behavior (Aschemann-Witzel & Niebuhr Aagaard, 2014; Yamoah & Acquaye, 2019). Studies have shown that psychosocial variables like personality traits, attitudes, beliefs, norms (subjective and personal norms) and intentions cannot independently influence a behavior (Cooke & Sheeran, 2004; Sheeran & Webb, 2016). Hence, in sustainable food consumption, many reported barriers, for example availability, price and past behavior, prevent consumers from purchasing or eating sustainable foods.

In this thesis, we use intention and attitude to explain seaweed consumption, as they are two significant predictors of behavior. Nevertheless, a substantial proportion of variance in intentions/behavior remains not explained by attitude or intention. To reduce the gap between attitude and behavior, various individual, social and contextual factors have been used in the literature as antecedents and moderators between attitude/intention and pro-environmental behavior, such as social norms, personality traits, involvement and trust, habit, price and contextual factors (ElHaffar et al., 2020; Vermeir & Verbeke, 2006). This dissertation explores the ability of a moderator to reduce the gap between attitudes (Paper 2) or intentions (Paper 1) and a given behavior.

Paper 2 uses perceived behavioral control to moderate the attitude-behavior gap. The concept of perceived behavioral control is derived from the concept of self-efficacy developed by Bandura (1977, 1997). Self-efficacy refers to "beliefs in one's capabilities to organize and execute the courses of action required to produce a given attainment" (Bandura, 1997, p. 5). Like self-efficacy, perceived behavioral control refers to "the extent to which people are capable of, or have control over, performing a given behavior" (Fishbein & Ajzen, 2010, p. 155). Perceived behavioral control is a general construct that considers the availability of information, skills, opportunities and other resources required to perform a behavior as possible barriers and obstacles (Fishbein & Ajzen, 2010).

Past studies have often used perceived behavioral control as an antecedent to various food and environmental behaviors (Fishbein & Ajzen, 2010; Yuriev et al., 2020). Moreover, perceived behavioral control is also used as a moderator of the different relationships of the TPB (e.g. La Barbera & Ajzen, 2021; Redondo & Puelles, 2017).

We believe that the higher the perceived behavioral control, the stronger the association between attitude and consumption. Thus, we argue that low perceived behavior control may act as a possible barrier for consumers with positive attitudes towards seaweed consumption. In contrast, high perceived behavior may increase the likelihood that consumers with positive attitudes consume seaweed food products.

In Paper 1, we study the effect of consumer food innovativeness (Fu & Elliott, 2013; Goldsmith & Hofacker, 1991) on seaweed food consumption as a relevant factor influencing the relationship between intention to eat seaweed and seaweed consumption. Consumer innovativeness refers to the tendency to purchase new products, services or ideas earlier than the majority of consumers or the tendency to be attracted to new products after their appearance in the market (Foxall, Goldsmith, & Brown, 1998). Traditionally, innovativeness depends on personality, as some customers have an innate predisposition to adopt new products, services or brands before others (Hoffmann & Soyez, 2010; Hurt, Joseph, & Cook, 1977; Midgley & Dowling, 1978). However, Goldsmith and Hofacker (1991) argue that consumers' adoption of innovation in a specific domain does not guarantee their adoption of innovation in another domain. In other words, a consumer can be innovative with particular products or services, such as food, but not with others, such as clothes or wine. Thus, consumers' food innovativeness refers to consumers' tendency to purchase new food products. Therefore, this thesis focuses on food innovativeness.

Previous studies have shown that innovativeness is crucial to the willingness to choose, consume and pay for new food products (Bartels & Reinders, 2010; Persaud & Schillo, 2017). With regard to novel foods, previous studies have shown that highly innovative food consumers are more willing to buy organic foods (Bartels & Reinders, 2010), but this can differ among cultures (Altintzoglou, Heide, & Borch, 2016). Paper 1 tests whether consumer food innovativeness is associated with seaweed consumption. Moreover, food-innovative consumers are believed to be more likely to take the last step between intending to consume seaweed and consuming seaweed; therefore, we suspect that consumer innovativeness increases the likelihood that consumers who intend to consume seaweed will actually consume it.

Intentional behavior versus prospective behavior

Most studies using the NAM (Han et al., 2015; He & Zhan, 2018; J. J. Kim & Hwang, 2020; Rezaei et al., 2019; T. Zhang et al., 2020; X. Zhang, Geng, & Sun, 2017; X. Zhang et al., 2018) use intentional behavior as an indication of future behavior. However, intention and behavior are separate concepts, and the relationship between these two concepts can be controversial (Armitage & Conner, 2001; Rhodes & de Bruijn, 2013; Sheeran & Webb, 2016). Indeed, in sustainable foods (Campbell & Fairhurst, 2016; Vermeir & Verbeke, 2006) and healthy foods (Conner, Norman, & Bell, 2002), high intentions do not always translate into high consumption.

Paper 1 explores whether and how intention predicts behavior using a prospective design. This means that we investigate the variations in intention to eat seaweed and predict consumption of seaweed food products one month later. Therefore, this study uses the phrase "future consumption of seaweed" to underline the reported seaweed consumption the month after the first part of the survey (t1). The practice of predicting and measuring behavior one month after measuring intention is frequently used in the TPB (Carfora et al., 2019; Fila & Smith, 2006) and exhibits a theoretical advantage concerning causality compared to the use of past behavior/frequency (Aguilar-Luzón, García-Martínez, Calvo-Salguero, & Salinas, 2012; Ajzen, 1985; Ajzen, Brown, & Carvajal, 2004). It also presents a methodological advantage in forming and reducing common method bias or carryover effects (Podsakoff, MacKenzie, Lee, & Podsakoff, 2003; Tourangeau, Rasinski, Bradburn, & D'Andrade, 1989). Thus, this study contributes to the literature (using either behavioral intention or past behavior) by using future seaweed consumption (prospective design) to explore the attitude/intention-behavior gap (Paper 1).

1.3.4 Profiling Seaweed Consumers Based on Self-Identity and Values

Consumer segmentation is a popular method in marketing research as it describes and identifies consumers who share one or more similar characteristics. Consumer segmentation is essential for understanding the consumers better, and for designing more effective and appropriate marketing strategies (Wedel & Kamakura, 2000). Many types of segmentation method can be used to group consumers. Segments are usually based on demographics (e.g. age, sex, life stage, etc.), geography (e.g. region, province, urban-suburban-rural), behavior (e.g. occasion-oriented, usage-oriented, loyalty-oriented behavior) or psychographic variables (Wedel & Kamakura, 2000). This thesis bases consumer segmentation on salient psychological factors influencing consumer food consumption. There are a large number of studies that have used a consumer segmentation approach regarding superfoods (e.g. Meyerding, Kürzdörfer, & Gassler, 2018; Nystrand & Olsen, 2021), organic food (e.g. Gil, 2000; Hamzaoui-Essoussi & Zahaf, 2012; Van Huy, Chi, Lobo, Nguyen, & Long, 2019) and novel food (e.g. Henriques, King, & Meiselman, 2009; Legendre, 2021). As regards seaweed food consumption, Palmieri and Forleo (2020) segmented Italian consumers based on food habits and attitudes toward food. This thesis focuses on values and self-identity as a base for profiling consumers.

Within psychology, a significant amount of research has been conducted to study the effect of values and self-identity on pro-environmental behaviours. Values and self-identities are stable factors influencing behaviour across contexts and situations (Gatersleben et al., 2014). People behave according to what they value in life (Thøgersen & Ölander, 2003) as mentioned in Section 1.3.2. Similarly, consumer actions and choices are related to whether people perceive themselves as a person who should adopt such behaviour (e.g. Sparks & Shepherd, 1992; Whitmarsh & O'Neill, 2010). This dissertation refers to self-identify as the label people use to describe themselves (Cook, Kerr, & Moore, 2002). How consumers behave is influenced by their perception of who they are, wish to be or think they should be (Hansen et al., 2018; Sparks & Guthrie, 1998; Stead, McDermott, MacKintosh, & Adamson, 2011). In other words, self-identity affects how people consume.

Consumers can have many different and sometimes conflicting identities, which can be salient depending on the context (Stryker & Burke, 2000). For instance, food-innovative self-identity, referring to whether people see themselves as a person that likes to try new food, is an especially salient factor in the context of novel food consumption Bouman et al., 2021).

Indeed, food innovativeness is positively related to novel food (Huotilainen, Pirttilä-Backman, & Tuorila, 2006) consumption such as that of seaweed (Govaerts & Olsen, 2022), functional food products (Nystrand & Olsen, 2021) and organic food products (Bartels & Reinders, 2010).

Health identity is another relevant construct in the context of seaweed food product consumption. Health identity is a construct that deals with the degree to which individuals see themselves as a person with a healthy lifestyle (Quaye et al., 2021). Seaweed is considered healthy because it is rich in minerals and vitamins, is low in calories and contains dietary fibers (Blikra et al., 2021; Stévant, Rebours, & Chapman, 2017). Previous studies have underlined the importance of consumers' health motives in consuming organic food (Kushwah et al., 2019). Govaerts and Olsen (2022) indicated a positive relationship between consumer knowledge of the benefits of seaweed for health and their intentions to consume such products.

In the literature, much of the focus has been on testing models integrating values and self-identity, such as the value-identity-personal (VIP) norms (Ruepert et al., 2016; van der Werff & Steg, 2016) model, or extending theories, such as the theory of planned behaviour (TPB) with values and identity (Ateş, 2020; Gkargkavouzi, Halkos, & Matsiori, 2019). However, we are unaware of any previous studies on this combination of values and self-identity as a basis for consumer segmentation (Grunert, 2019). Thus, in Paper 3, we argue that the difference between consumers' self-identities and values influences consumer behavior. Moreover, we also study whether the variation in self-identity and values between the groups affects consumers' personal norms, knowledge, attitudes and intention towards seaweed consumption. Finally, the paper focuses further on profiling the segments with demographics.

1.3.5 Differences and Similarities in Attitudes and Behavior towards Seaweed in Norway and the UK

Consumer behaviour varies depending on countries and cultures. For instance, in Asia, coastal countries like Japan, Korea, Vietnam and China have a long tradition of seaweed consumption (Pereira, 2016). However, Western countries have no traditions or knowledge of seaweed as a food (or have lost them) (Pereira, 2016). The globalization of food markets and the increased attention to pro-environmental and healthy food have boosted interest in seaweed (Anusha Siddiqui et al., 2022). This thesis focuses on two European countries, Norway and the UK. Comparing these two countries is of great interest as they differ in terms

of (food) culture and market size. Norway is a small country (5 million inhabitants) and has a fairly traditional food market (Amilien & Notaker, 2018). Until the late ’90s, the restrictive import policies regarding products meant that consumers were pretty traditional in their food choice (Nygard & Storstad, 1998).

Meanwhile, the UK is the third-largest European market, with 67 million inhabitants. In regard to food, the UK market has always been open to the global food market due to its colonial empire and the development of international trading. The UK (Panayi, 2008) has traditionally been one of the gateways for new (food) products (spices, tobacco, tea, chocolate, kiwis, etc.) and food cultures (e.g. food dishes from India, including chicken tikka masala) coming from all over the empire (Panayi, 2008). For these cultural and historical reasons, UK consumers are expected to be more open to a new type of food, such as seaweed.

It is also of practical or managerial interest to compare the differences between the two markets, which vary significantly in size and (food) culture. Thus, the last objective of this thesis is to explore the differences in personal norms, attitudes, intentions and behaviours towards seaweed food products between Norway and the UK. To do so, we will conduct a descriptive statistical analysis to compare the results from the two surveys.

2 Method

2.1 Research Design and Data

This thesis is based on data from two online surveys. The first survey was conducted in June 2020 in Norway, and the data were used in Papers 1 and 2. The second survey was conducted in September 2022 in the UK, and the data were used in Article 3. We collected the data through the YouGov consumer online panel for both surveys. The samples were representative of gender, age and region. The respondents were required to answer all the questions to complete the survey.

Seaweed as a food source is used very little in Norwegian and UK culture. Therefore, at the beginning of both surveys, we introduced pictures of seaweed food products available in the Norwegian and UK market with a description of seaweed: “Seaweed is a form of algae that grows in the sea. There are various species of edible seaweed, the color range of which varies from red to green to brown. Seaweed helps to capture CO_2. Seaweed is a good source of nutrients, such as proteins, vitamins, minerals and dietary fiber.”

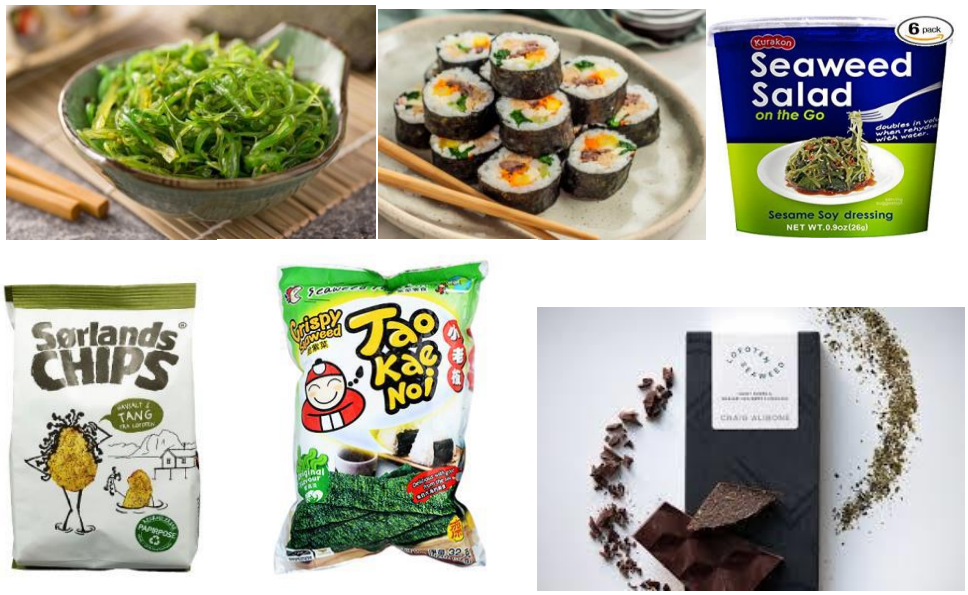

Figure 2. *Sample of Pictures Used in the Surveys.*

Papers 1 and 2 adopted a confirmatory analysis and structural equation modeling approach to test the theoretical associations among constructs. Paper 3 used data from the second survey and utilized exploratory and confirmatory factor analysis before conducting a cluster analysis. The following sections will discuss further the survey design and statistical methods used throughout this thesis.

2.2 Sample and Procedures

The sample used in Papers 1 and 2 consisted of 426 Norwegian participants, and the sample used in Paper 3 consisted of 1,110 participants in the UK. The participants in both data sets were all aged 18 or older.

The first survey was structured in two parts to measure past and future behaviour, and was administered at two different times (t1 and t2). The first part, which required approximately 8–11 minutes to complete, consisted of the constructs of the extended NAM and VAB and some others not reported in the papers.

The second part was administered about one month later. This part was shorter and measured the consumption of seaweed between the surveys: future seaweed consumption. The same participants participated in the second questionnaire. However, to avoid the data being influenced, participants were not informed of our intention to conduct a second round a month later. This thesis only includes data from participants who filled out both questionnaires.

Table 2. *Sociodemographic Characteristics*

Variables	Norway (N = 426) Percent	UK (N = 1110) Percent
Gender		
Female	52	52
Male	48	48
Age		
18–29 y/o	17	18
30–39 y/o	17	18
40–49 y/o	16	17
50–59 y/o	18	13
≥ 60 y/o	32	34
Level of education		
Low	7	15
Medium	33	38
High	60	47

Confirmatory factor analysis and structural equation modeling

Structural equation modeling (SEM) is a set of statical analyses used to simultaneously estimate the relationship between many independent variables and more than one dependent variable. Moreover, SEM allows the use of latent independent and dependent variables compared to regression analysis. Therefore, SEM can be defined as a simultaneous multi-

equation technique that includes latent variables on both sides of the equations (Mehmetoglu & Jakobsen, 2022).

Papers 1 and 2 applied SEM to examine the relationship between the constructs. For both papers, we used a stepwise approach using the program STATA. The first step consisted in applying a confirmatory factor analysis (CFA) to assess the latent factors' structure containing a set of indicators (Mehmetoglu & Jakobsen, 2022). CFA is a popular structural equation technique in social science research for the reason that CFA contributes to making structural equation model estimates less biased compared to other simple regression techniques, which assume no measurement error (Brown, 2015).

The second stage consisted of structural equation modeling with maximum likelihood estimation to test causal relationships among latent variables. Based on the output, the model is evaluated and interpreted. The validity of the model is assessed based on the following indicators: chi-square (χ^2), comparative fit index (CFI), Tucker–Lewis index (TLI), root mean square error of approximation (RMSEA) and standardized root mean residual (SRMR).

Moderation and mediation analysis

Mediators and moderators are variables affecting the association between an independent and dependent variable (Baron & Kenny, 1986). The following section describes the conceptual differences between a moderator variable and a mediator.

A moderator is an independent variable that affects the strength and direction of a relationship between another independent variable and a dependent variable (Figure 3).

Paper 1 evaluates the moderating effect of consumer food innovativeness on the intention-future seaweed consumption relationship, while Paper 2 assesses the moderating effect of product-specific beliefs on the relationship between values and attitudes. The study also evaluates the moderating effect of perceived behavioral control on the relationship between attitude and seaweed consumption.

In contrast, a mediator variable is a variable that specifies how the association occurs between an independent variable and a dependent variable and why two variables are strongly associated (Baron & Kenny, 1986). Unlike the moderator effect, there must be a significant relationship between the independent and the dependent variable to test for an eventual moderator effect. There is a mediator effect when the following conditions are met: First, the

variations in the independent variable must predict variations in the mediator variable; second, the variations in the mediator variable must predict variations in the dependent variable; third, suppose the first and the second conditions are met – in that case, the inclusion of the mediator variable in the model has to affect the direct relationship between the dependent and the independent variable by making it nonsignificant (Baron & Kenny, 1986).

In Paper 1, we evaluate the mediator effect of the ascription of responsibility on the relationship between awareness of health consequences and the intention to eat seaweed.

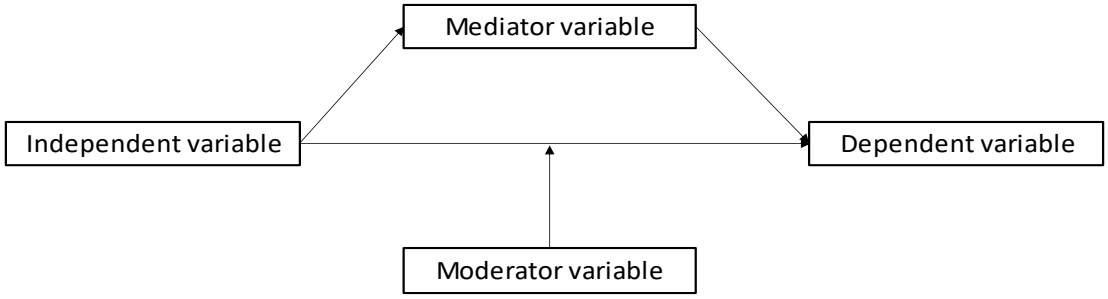

Figure 3*. Conceptual Model of a Mediator Effect and a Moderator Effect*

2.3 Cluster Analysis and Analysis of Variance

Cluster analysis is an analytical technique for developing meaningful subgroups of individuals (Hair, Anderson, Tatham, & Black, 1995). The aim is to categorize a sample of individuals into a small number of mutually exclusive groups based on the similarities among these individuals. Similarly to factor analysis, cluster analysis is a grouping technique. However, cluster analysis diverges from factor analysis in that cluster analysis structures respondents in distinct groups (people), while factor analysis structures variables in distinct groups (Hair et al., 1995).

Hierarchical and nonhierarchical are the two general categories of the clustering procedures. Hierarchical procedures consist of the construction of a tree-like structure. The tree-like structure can either be based on the agglomerative or the divisive method. The agglomerative method combines observations (or individuals) into new aggregate clusters, thus reducing the number of clusters by one at each step. The divisive method does the opposite, as each step divides large clusters into smaller ones. The process continues until each observation is a cluster itself. Finally, nonhierarchical algorithms partition a data set into a prespecified number of clusters.

Paper 3 identifies and profiles seaweed food consumers based on identity and seaweed knowledge and studies how the segments are related to seaweed food consumption. Like most studies using cluster analysis, it uses a two-step approach. The first step involves measuring some form of similarity or association between the respondents to determine how many groups exist in the sample. The second step describes each cluster's characteristics to explain how they may differ in relevant dimensions.

In Paper 3, following the cluster analysis, we will verify whether there are significant differences between clusters in terms of the segmentation variables (identity and values) and profiling variables (i.e. attitude, intention, personal norms, knowledge and consumption). Hence, to identify differences between groups, we conduct a one-way analysis of variance (ANOVA).

2.4 Measures and Validation of the Constructs

This thesis uses a variety of latent variables (also called “constructs” or “factors”) and a few observables (e.g. seaweed consumption, age, gender, education). A latent variable “is an unobservable variable that influences more than one observed measure and accounts for the correlations among these observed measures” (Brown, 2015, p. 10). In other words, a latent variable is a set of intercorrelated observed measures sharing a common use (Brown, 2015).

The constructs used in this thesis all originated from the literature. However, some of them have been adapted to fit the context of this study. Several variables were included in both surveys, namely values, attitude, perceived uniqueness and naturalness, personal norm and intention. Both surveys measured environmental values using a scale developed by Steg, Perlaviciute, et al. (2014). Paper 2 only used biospheric and hedonistic values in the model, while Paper 3 included egoistic values in addition to biospheric and hedonistic values. Attitude was assessed using items commonly employed in food-related studies (e.g. Hayley et al., 2015; Honkanen, Olsen, & Verplanken, 2005). Perceived uniqueness was composed of two items adapted from Jaeger et al. (2017), and perceived naturalness’s three items were collected from Michel and Siegrist (2019). Personal norm was measured in both surveys using composed items adapted from Jakovcevic and Steg (2013) and S. H. Kim and Seock (2019). Intention was also measured in Norway (Paper 1) and the UK (Paper 3) using items adapted from Menozzi, Sogari, Veneziani, Simoni, and Mora (2017).

Other variables were measured in only one of the two surveys: awareness of consequence, ascription of responsibility, consumer food innovativeness, food-innovative and health identity and perceived knowledge and perceived behavioral control. Awareness of consequences and ascription of responsibility were measured only in Norway using three items adapted from De Groot and Steg (2009). Consumer food innovativeness (Paper 1) was measured using three items borrowed from Goldsmith and Hofacker (1991). Food innovativeness and health identity were measured only in the UK and are composed of three items adapted from Chan, Pong, and Tam (2020) and Wang and Mangmeechai (2021). Knowledge (Paper 3) is formed of four items borrowed and adapted based on Fu and Elliott (2013). Perceived behavioural control (Paper 2) was based on items from Armitage and Conner (2001) and Park and Ha (2014).

Seven-point Likert-type scales with response categories ranging from 1 (strongly disagree) to 7 (strongly agree) were used to measure most of the constructs except for values, attitudes, perceived uniqueness and naturalness, knowledge, perceived behavioral control and intention. Environmental values items were measured on a scale from 1 ("opposed to my principles") to 9 ("extremely important") (Schwartz, 1992). Attitude, perceived uniqueness and naturalness items were evaluated along a seven-point semantic differential scale (e.g. 1 = bad/7 = good, 1 = ordinary/7 = unique and 1 = unhealthy/7 = healthy). Knowledge was measured on a scale ranging from 1 ("very unknowledgeable") to 7 ("very knowledgeable"). Intention items were measured on a scale from 1 to 7 (extremely unlikely/extremely likely).

A CFA with a maximum likelihood estimation method was used to estimate the model fit in Papers 1, 2 and 3. In Paper 1, the results indicated a good fit of the measurement model to the data ($\chi 2$ (80) = 218.51, $p < 0.001$, RMSEA = 0.06, CFI = 0.97, TLI = 0.96, SRMR = 0.04). The results show convergent and discriminant validity of latent variables as AVE > 0.5 and AVE > SC, respectively (Table 3). In addition, the internal consistency of the latent variables was all > 0.7, indicating good construct reliability, as shown in Table 3.

In Paper 2, five latent variables, with a total of 15 indicators and one observable variable, indicated a good fit to the data ($\chi 2$ (120) = 303.34, $p < 0.001$, RMSEA = 0.06, CFI = 0.96, TLI = 0.94, SRMR = 0.05). The results of the convergent and discriminant validity assessment showed no convergent and discriminant validity problems between the latent variables with AVE > 0.5 and AVE > SC, respectively. The CR were all > 0.6, indicating good construct reliability (Table 3).

Finally, we performed a CFA for the segmentation and profiling variables. The CFA confirmed the validity of the structure of latent variables with a total of 16 indicators for the five segmentation variables (χ^2 (109) = 623.03, p < 0.001, RMSEA = 0.06, CFI = 0.96, TLI = 0.96, SRMR = 0.06) (see Table 3). The CFA confirmed the validity of the structure of the four profiling latent variables with a total of 18 indicators (see Table 3) (χ^2 (113) = 499.31, p < 0.001, RMSEA = 0.05, CFI = 0.97, TLI = 0.97, SRMR = 0.03).

Moreover, for both the segmentation variables and the profiling variables, we did not find any convergent and discriminant validity issues between the latent variables with AVE > 0.5 and AVE > SC, respectively (see Table 3). The internal consistency score was greater than 0.6, indicating good construct reliability (see Table 3)

Table 3*. Summary of the Constructs*

Constructs	**Paper (country)**	**Mean (SD)**		**Internal consistency**		**AVE**	
Egoistic values	3 (UK)	4.22 (1.47)		0.80		0.52	
Hedonistic values	2 (Norway), 3 (UK)	Norway	UK	Norway	UK	Norway	UK
		6.99 (1.35)	7.07 (1.55)	0.81	0.87	0.60	0.78
Biospheric values	2 (Norway), 3 (UK)	6.54 (1.63)	7.03 (1.73)	0.90	0.95	0.70	0.83
Attitude	2 (Norway), 3 (UK)	4.02 (1.79)	3.89 (1.61)	0.93	0.93	0.82	0.73
Food innovative identity	3 (UK)	4.27 (1.64)		0.95		0.86	
Health identity	3 (UK)	4.20 (1.46)		0.91		0.79	
Knowledge	3 (UK)	2.15 (1.31)		0.87		0.70	
Awareness of consequence	1 (Norway)	4.61 (1.27)		0.87		0.70	
Ascription of responsibility	1 (Norway)	4.04 (1.41)		0.89		0.74	
Consumer food innovativeness	1 (Norway)	3.89 (1.39)		0.92		0.81	
Perceived uniqueness	2 (Norway)	4.83 (1.59)		0.66		0.52	
Perceived naturalness	2 (Norway)	5.36 (1.43)		0.84		0.60	
Perceived behavioral control	2 (Norway)	3.82 (1.72)		0.74		0.63	
Personal norms	1 (Norway), 3 (UK)	Norway	UK	Norway	UK	Norway	UK
		3.31 (1.55)	2.33 (1.33)	0.92	0.90	0.81	0.61
Intention	1 (Norway), 3 (UK)	3.72 (1.89)	2.42 (1.76)	0.95	0.96	0.87	0.86

Part 2

3 General Discussion and Main Findings

Based on the established literature about seaweed/food preferences, acceptance, choice and consumption this thesis developed five main research questions to theoretically and empirically explore this research issue. The following sections summarize the main findings and contributions. In addition, limitations and suggestions for future research are presented.

3.1 Validation of the Extended Norm Activation Framework (NAM Model)

Paper 1 validated the ability of the norm activation framework to explain consumers' intention to eat seaweed. The study confirmed that personal norms were positively related to ascription of responsibility. At the same time, ascription of responsibility was also positively associated with awareness of consequences. Paper 1 confirmed other studies using the NAM framework to predict diverse environmentally friendly behavior (Han, Chua, Ariza-Montes, & Untaru, 2020; J. J. Kim & Hwang, 2020; Park & Ha, 2014).

Then, this study extended the norm activation model by adding a direct causal relation between awareness of health consequences and intention and the direct relationship between ascription of responsibility and intention. In this regard, the model confirmed that awareness of health consequences and ascription of responsibility have a direct positive relationship with intentions. The aforementioned results have several implications. First, the study confirms that awareness of consequences is a key variable when predicting intentions to eat seaweed. These results are in accordance with (Vaske, Jacobs, & Espinosa, 2015).

Moreover, the results show a more substantial causal relationship between people's awareness of health consequences and intention to eat seaweed than between people's environmental responsibility and intention to eat seaweed. The strong positive relationship between awareness of health consequences and ascription of responsibility indicated that people who are aware of the health consequences of seaweed are more likely to feel they have a responsibility to engage in eco-friendly behavior such as consuming seaweed. The study also confirms that in some cases, health/egoistic and biospheric values are related (Asif, Xuhui, Nasiri, & Ayyub, 2018; Birch, Memery, & De Silva Kanakaratne, 2018) but also that health motive is an influential part of people’s motivation to consume seaweed and other pro-environmental foods (Magnusson, Arvola, Hursti, Åberg, & Sjödén, 2003).

Finally, we extended the NAM by introducing a prospective design. The aim was to verify the ability of intention to predict and explain future consumption of seaweed food products. Future consumption was measured one month after measuring intention. The results confirmed the positive effect of intention on future consumption, but it explained only 9% of the variance in the consumption of seaweed food products, confirming that in the context of novel/unfamiliar food, there is a large gap between intention and behavior (Chekima, Oswald, Wafa, & Chekima, 2017; Schäufele & Hamm, 2018). This gap may be caused by the low availability of seaweed products in stores and the absence of knowing how to prepare and consume seaweed.

Paper 1 shows that people intend to eat seaweed because they feel morally obligated, but also because they know seaweed's positive health consequences and feel they have an environmental responsibility. In managerial terms, this study shows that consumers feeling that seaweed consumption is healthy and good for the environment activates their moral obligation to eat seaweed.

Moreover, this study showed the direct relationship between consumers' awareness of health consequences and their intention to eat seaweed. Likewise, to a lesser extent, consumers feeling a responsibility to reduce environmental problems plays a role in their intention to eat seaweed. Finally, this finding is important for developing seaweed products that provide good nutritional value. Campaigns should target consumers with higher health and environmental consciousness levels, as they are more likely to eat seaweed.

3.2 Salient Values, Beliefs and Attitudes Motivate Seaweed Food Consumption (VAB Model)

Paper 2 studied the ability of a VAB model to explain the consumption of seaweed food products among Norwegian consumers. The results showed that consumers' attitudes are closely associated with seaweed consumption. Moreover, this study highlighted the importance of biospheric values in forming attitudes and the lack of a significant relationship between hedonistic values and attitudes. The absence of a relationship between hedonistic values and attitudes (Ateş, 2020; Nguyen, Lobo, & Greenland, 2016) might be explained by consumers' lack of familiarity with seaweed, which might hold little sensory appeal for consumers who value their pleasure highly (Tan, Tibboel, & Stieger, 2017).

Paper 2 extended the VAB model by introducing two relevant perceived attributes in the context of seaweed food. We studied the direct relationship between perceived uniqueness

and perceived naturalness, and attitude. The positive causal relationship between the two beliefs and attitude shows that when seaweed food products were perceived as unique and natural, they generated a favourable attitude among consumers. Thus consumers' perception of a food product as healthy, not artificial and more environmentally friendly significantly affects the general acceptance of a given food (Román et al., 2017).

In addition to testing the direct effect of specific beliefs, we investigated the moderating effect of specific attributes on the relationship between values and attitude. The results showed that consumers with high hedonic values are more likely to have favorable attitudes towards seaweed consumption if they perceive seaweed food products as unique. Moreover, the results indicated that consumers who value the protection of the environment are even more likely to have a favorable feeling towards seaweed consumption when they believe it is natural.

The findings have theoretical and practical implications. First, they show that the model's biospheric motivations have a stronger influence on attitude towards seaweed consumption than the hedonistic motivation, which means the higher consumers' biospheric values, the higher the chance that they are favorable towards seaweed consumption. This finding confirms that biospheric values are essential in explaining pro-environmental consumption (Katz-Gerro, Greenspan, Handy, & Lee, 2017; Van der Werff, Steg, & Keizer, 2014). However, higher hedonic value is not related to more positive attitudes towards seaweed consumption. Moreover, Paper 2 confirms that salient perceived attributes impact the value-attitude relationship (Aertsens et al., 2009; Dreezens, Martijn, Tenbült, Kok, & De Vries, 2005), and that in some cases, specific product attributes activate the value-attitude relationship (Cardello et al., 2016).

Second, the results are also of practical relevance for seaweed stakeholders. Marketing campaigns should emphasize the naturalness and the low environmental impact of seaweed production. These attributes are regarded as important for consumers who care about the environment. Moreover, marketers should also encourage consumers to associate seaweed with pleasure by, for example, highlighting the uniqueness of seaweed to strengthen attitudes towards, and motivation for, consuming seaweed products.

3.3 Perceived Behavioral Control and Innovativeness Moderate the Attitude/Intention-Behavior Gap

Paper 1 extended the NAM model to a prospective design and included future seaweed consumption. The study verified and confirmed the ability of intention to predict and explain the future consumption of seaweed. Hence, we confirmed the relationship between intention and seaweed consumption measured one month after intention.

Papers 1 and 2 examined the effect of a third variable in reducing the attitudes/intention behavior gap. Paper 1 investigated the moderating effect of consumer food innovativeness on the relationship between intention and future consumption. The moderator analysis showed that the relationship between intention and seaweed consumption was stronger for consumers with a higher level of food innovativeness. This finding indicated that consumers who intended to consume seaweed food products were also more likely to do so if they were food innovative. We also tested whether there was a direct causal relationship between consumer food innovativeness and seaweed consumption. The results confirmed that consumer food innovativeness was positively related to future consumption, indicating that food-innovative consumers were more likely to consume seaweed. This finding provides positive news to the seaweed industry as food-innovative consumers are more likely to spend time and money on finding new food products (McCarthy, O'Reilly, & Cronin, 2001). Moreover, food-innovative consumers are also expected to introduce the food to other consumers (Goldsmith, 2001; Payini, Ramaprasad, Mallya, Sanil, & Patwardhan, 2020).

Paper 2 tested the effect of perceived behavioral control on the relationship between attitudes and (past) seaweed consumption. Perceived behavioral control led to a higher predictive power of attitude regarding seaweed consumption. In other words, consumers favoring seaweed food products are even more likely to consume seaweed if they believe they can perform the behavior. Finally, seaweed food actors should be aware that to increase people's consumption of these products, they should increase consumers' ability to consume them. For example, consumers must know that they can find and buy seaweed on the market.

3.4 Consumer Profiles: Progressive Consumers Are the Most Promising Target for Seaweed

The aim of Paper 3 was to understand seaweed food consumers better by grouping them based on psychological variables. By using a combination of five variables, including three

values (egoistic, biospheric and hedonistic), self-identity (food innovative) and social identity, Paper 3 successfully identified three clusters of consumers in the UK. These clusters were named progressive, conservative and egoistic. These clusters were of different sizes: Progressive was the largest group (N = 437), followed by the conservative (N = 364) and egoistic (N = 309) groups.

The progressive cluster was also characterized by a greater food innovativeness and health identity. In terms of value, progressive consumers consider protecting the environment to be essential, but they also value their pleasure highly. The second cluster, the conservative group, distinguishes itself because it had the lowest self-perception of being food innovative and having a healthy lifestyle. The conservative group gave the least importance to egoistic values. However, the conservative segment gave the highest importance to environmental and hedonistic values. Finally, we called the last group egoistic because they had higher scores on egoistic values. Egoistic consumers gave the lowest importance to preserving the environment, indicating low collective and high individualistic values. It is crucial to emphasize that the progressive and conservative groups score relatively higher than the egoistic group on hedonic values, indicating that egoistic and hedonistic values are somewhat different individual values as a basis for segmentation of consumers even though they are both highly individualistic (Schwartz, 1992). Thus, this finding empirically confirms the importance of separating hedonistic from egoistic values as shown by Steg, Perlaviciute, et al. (2014).

In terms of seaweed, the progressive group distinguishes itself from the others as it scores significantly higher on knowledge, personal norms, attitudes, intentions and consumption. From the results, we first note that the group with the highest food-innovative score and health identity score (the progressive) has the best knowledge about seaweed, while the conservative group, who felt the least innovative and did not feel like having a healthy lifestyle, had the lowest knowledge about seaweed. Thus, a high level of food innovativeness seems to be related to greater knowledge about seaweed. Innovative consumers may be more curious and have a higher level of interest and thus may have heard or remember better information about seaweed. These results are in line with earlier findings indicating that innovative consumers engage more in ongoing information searches and have weaker perceptions of risk; they thus have better product knowledge than low-innovative consumers (Z. Zhang & Hou, 2017). Nevertheless, it is important to underline that the level of

knowledge remained low in all three groups as most UK consumers have little knowledge about seaweed.

The results indicated that a higher level of knowledge is also followed by a higher feeling of obligation to eat seaweed and more positive attitudes towards seaweed consumption. Indeed, progressive consumers felt significantly more obliged to eat seaweed than the conservative and the egoistic. The results confirm findings in Paper 1, indicating that the more people know about seaweed's environmental consequences and health qualities, the more likely they are to develop the moral obligation to eat it. The results confirm that consumers' personal norms vary among the segments, depending on salient self-identity, as argued in the value-identity-personal norms framework (Ruepert et al., 2016; van der Werff & Steg, 2016).

Progressive consumers were positive about eating seaweed, whereas the egoistic consumers' segment was the most negative. Again, we indicate that a combination of seaweed's environmental, health and hedonistic characteristics has positively influenced consumers' perception of seaweed food products. Moreover, this finding is in line with Paper 2, which showed a positive relationship between biospheric values and motivation and consumers' attitudes towards eating seaweed. However, consumer egoistic values stand out as being negatively related to attitude towards eating seaweed. This finding is in line with previous studies indicating the negative relationship between egoistic values and pro-environmental food consumption (Qian, Yu, & Gao, 2019; Steg, Perlaviciute, et al., 2014). In addition, the progressive group's intentions to consume and consumption of seaweed products were higher, while the conservative group had the lowest intention and the lowest consumption. This finding confirms that higher intentions to eat seaweed are followed by higher consumption, as shown in Papers 1 and 2.

The progressive group had the highest level of education. Similarly to previous studies (Birch et al., 2019; Palmieri & Forleo, 2020), we found that the more favorable segment towards seaweed food products is also the most educated. It is also worth noting that the most favorable group (progressive) towards seaweed food products is also the largest (39%).

Finally, from a practical point of view, this study shows that progressive consumers should be reached by stimulating their pro-environmental and hedonistic values, food innovativeness and health self-identity. Marketers will meet more substantial motivational adoption barriers from the conservative and the egoistic segments. In addition, it is estimated that the

progressive segment represents almost 40% of the UK consumers. People in the conservative and egoistic segments do not identify themselves as having a healthy lifestyle, which means, at first glance, they may be less sensitive to seaweed's health qualities. To target the conservative segment, marketers should emphasize that it is sustainable as its cultivation does not need fertilizers, heating and watering (Pereira, 2016). Seaweed food producers should also propose a variety of exciting snacks containing seaweed to introduce seaweed to (younger) consumers. Healthy, high-value snacks are food products that are closely related to pleasure, and as they are eaten in small amounts between meals, consumers are more likely to try novelties containing seaweed (Palmieri & Forleo, 2020). With regard to the egoistic segment, marketers should promote seaweed to maximize individuals' benefit. Hence, marketers should target the superfood marked by promoting seaweed as beneficial, especially for well-being.

3.5 Differences and Similarities between Consumers in Norway and UK

Describing differences in consumers' acceptance of seaweed in different countries is relevant for theoretical and practical reasons. Two studies we are aware of compared consumer acceptance across countries (Grahl et al., 2018; Weinrich & Elshiewy, 2019). Grahl et al. (2018) explored consumers' acceptance of pasta, sushi and jerky containing seaweed in France, Germany and the Netherlands. Their results showed that pasta was the most widely accepted product across the three countries. They found no significant difference in consumer acceptance between the three countries. Weinrich and Elshiewy (2019) found no significant difference between French, German and Dutch consumers' willingness to pay for meat substitutes based on seaweed.

Because none of the papers in this thesis compared the differences in consumers' attitudes, intentions and consumption of seaweed food products between Norway and the UK, this chapter aims to briefly describe the differences and similarities between British and Norwegian consumers. To compare the mean of the variables between the two samples, we conducted a two-sample t-test using STATA 17.

Seaweed food products consumption – Norway vs UK

We asked the respondents how often they assume they will eat different seaweed food products. In Norway, spices and pasta are the products respondents are most willing to eat (Figure 5**)**. Surprisingly, sushi had one of the lowest scores (Figure 4). In the UK, we

observed that snacks are the most popular seaweed product among the respondents. Seasoning was the second most popular, and spices were the third most popular category. The three categories UK consumers assumed they would consume the least were chocolates, superfoods and alcoholic beverages (Figure 4).

Respondents are generally more willing to try spices, snacks and pasta containing seaweed. Finally, we underline that Norwegian respondents who want to eat or do eat seaweed had a higher frequency of consumption than respondents from the UK.

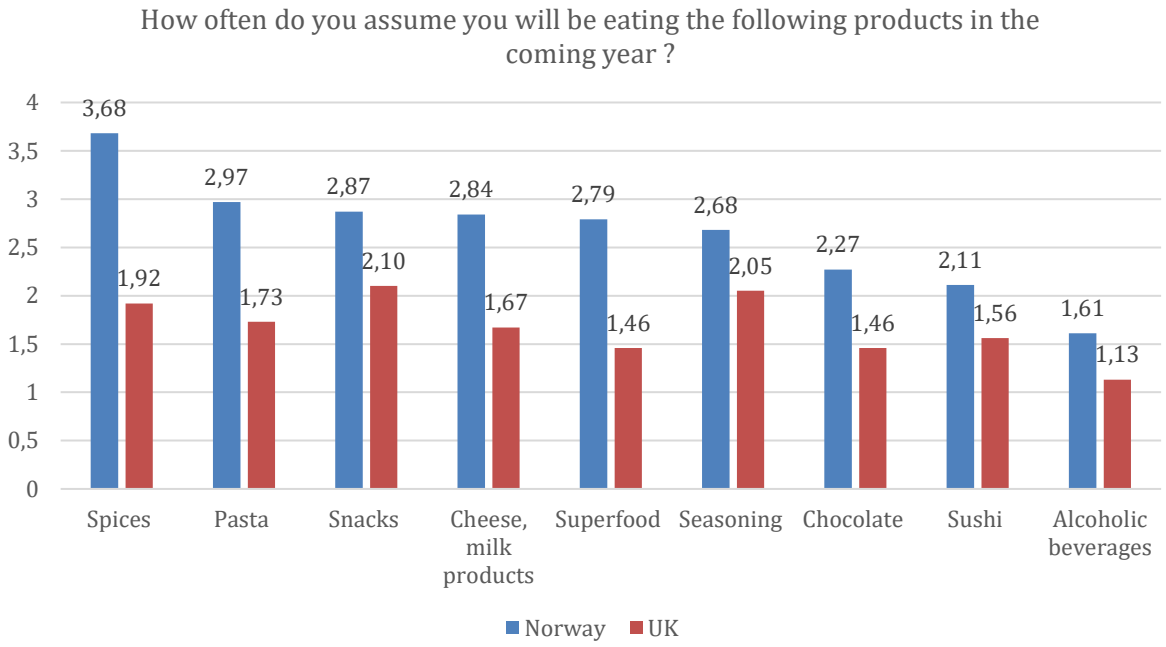

Figure 4. *Consumption Frequency Means by Products in Norway and the UK (On a nine-point scale: 1 – never; 2 – once a year; 3 – twice a year; 4 – four times per year; 5 – once a month; 6 – twice a month; 7 – once a week; 8 – twice a week; 9 – three times or more per week)*

Moreover, when looking at a potential difference between products that respondents would be willing to eat and the products that are consumed (Figures 5 and 6), we observed similar results in the UK as snacks, seasoning and spices are the most widely consumed seaweed products. However, in Norway, we observed a difference, as sushi (and not spices) was the product that was consumed the most (Figure 6).

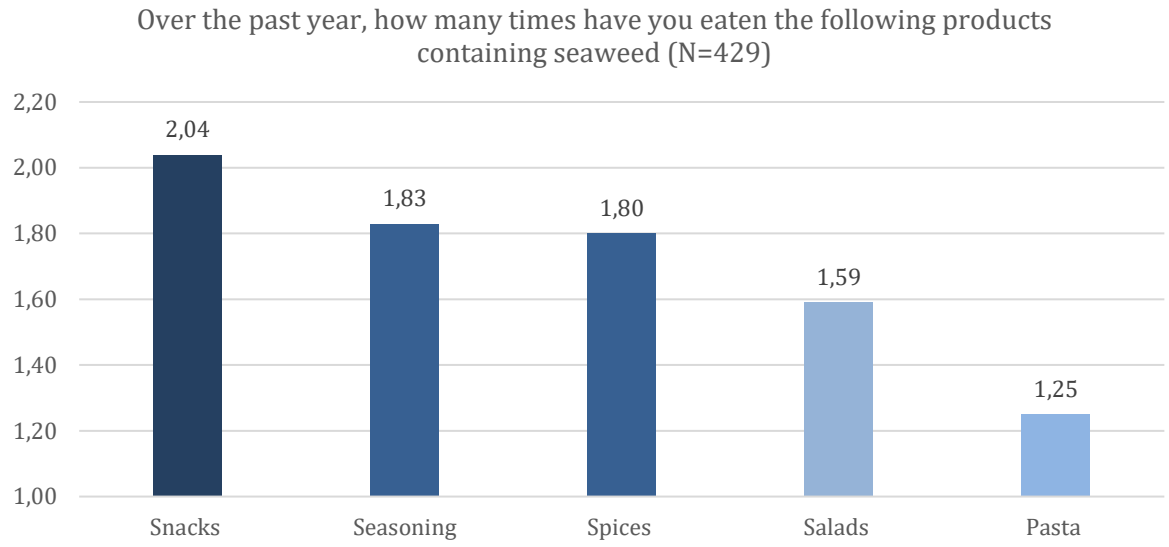

Figure 5. *Seaweed Products Consumption Frequency Mean in the UK (On a nine-point scale: 1 – never; 2 – once a year; 3 – three times per year; 4 – four times per year; 5 – once a month; 6 – twice a month; 7 – once a week; 8 – twice a week; 9 – three times or more per week)*

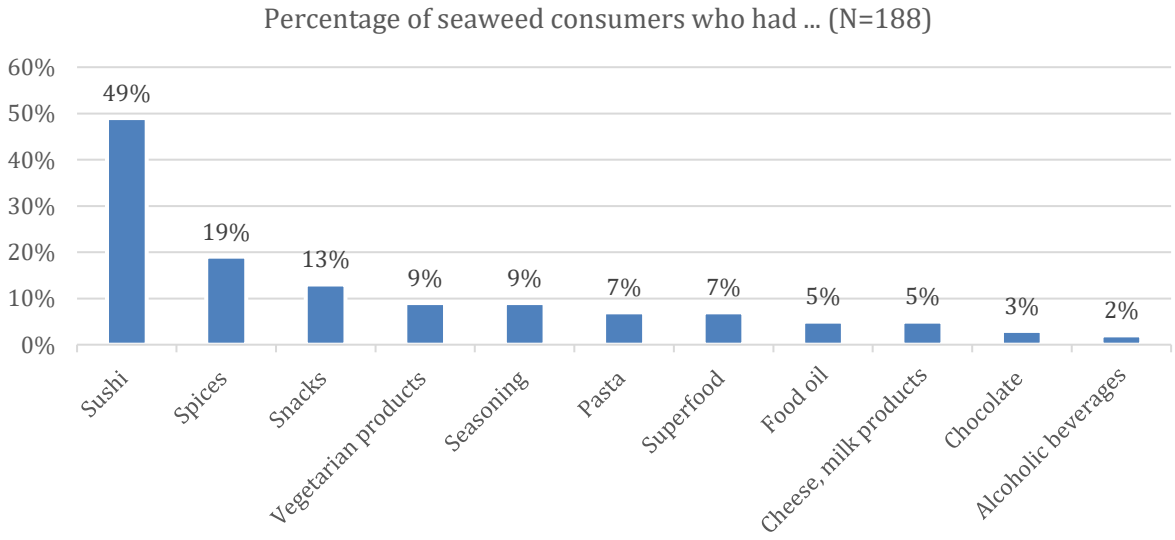

Figure 6. *Percentage of Norwegian Seaweed Consumers Who Ate these Products over the Past Year*

Attitudes – Norway vs. UK

In both surveys, we asked the respondents their general opinion about seaweed. We observe no significant difference between Norwegian and UK respondents regarding their attitudes towards seaweed consumption ($t(1534) = 1.33$, p = n.s.) (e.g. bad/good: ($t(1534) = 1.89$, p = n.s. ; dislike/like: ($t(1534) = 1.31$, p = n.s.). In both countries, respondents have a quite neutral opinion towards seaweed when asked if they believe that seaweed food products are bad or

good (Figure **7**). However, respondents were more negative about seaweed food products when asked if it is something they dislike or like.

When asked if they believe seaweed food products are exciting, unique and new, we observed significant differences between the two countries. In both countries, respondents perceived seaweed food products as new and unique (Figure 8). However, a two-sample t-test indicated that Norwegian respondents are significantly more likely to perceive seaweed food products as something new ($t(1534) = 7.95$, $p < .001$) and unique ($t(1534) = 4.39$, $p < .001$) than the UK respondents. As regards consumers' perception of seaweed food products as exciting or boring, the results of the two-sample t-tests showed that consumers in the UK believe, on average, these products are boring, while in Norway, consumers are significantly more likely to believe that these products are exciting ($t(1534) = 4.25$, $p < .001$).

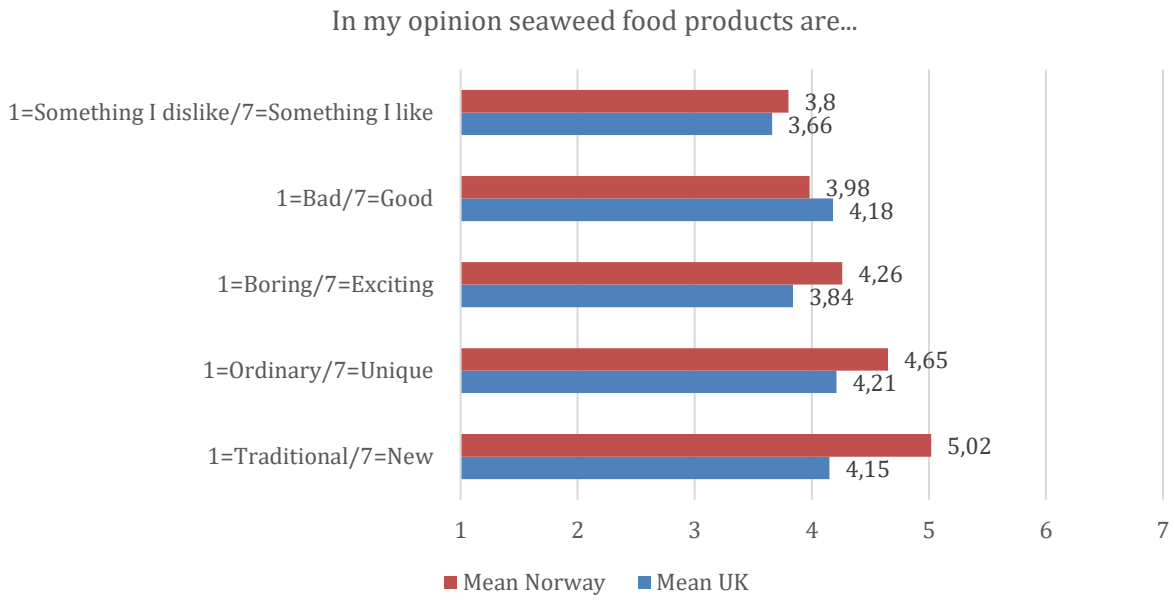

Figure 7. *General Opinion UK Vs. Norway*

The survey also tested the consumer perception of seaweed food products' attributes. When asked about the price, there was no significant difference between the two countries ($t(1534) = 1.83$, p = n.s.). Similarly, consumers in both surveys tended to perceive these products' smell negatively ($t(1534) = 1.27$, p = n.s.). As for perceived taste, the results show a significant difference between Norwegian and UK respondents ($t(1534) = 2.57$, $p < .05$).

Moreover, there was a significant difference in opinion regarding seaweed food products' safety, healthiness and naturalness. Hence, Norwegian respondents perceived seaweed food

products as safer ($t(1534) = 2.36$, $p < .05$), healthier ($t(1534) = 3.24$, $p < .001$) and more natural ($t(1534) = 6.59$, $p < .001$) than the UK respondents (Figure 8). Similarly, we observed an important difference between the UK and Norway regarding perceived accessibility. UK consumers believed that seaweed food products were much less accessible than Norwegian consumers ($t(1534) = 6.44$, $p < .001$). The results indicate that Norwegian consumers have a much higher perception of seaweed food products as natural than their counterparts from the UK ($t(1534) = 6.59$, $p < .001$) (Figure 8).

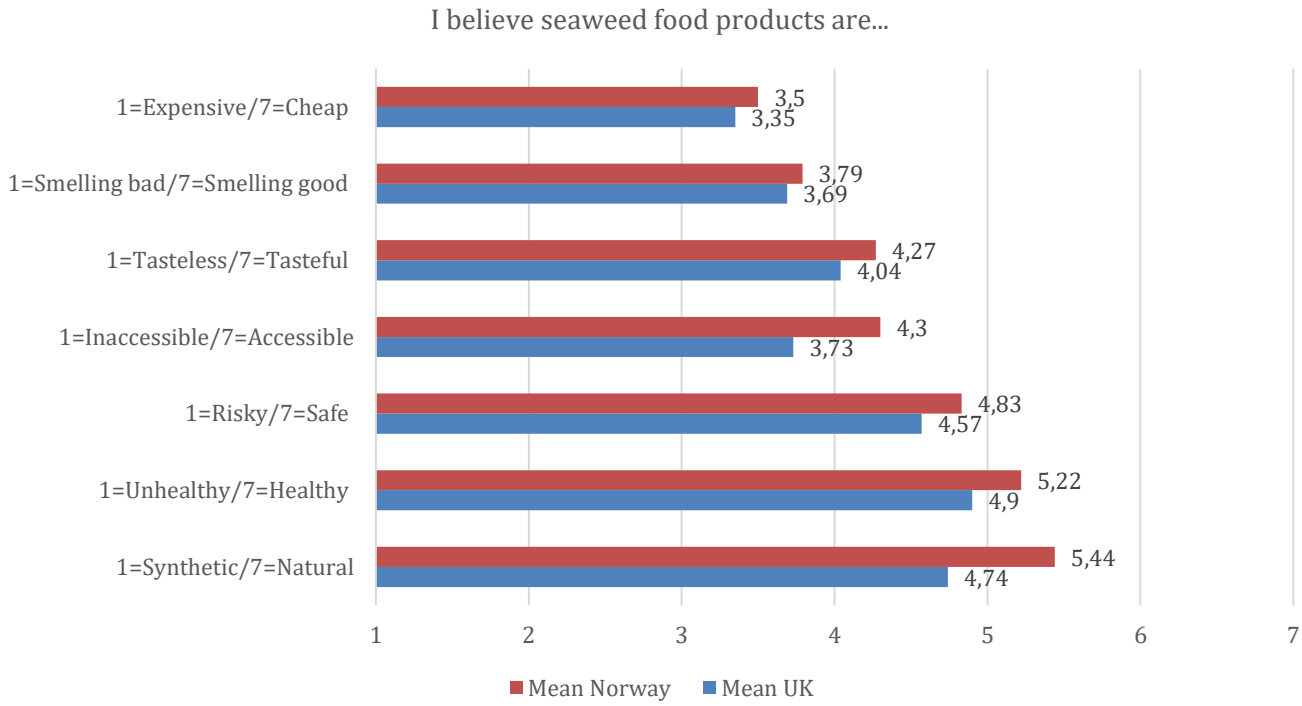

Figure 8. *Perceived Attributes UK Vs. Norway*

Personal norms, intention to eat seaweed – Norway vs. UK

Norwegians are more likely to eat seaweed than UK consumers. Also, Norwegian consumers showed a significantly higher moral obligation to eat seaweed than the British ($t(1534) = 12.33$, $p < .001$). Similarly, we observed a significant difference in their intention to eat seaweed food, as respondents from the UK are more unlikely to eat seaweed in the future than those from Norway ($t(1534) = 12.70$, $p < .001$).

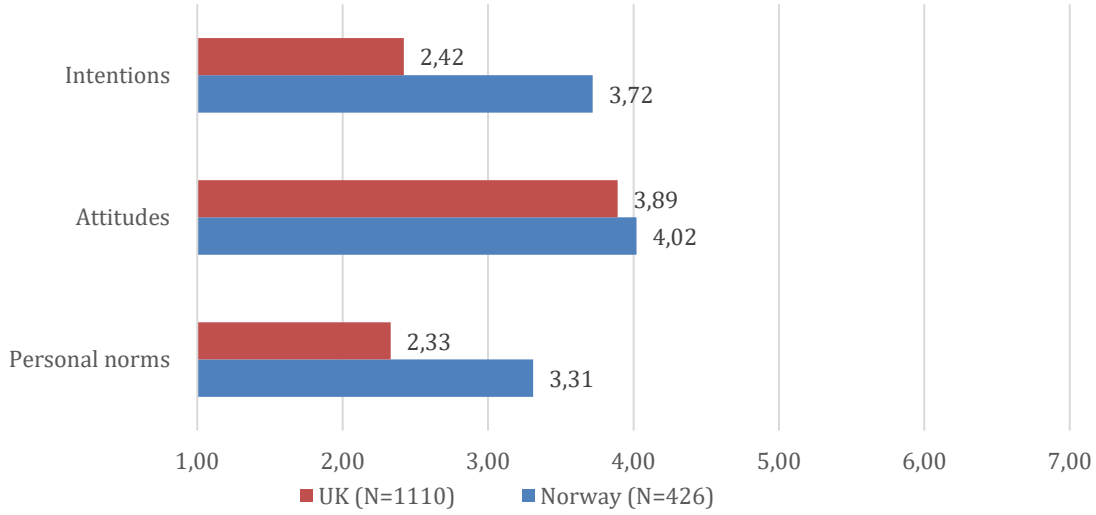

Figure 9. *Consumers' Intentions, Attitudes and Personal Norms Norway vs. UK*

Finally, in terms of their seaweed consumption, on average more Norwegians (44%) have tried seaweed than their British counterparts (41%) (Figure 10).

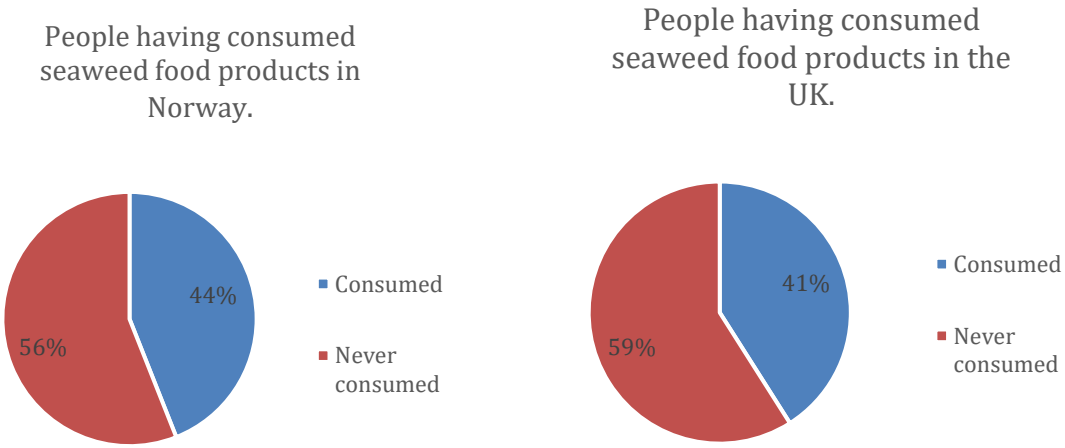

Figure 10. *Seaweed Food Products Consumption UK vs. Norway*

Conclusion

In the UK, snacks, spices and seasoning are the most popular food products among all respondents (consumers and non-consumers). In Norway, most people who have consumed seaweed had it in sushi, but, in general, respondents were more willing to eat spices and pasta containing seaweed. Moreover, it is important to underline that Norwegian respondents indicated they were willing to eat seaweed products more frequently than respondents from the UK. When evaluating the perceived attributes of seaweed food products, we observed

some important differences between the UK and Norway. Norwegians perceived seaweed as healthier, more natural, tastier and safer than their UK counterparts.

Moreover, Norwegian consumers perceived seaweed food products as newer and more unique. Seaweed food products are perceived as being significantly more inaccessible in the UK than in Norway. In both countries, respondents equally perceived seaweed foods as expensive and smelly.

Norwegian consumers generally showed a trend towards more positive attitudes towards seaweed consumption than consumers from the UK (Figure 7). The results showed a significant difference between Norwegian and UK respondents' personal norms and intention to eat seaweed. Norwegian respondents feel significantly more responsibility to eat seaweed and have a higher intention to eat seaweed than UK respondents. Moreover, the results show that a larger proportion of respondents had tried seaweed in Norway than in the UK. These findings follow earlier findings of this thesis, indicating a relationship between personal norms and seaweed consumption and between intention and seaweed consumption (Govaerts & Olsen, 2022).

In conclusion, similarly to Palmieri and Forleo (2020), the results indicate that seaweed producers should focus on developing and promoting a range of snacks and spices to appeal to new consumers in Norway and the UK. Moreover, the results suggest that, generally, Norwegian consumers are more inclined to consume seaweed than their British counterparts. Thus, extra efforts would be needed to introduce seaweed food products to UK consumers than to Norwegian consumers. For both countries, marketers should highlight their seaweed products' health and environmental characteristics with a view to increasing consumer acceptance, given consumers' concerns about their health and the environment.

Finally, it must be emphasized that the surveys were not conducted simultaneously. The survey in the UK was conducted in 2022, two years after the Norwegian one. To compare the two countries better, we should remeasure these variables in Norway. Moreover, a new survey in Norway would allow us to see if there has been an evolution in consumer personal norms, intentions, attitudes and seaweed consumption after two years.

3.6 Limitations and Future Research

This thesis is a first step towards increasing our knowledge about seaweed food consumption. However, it suffers from some limitations that could provide future research opportunities.

First, we emphasized that this thesis is prone to biases similar to other studies based on self-reported data. Typically, respondents are prone to social desirability bias (Cerri, Testa, Rizzi, & Frey, 2019; Fisher & Katz, 2000). Respondents could be susceptible to overrating their pro-environmental values, beliefs and behavior as they feel it is a more socially desirable response.

Second, this thesis focuses on seaweed food products as a general category. However, there might be differences between specific seaweed food products. Future studies should evaluate consumer attitudes, intentions and consumption of particular seaweed food products and compare these results with ours. Moreover, it would be interesting to compare whether different seaweed food products generate variation in the factors influencing their consumption. For example, hedonistic values might be strongly related to attitudes towards consuming snacks with seaweed rather than seaweed salads.

Moreover, seaweed foods in Norway and the UK remain hardly available, making consumers unfamiliar with seaweed food products. Hence, consumers could have biased taste and smell expectations of seaweed food, which strongly influences food choice (Clark, 1998). Future research should include a sensory test of products (Lawless & Heymann, 2010) to explore consumer preferences, attitudes, expectations and willingness to pay before and after tasting seaweed products.

Third, this thesis limited its focus to two countries (Norway and the UK) where seaweed is unfamiliar for many consumers. As we saw in Section 2.1.5, consumers' attitudes, personal norms, intentions and behavior vary depending on the country. As attitudes, personal norms, intentions and behavior change across borders and cultures, future studies should compare seaweed food behavior in different countries (Morren & Grinstein, 2016). Future studies should focus on other potentially important Western (e.g. the USA, France and Germany) and East Asian (e.g. China, Japan and Korea) markets. East Asian countries have a long tradition of cultivating and consuming seaweed. East Asia could be a key export market for Western seaweed companies. Yet, no studies have examined consumer acceptance towards European seaweed in East Asia. Many questions still have to be answered. For example, would

consumers in Japan, China and Korea be willing to eat seaweed made in Norway? What would their perception be of seaweed food imported from Europe? What are the factors influencing East Asian consumers to eat seaweed from Europe? Thus, future studies should explore consumers' perceptions and cognitive associations with European seaweed in East Asia.

Fourth, Papers 1 and 2 demonstrated the ability of the NAM and VAB to explain seaweed consumption. Future studies could explore the validity of other models and theories, such as the value-belief-norm model (VBN: Stern, 2000), environmental concern/attitude models (Rodríguez-Casallas, Luo, & Geng, 2020), value-identity-personal norms (van der Werff & Steg, 2016), time perspective theories (Kooij et al., 2018; Milfont et al., 2012), and big five facets of personality (Soutter & Mõttus, 2021). This research would help to extend the breadth and depth of theoretical knowledge about antecedents of seaweed consumption further.

As this study is based on cross-sectional questionnaire methodologies, it is difficult to establish causal relationships since the data only represent a one-time measurement. Thus, the interpretation of relationships proposed in Articles 1 and 2 requires caution. Future studies should use longitudinal or experimental research designs to increase the insight into causal relationships, as well as moderating and mediating effects. Moreover, as measurements are repeated in time, a longitudinal design would help to examine the process of consumers' adoption of seaweed.

The literature has shown that explaining novel food behavior is complex as there is a gap between consumer attitude and intention to eat and their actual consumption (Schäufele & Hamm, 2018; Vermeir & Verbeke, 2006). In Papers 1 and 2, we saw that introducing a third variable (perceived behavioral control and consumer innovativeness) reduces this gap. Nevertheless, the results showed that a large amount of variance remained unexplained, indicating that many factors still influence the attitude/intention-consumption relationship that has yet to be explored. Future research should explore the role of other factors in reducing the gaps between attitude and behavior and between intentions and behavior.

Fifth, this thesis uses three facets of core values and two specific dimensions of self-identity. Future studies could extend to other dimensions of values and self-identity as a basis for segmentation. For example, it is possible to use broader value dimensions such as self-

enhancements and self-transcendence (Schwartz, 1992) in combination with social identity (Brieger, 2019), environmental identity (Van der Werff et al., 2013b) or other relevant self-identities to food consumption (e.g. ethical self-identity (Talwar, Jabeen, Tandon, Sakashita, & Dhir, 2021)). Moreover, this thesis did not compare the consumer attitudes toward, and consumption of, other food products (e.g. organic foods and seafood) with attitudes toward, and consumption of, seaweed. Future studies could include those issues as profiling together with other relevant profiling variables (e.g. ways of shopping, cooking habits and convenience orientation).

Finally, this thesis focuses on exploring the influence of personal norms on seaweed consumption. So far, there has been no research on the impact of social influence on seaweed food consumption. Social influence and norms are essential in explaining and predicting intention and behavior (Keiser & Schultz, 2019; Thøgersen, 2006) . Exposing people to a normative message is an effective way of encouraging a specific behavior. Recent research has indicated that when people are aware that increasingly more people are engaging in the desired behavior (dynamic norm) it can successfully influence people to adopt the behavior (Cheng, Hao, Xiao, & Wang, 2020; Loschelder, Siepelmeyer, Fischer, & Rubel, 2019; Mortensen et al., 2019; Sparkman & Walton, 2017). Thus, we believe that normative information may help overcome psychological barriers caused by consumers' unfamiliarity with, and knowledge about, seaweed, thereby increasing their willingness to consume it in the future.

3.7 Practical Concluding Remarks

The absence of a seaweed food culture is a crucial challenge for adopting seaweed food products in Western countries. This thesis provides the emerging European seaweed sector with valuable insights into consumers' motivations to eat seaweed. This work applied different theoretical frameworks (NAM and the VAB) and methodological approaches (modeling, moderation and segmentation). Throughout the models, we have shown that values, personal norms, identity and beliefs are important factors that influence novel food consumption. Furthermore, consumer innovativeness and perceived behavioral control strengthen the intention-behavior relationship and the attitude-behavior relationship in the case of seaweed food consumption. In addition, the consumer segmentation study indicated that seaweed consumers are guided by pro-environmental and hedonistic motivation and possess strong food innovativeness and health self-identity.

The theoretical findings can be used to develop effective campaigns and interventions to promote seaweed foods as sustainable, healthy, natural and unique. Moreover, the segmentation study's insights are valuable indicators when implementing promotional campaigns. By profiling the seaweed consumers, seaweed actors can use their limited resources more efficiently by focusing on the consumers who are more likely to eat seaweed in the future. Moreover, it would be more challenging to try to influence consumers with low food innovativeness identity to consume seaweed. More crucially, the lack of association between seaweed and pleasure is a challenge for marketers to respond to. Emphasizing perceived uniqueness can be a way to encourage consumers to associate seaweed with pleasure. Finally, health and environmental considerations are key factors in explaining consumer intention and consumption; the seaweed industry should focus on promoting seaweed food products as healthy and environmentally friendly.

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Part 3

Paper 1

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Exploration of seaweed consumption in Norway using the norm activation model: The moderator role of food innovativeness

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ABSTRACT

Seaweed is considered to be a sustainable and healthy food source. However, for western consumers, it remains an unfamiliar source of food. Using a sample of 426 Norwegian consumers, this study aimed to explain and predict seaweed consumption using an extended version of the norm activation framework with a prospective design, including behaviour and consumer food innovativeness. Confirmatory factor analysis was conducted to validate the reliability of the measurements, while structural equation modelling was applied to test the hypothesised relationships. The findings support the ability of the norm activation framework to explain the intention of consuming seaweed. Moreover, this study determined a positive relationship between awareness of health consequences and intention, as well as ascription of responsibility and intention. Intention and food innovativeness are both predictors of seaweed consumption. Consumer food innovativeness positively moderates the relationship between intention and seaweed consumption.

1. Introduction

Our food system is confronted with important challenges. Globally, a range of issues including climate change, population growth, over-exploitation of land resources, malnutrition, and poor nutrition are pressing societies to find and promote new sustainable food sources. Additionally, in the western countries, consumers are becoming increasingly aware of the environmental and health issues caused by food consumption. Consequently, food trends pertaining to natural, local, organic, traceable, and functional foods are becoming increasingly popular among consumers (Aertsens et al., 2009; Feldmann & Hamm, 2015; Perera et al., 2018).

In the context of this global trend towards a more sustainable and healthy food production and consumption, seaweed is considered to be a promising new food source in the western markets. First, seaweed is considered a sustainable food source (Kim et al., 2017; Lenstra, et al., 2011), whose production does not require soil, fresh water, or fertiliser (Buschmann et al., 2017), and which removes and stores carbon dioxide from the atmosphere (Duarte et al., 2017). Second, seaweed is a healthy low calorie and highly nutritional food source. It is especially known for its high content of iodine, vitamins, and fibre (Mabeau & Fleurence, 1993). Some seaweeds are rich in proteins, such as the 'Nori' green seaweed which contains up to 47% proteins (Prager, 2016). Finally, seaweed is tasteful (Wendin & Undeland, 2020) but remains unfamiliar to western consumers (Birch et al., 2019). Hence, new seaweed products can provide to western consumers new taste experiences.

In the literature, only few studies have focused on seaweed from the perspective of consumer behaviour (Birch et al., 2019; De Boer et al, 2013; Palmieri & Forleo, 2020, 2021; Wendin & Undeland, 2020). Understanding how and why consumers adapt and use new food products and services is important since there is a need for consumer insight which would help the seaweed industry to develop a new and sustainable food product (Stévant et al., 2017). Therefore, the main objective of this study is to understand consumers' motivation for consuming seaweed food products from a sustainable and environmental behavioural perspective.

Several studies focus on consumer behaviour towards sustainable products and services (Trudel, 2018; White et al., 2019) using theories and models such as the theory of planned behaviour (TPB) (Ajzen, 1991), habit theory (Verplanken & Aarts, 1999), alphabet theory (Zepeda & Deal, 2009) , the norm activation model (NAM) (Schwartz, 1977), value-belief-norm model (Stern, 2000), and combinations and extensions of these models (Kim & Hwang, 2020; Klöckner, 2013; Nordlund et al., 2018).

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Seaweed is a new food source for most western consumers. Thus, a lack of knowledge and awareness of this source of protein and its benefits to the environment and health may be a consumption barrier. Several environmental consumption theories suggest that belief, knowledge, and awareness activate personal norm (Schwartz, 1977; Steg & Groot, 2010; Ünal et al., 2018). Therefore, this study contributes to the existing food consumption literature, using the NAM (Schwartz, 1977) to explore seaweed consumption. The NAM model assumes that behaviour results from the activation of personal norm by ascription of responsibility and awareness of consequences. The structural relationship between the constructs in the NAM varies across products and contexts (De Groot & Steg, 2009; Han et al., 2015; Kim & Hwang, 2020; Onwezen et al., 2013) due to which an alternative model structure is often considered (Onwezen et al., 2013; Zhang et al., 2018).

Moreover, most studies on pro-environmental behaviour using the NAM do not examine the relationship between intention and behaviour. Solely using intentional behaviour to explain consumer behaviour is problematic as there tends to be an important gap between consumer's intentions and behaviour (Armitage & Conner, 2001; Rhodes & de Bruijn, 2013; Sheeran, 2002), especially in the area of sustainable, ethical, and pro-environmental consumption (Carrington et al., 2014; Hassan et al., 2016; Vermeir & Verbeke, 2006). However, some studies that use the NAM by including behaviour, apply a cross sectional survey and measure past behaviour and intention simultaneously (e.g., Han, 2014). Hence, to solve this problem, this study extends previous studies using the NAM to explore intention-behaviour relationship using a prospective research design (Fishbein & Ajzen, 2010). The practice of predicting and measuring behaviour one month after measuring intention is frequently used in the original TPB (Carfora et al., 2019) and exhibits a theoretical advantage concerning causality (Aguilar-Luzón et al., 2012; Ajzen, 1985; Ajzen et al., 2004) as well as a methodological advantage in forming and reducing common method bias or carryover effects (Podsakoff et al., 2003; Tourangeau et al., 1989). This study addresses these theoretical and methodological shortcomings of previous studies using the NAM.

In the context of novel or unfamiliar foods such as insects (Mancini et al., 2019; Onwezen et al., 2019), only a small fraction of adventurous food innovators would eat seaweed, while the majority would avoid it for the fear of the unknown. Knowing that innovative food consumers are more adept at adopting new foods, this study extends the established literature (e.g., Mancini et al., 2019; Onwezen et al., 2019) by testing the role of consumer food innovativeness in the prediction of consumption behaviour and as a moderator between intention and behaviour in a prospective design. To the best of our knowledge, this is the first study that tests the relationship between consumer food innovativeness and behaviour with a prospective design.

2. Theoretical framework

The TPB (Ajzen, 1991) is probably the most frequently used theory to explain and predict sustainable food products, such as ethical foods (O'Connor et al., 2017), organic and green foods (Carfora et al., 2019), and new sustainable food products (Mancini et al., 2019; Onwezen et al., 2019). In the area of sustainable and environmental theories, the value-belief- norm framework is frequently used to explain a multitude of pro-environmental attitudes and behaviours regarding recycling (Gkargkavouzi et al., 2019), energy conservation (Abrahamse & Steg, 2011), transportation (Jakovcevic & Steg, 2013), green hotel setting (Choi et al., 2015), and environmentally friendly eating (Kim et al., 2020). When the NAM is used in food behaviour, it is also integrated with either the TPB or the value-attitude-behavioural framework (Kim & Hwang, 2020; Shin et al., 2018). This study applies the basic and linear NAM with alternative model structures, extends the linear model with prospective design, and measures the influence of consumer food innovativeness on consumption in the context of novel/unfamiliar sustainable food.

2.1. Norm activation model

The NAM developed by Schwartz (1977), to explore altruistic behaviour, is widely used today to study sustainable attitudes and intention (Joanes, 2019; Kiatkawsin et al., 2020; Onwezen et al., 2013). NAM is a sequential linear model that argues that intention or behaviour is the result of the activation of personal norm. The core construct of the model personal norm is defined by Schwartz (1977, p. 227) as 'the self-expectations for specific action in particular situations that are constructed by the individual'. Personal norm is also defined as the 'feeling or responsibility for the negative consequences of not acting pro-socially' (De Groot & Steg, 2009, p. 426). In this study, personal norm is defined as the feeling of moral and environmental obligation to buy and eat seaweed.

Two factors activate the personal norm in the model: awareness of consequences and ascription of responsibility. Awareness of consequences is defined as the level of consciousness of the potential repercussion of a performed action (Schwartz, 1977). Recent studies refer to awareness of consequences as the degree to which a person is mindful of the adverse consequences for others or for things one values, when not acting pro-socially (De Groot & Steg, 2009; Hansla et al., 2008). Consumers are willing to consume environmentally friendly foods, like organic foods, not just for environmental and social consequences, but for better quality, health, and other more 'egoistic' benefits (Kushwah et al., 2019). Thus, this study refers to awareness of consequences of health consequence, as seaweed is considered to have positive health consequence (O'Connor, 2017; Pereira, 2016). The other main factor, ascription of responsibility, indicates a person's feelings of responsibility for consequences of a behaviour (Schwartz, 1977). In this study's context, we refer to ascription of responsibility as the feeling of responsibility to reduce environmental problems (e.g., climate change and pressure on land resources) by consuming seaweed.

This study defines intention as an indication of how hard people are willing to try, and how much effort they are planning to exert, to eat seaweed in the future (Ajzen, 1991). This study defines behaviour as a person's self-reported consumption of seaweed. It is measured one month after the assessment of intention (prospective design; Future consumption). A visual presentation of our conceptual model with hypotheses is presented in Fig. 1.

2.2. Relationships between ascription of responsibility, personal norm, and intention

According to De Groot & Steg (2009), a person must first be aware of the consequences of a behaviour before feeling responsible for it. Thus, the model assumes that feelings of responsibility would activate personal norm. When personal norm is activated, it influences individual intention directly and behaviour indirectly (see Fig. 1: in blue the original NAM) (Harland et al., 2007). For example, regarding pro-environmental intention and behaviour, personal norm is stronger when people are aware of the environmental problems caused by their behaviour, and when they feel personally responsible for these problems and do not blame these problems on the actions of others (Schwartz, 1977; Van Liere & Dunlap, 1978). Moreover, personal norm is stronger when people feel that they can contribute to solving or reducing the problem (Bamberg et al., 2007; Schwartz, 1977; Stern, 2000).

Many studies have supported the NAM linear direct relationships (ascription of responsibility → personal norm → intention) in diverse environmentally friendly behaviour, such as energy-saving (Song et al., 2019; van der Werff & Steg, 2015), eco-friendly tourism behaviour (Han et al., 2015; Han et al., 2019; Kiatkawsin & Han, 2017) and transport behaviour (De Groot & Steg, 2008; He & Zhan, 2018; Nordlund et al., 2018). For example, Shin et al. (2018) included the TPB and the NAM to study consumer behaviour toward organic menus and found a high relationship between ascription of responsibility and personal norm ($\beta = 0.50$), and between personal norm and intention ($\beta = 0.26$). However,

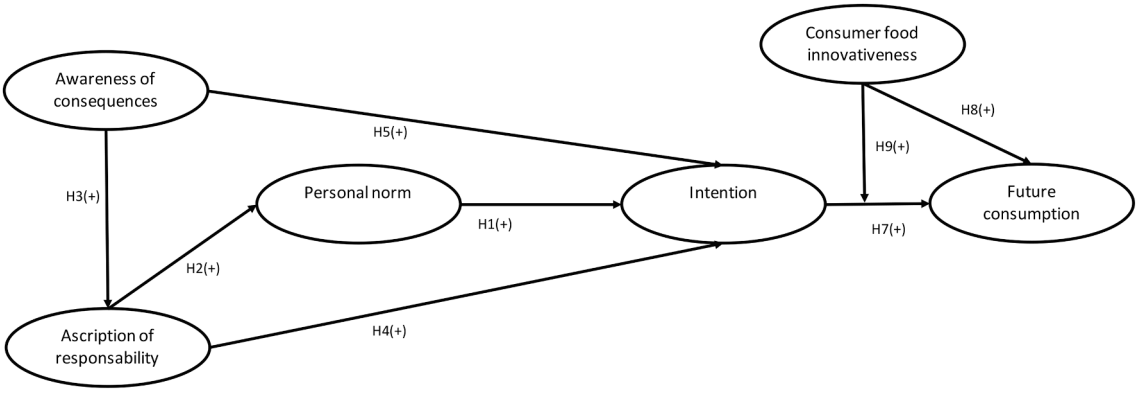

Fig. 1. Proposed conceptual model with hypotheses.

to the best of our knowledge, this is the first study that uses the NAM framework to study novel/unfamiliar sustainable food consumption, but there is reason to believe that because seaweed has pro-environmental advantages (see our introduction), a positive relationship exists between ascription of responsibility and personal norm, and personal norm and intention in our context. Integrating the theoretical and empirical backgrounds, the following hypotheses are proposed:

H1: Increasing personal norm leads to higher intention to eat seaweed.

H2: Increasing ascription of responsibility leads to higher personal norm.

2.3. Awareness of (health) consequences

Seaweed is considered to have pro-environmental consequences and health benefits for consumers (Pereira, 2016). Health benefits are important for consumers' food choice (Hughner et al., 2007; Rana & Paul, 2017), especially for foods like seaweed, vegetables, and organic food (e.g., Birch et al., 2019; Kushwah et al., 2019). In addition, recent literature has underlined a relationship between consumer health awareness and sustainable food consumption (Kriwy & Mecking, 2012; Tarkiainen & Sundqvist, 2009). In practice, consumers are more likely to eat sustainable foods as they are considered healthier than traditional foods. Hansen et al. (2018) showed that health consciousness is positively related to personal identification as an organic food consumer. Magnusson et al. (2003) demonstrated that perceived health benefits are stronger indicators of pro-environmental food behaviour than perceived environmental benefits. Thus, this study contributes to the existing NAM literature by exploring the possible positive relation between awareness of health consequences and ascription of responsibility.

Accordingly, the following hypothesis was formulated:

H3: Increasing awareness of health consequences leads to higher ascription of responsibility.

2.4. Alternative routes to pro-environmental food behavioural intentions

Alternative model structures to the NAM are often considered (Onwezen et al., 2013; Rosenthal et al., 2020; Steg & Groot, 2010; Zhang et al., 2018). For instance, Zhang et al. (2018) tested the moderating effect of awareness of consequences and ascription of responsibility on the relationship between personal norm and behaviour, while Kim et al. (2018) explored the mediating effect of ascription of responsibility on the relationship between awareness of consequences and personal norm. Similar to the previous studies cited, this study applies an alternative model structure to the original linear structure of the NAM proposed by Schwartz (1977).

Generally, studies have considered personal norm towards pro-environmental action as a mediator between ascription of responsibility and intention (e.g., Choi et al., 2015; De Groot & Steg, 2008; Gkargkavouzi et al., 2019; Jakovcevic & Steg, 2013). Few studies have considered the association between ascription of responsibility and pro-environmental behavioural intention. To the best of our knowledge, three studies have indicated a positive effect of ascription of responsibility on eco-friendly behaviours (Vaske et al., 2015; Verma et al., 2019) and on the pro-environmental behaviours of public servants (Fang et al., 2019). Based on the above observations, in the context of novel foods, it is reasonable to assume that consumers who feel responsible for the environment are more likely to intend to eat seaweed. Moreover, in some circumstances, ascription of responsibility does not activate moral norms, but rather triggers intention to consume seaweed directly or indirectly through other mediators (e.g. Onwezen et al., 2013; Vaske et al., 2015). For example, Kiatkawsin and Han (2017) indicated that ascription of responsibility influenced intention through individual's expectancy that environmental action will lead to an outcome, in addition to pro-environmental personal norm.

Hence, the following hypothesis is proposed:

H4: Increasing ascription of responsibility leads to higher intention to eat seaweed.

An alternative NAM model showed a strong relationship between awareness of consequences and consumer pro-environmental intention in the context of tourism (Vaske et al., 2015), energy (van der Werff & Steg, 2015), and cosmetics (Munerah, Koay, & Thambiah, 2021). Several studies integrating the NAM with other theories confirm that awareness of consequences directly and indirectly influences intention through other mediators besides personal norm, such as attitudes (Kim & Hwang, 2020), subjective norms, and perceived behavioural control (Zhang et al., 2017). In the context of food consumption, health is a significant factor for consumers when purchasing food (Rana & Paul, 2017; Wandel & Bugge, 1997). Hence, consumers with higher health knowledge are more likely to have positive attitudes towards healthy foods and organic foods (Rana & Paul, 2017). Lee et al. (2013) showed that health concerns and health knowledge significantly affect intention to eat healthy foods. At the same time, other studies indicate a strong association between sustainable foods and health benefits (Bryła, 2016; Lea & Worsley, 2005). Loebnitz & Grunert (2018) have also indicated that health-conscious consumers show higher intention to buy sustainable foods. Thus, in line with previous findings, there is reason to believe that consumers with higher awareness of health consequences will have higher intention to eat seaweed than consumers with lower awareness. Thus, the following hypothesis is proposed,

H5: Increasing awareness of health consequences leads to higher intention to eat seaweed.

Finally, previous studies emphasised the mediating role of responsibility as individuals must be aware of the consequence of behaviour to feel responsible for it (De Groot & Steg, 2009; Onwezen et al., 2013). However, most of the studies measured the direct effect of ascription of responsibility while just a few considered ascription of responsibility as a mediator between awareness of consequences and

intentions (Fang et al., 2019; Vaske et al., 2015). Furthermore, it is known that a relationship exists between health awareness and pro-environmental concern (Rana & Paul, 2017; Wandel & Bugge, 1997), but there are no extant studies considering the mediating effect of pro-environmental feeling of responsibility on the relationship between the awareness of health consequences, and intention to eat pro-environmental foods. Therefore, we assume that aware consumers feel a greater sense of responsibility to eat seaweed and that ascription of responsibility is positively related to intention to eat seaweed and serves as a mediator between awareness of health consequences and intention to eat seaweed. Accordingly, the following hypothesis was formulated:

H6: The relationship between awareness of health consequences and intention to eat seaweed is mediated by ascription of responsibility.

2.5. Intention-behaviour gap under prospective design

Intention is suggested to be the most important predictor of an individual's behaviour within attitude-behavioural theories like the TPB (Fishbein & Ajzen, 2010; Sheeran, 2002). Thus, most studies that use the NAM (e.g., He & Zhan, 2018; Kim & Hwang, 2020; Zang et al., 2017; 2018) or include the NAM in other theories (e.g., the TPB) (e.g., Zhang et al., 2020; Kiatkawsin & Han, 2017; Rezaei et al., 2019) to define intention as the ultimate dependent variable. Few studies use past behaviour or a combination of intention and past behaviour (e.g., Lopes et al., 2019; Onwezen et al., 2013; Udo et al., 2016). However, intention and behaviour are separate concepts, and the relationship between them is controversial (Armitage & Conner, 2001; Rhodes & de Bruijn, 2013; Sheeran & Webb, 2016), especially regarding pro-environmental behaviour (Glimmer & Miles, 2017) and ethical consumption (Carrington et al., 2010; Hassan et al., 2016). The gap between intention and consumption in the area of sustainable foods (Vermeir & Verbeke, 2006) and healthy foods (Conner et al., 2002) is well documented in the existing literature.

All NAM studies we know, including the intention-behaviour relationship in the NAM sequential and linear structure, use 'past behaviour' as an outcome of intention to behave. This study follows the reason action approach of the TPB and uses a prospective design (Fishbein & Ajzen, 2010) assessing self-reported behaviour, one month after assessing intention. Thus, this study explains variations in intention and explores if and how intention predicts future behaviour as suggested by original versions of the TPB. This not only strengthens the theoretical causal relationship between constructs in the theoretical model (Fig. 1), but temporal separation reduces the possibility for common method bias and carryover effects (Podsakoff et al., 2003; Podsakoff et al., 2012; Tourangeau et al., 1989). To better understand the relationship between intention and behaviour, this study extended the NAM by integrating behaviour into the linear structure and assessing seaweed consumption one month after measuring intention to consume seaweed within the coming month (prospective design). Based on this discussion the following hypothesis is proposed.

H7: Consumer's intention to consume seaweed predict future consumption of seaweed.

2.6. The role of consumer food innovativeness

Seaweed is traditionally eaten in Asia (for example, in China, Japan, Korea, and Thailand), where its nutritional properties and flavours are prized (Chapman et al., 2015; Stévant et al., 2017). However, it is still unfamiliar and largely unknown to consumers. In Norway, historical records reveal the use of seaweed in the diet during the Viking age, over 1000 years ago; however, its use has almost disappeared from the traditional Norwegian diet. Nowadays, seaweed food products remain new to Norwegian consumers.

In this context, the effect of consumer food innovativeness on seaweed food consumption is relevant as previous studies have shown that it plays an important role in the willingness to buy and consume and pay for new food products (Bartels & Reinders, 2010; Persaud & Schillo, 2017). Thus, this study includes consumer food innovativeness (Fu & Elliott, 2013; Goldsmith & Hofacker, 1991) in our conceptual framework (see Fig. 1) to extend our understanding of consumers' motivation to consume novel food, such as seaweed.

Consumer innovativeness is a frequently used term in consumer behaviour studies for all types of goods and services and defines innovativeness as a general theoretical construct across academic disciplines. Literature defines consumer innovativeness as the tendency to purchase new products, services, or ideas earlier than the majority of consumers or as the tendency to be attracted to new products after their apparition in the market (Foxall et al., 1998). Traditionally, innovativeness is viewed as depending on personality as some customers have an innate predisposition to adopt new products, services, or brands before others (Hoffmann & Soyez, 2010; Hurt et al., 1977; Midgley & Dowling, 1978). In contrast, the concept of domain specific innovativeness, introduced by Goldsmith & Hofacker (1991), focuses on consumer innovativeness for a specific product category. It proposes that consumers' adoption of innovation in a specific domain does not guarantee their adoption of innovation in another domain. In other words, a consumer can be innovative with some specific products or services such as food, but not with others such as clothes or wine. Thus, consumers food innovativeness refers to consumers tendency to purchase new food products

Consumer innovativeness is related to individual differences in personality, values, attitudes, intentions, and behavioural variables (Bartels & Reinders, 2010). It is suggested that consumer innovativeness influences intention to buy, use, or pay for new products (Flynn & Goldsmith, 1993; Fu & Elliott, 2013) or services (Liu, 2013). In general, the relationship between innovativeness and buying behaviour of new products is positive across products and services (Bartels & Reinders, 2010). Regarding novel foods, previous studies have shown that highly innovative food consumers are more willing to buy organic foods (Bartels & Reinders, 2010), but this can differ between cultures (Altintzoglou et al., 2016).

This study seeks to test whether and how consumer food innovativeness is associated with consumption of novel food (seaweed). Thus, the following hypothesis is proposed,

H8: Increasing consumer food innovativeness leads to higher future consumption of seaweed.

In the literature, personal innovativeness has been used as a moderator between various variables in various contexts (Fang et al., 2009; Fu & Elliott, 2013; Herrero Crespo & Rodríguez del Bosque, 2008). For example, Fang et al. (2009) studied the moderating effect of innovativeness on attitude and intention to participate in an online survey. Persaud and Schillo (2016) investigated the moderation role of innovativeness on the relationship between identity and intention to purchase organic food. However, to the best of our knowledge, no studies are investigating the moderating effect of innovativeness on the intention-behaviour relationship with a prospective design (future consumption).

Furthermore, as seaweed is not a part of the Norwegian food culture, it is expected that only a minority of the sample will consume seaweed between the first and the second survey, thereby generating a large gap between intention and future behaviour. Food innovative consumers are believed to be more likely to take the last step between intending to consume seaweed and consuming seaweed; it is expected that the gap between intention and behaviour will be lower as the consumer is food innovative. Thus, the following hypothesis is proposed,

H9: Consumer food innovativeness has a positive moderating effect on the intention- future consumption of seaweed relationship.

3. Methodology

3.1. Data collection

Data for this study were collected via a questionnaire survey carried

out through the intermediary of an online international survey research firm (Yougov) in June 2020. The sample was representative of gender, age, and region of Norwegian consumers. The sample consisted of 426 adult participants aged 18 years old and above, of whom 51% were male. The majority of respondents were well-educated (university or university college) (59%), and most lived in households without children (72.7%). Table 1 summarises the socio-demographic characteristics of the sample.

The survey consisted of two questionnaires which were administrated at two different times (t1 and t2). The first questionnaire, which required approximately 8–11 min to complete, consisted of four components of NAM (awareness of health consequences, ascription of responsibility, personal norm, and intention), and consumer food innovativeness, together with some other constructs not reported in this study.

The second questionnaire was administrated about one month after. This questionnaire was shorter as it contained a single item measuring seaweed consumption behaviour. The same participants participated in the second questionnaire. However, to avoid the data being influenced, at the first questionnaire round, participants were not informed of our intention to conduct another round a month later. The study only includes data from participants who filled out both questionnaires (t1 and t2).

As seaweed food products are relatively unknown in the Norwegian food culture, a series of pictures of seaweed food products were presented to the participants. The food products presented in the survey are all available on the Norwegian market. Some of these are popular in Asian countries and have been imported to Norway. For instance, the respondents were presented with pictures of sea grapes (also called green caviar: used as a side dish in Asia), sushi (in sushi, the Nori seaweed is used to wrap the roll) and wakame (often used as a side dish in Japanese restaurant) (Fig. 2).

Pictures of Norwegian produced seaweed were also presented in the survey, such as pictures of snacks (chocolate and chips), cheese, and drinks containing local seaweed, along with a short descriptive text for each picture.

3.2. Measurement instruments

The measurement instruments used were adopted from prior studies and amended to suit the present study setting. The questionnaire was presented in Norwegian, and the items were placed in a randomised order.

Participants' awareness of health consequences was measured using three items adapted from De Groot and Steg (2009) to reflect consciousness of the health benefit of seaweed: 'Seaweed products can be considered as superfood', 'Seaweed products are good for your health', and 'Seaweed can be considered as the vegetable of the sea'. The ascription of responsibility was measured using three items adapted from De Groot and Steg (2009): 'Eating seaweed can contribute to the fight against climate change', 'I feel that people should eat (more) seaweed to reduce the impact of food on the climate' and 'Every person should eat seaweed to reduce the pressure on land resources'. Personal norm was assessed using three items adopted from Jakovcevic and Steg (2013). The measurement items for these three constructs were adapted to fit the context of seaweed food consumption. To measure awareness of health consequences, ascription of responsibility, and personal norm, respondents were asked for each item to indicate to what extent they disagreed or agreed with the statement on a scale, ranging from 1 = 'strongly disagree' to 7 = 'strongly agree'. Table 2 shows the measurement items used to measure awareness of health consequences, ascription of responsibility, and personal norm.

Intention to eat seaweed was measured by rating three items on a scale from 1 to 7 (extremely unlikely/extremely likely). The items were adapted from Menozzi et al. (2017). As it is not common to find seaweed food products in Norwegian stores, a short introduction preceded the three items: 'If seaweed products are readily available in the stores you usually shop in, how likely is it that you will eat them in the time to come'. The three items used to assess behavioural intention were: 'I intend to eat products containing seaweed in the future', 'I expect to eat products containing seaweed in the future', and 'I will try to eat products containing seaweed in the future'.

Three items borrowed from Goldsmith & Hofacker (1991) were used to measure the latent variable consumer food innovativeness. A 7-point bipolar rating scale from 1= 'strongly disagree' to 7= 'strongly agree' was used. The items consisted in 'I am constantly sampling new and different foods', 'I try new foods before other people do' and 'Compared to my friends, I try more new foods'.

Future consumption of seaweed consisted of asking the frequencies with which respondents bought seaweed food products during the last month. Prospective seaweed consumption was assessed on a scale from 0 (none) to 10 (10 times), following the question 'How many times in the last month have you eaten a product that contained seaweed?'. However, as the data was not normally distributed, the scale was changed to a dichotomous variable: 0 = has not consumed seaweed within the last month vs 1 = has consumed seaweed within the last month. This item was inspired by a similar measure of food consumption frequency used by Nystrand and Olsen (2020) and adapted to seaweed food product consumption.

3.3. Analytical procedure

The statistical analyses in this study were conducted using a two-step approach recommended by Anderson and Gerbing (1988). A confirmatory factor analysis (CFA) using STATA 16.0 was first used to assess the validity of the measures of the constructs (awareness of health consequences, ascription of responsibility, personal norm, intention, and consumer food innovativeness). The constructs' convergent validity and discriminant validity were established using the Fornell and Larcker (1981) methodology. There was convergent validity when the construct can explain an average of 50 per cent variance of its indicators. There was discriminant validity when the AVE of latent variables was higher than the squared correlations (SC) values of other latent variables (AVE $>$ SC), indicating that each latent construct shares more variance with its associated indicators than with any other latent variable expressed in the model. Finally, Composite reliability (CR) (threshold of reliability CR $>$ 0.70) was used to evaluate the reliability of the scales (Hair et al., 2010).

Using STATA 16 (software for statistics and data science), the second step consisted in using structural equation modelling with maximum likelihood estimation to test causal relationships among latent variables. In each stage, the assessment of goodness of fit was made by multiple

Table 1
Socio-demographic characteristics (N = 426).

Variables	Percentage
Gender	
Female	51.64
Male	48.36
Age	
18–29 y/o	16.43
30–39 y/o	17.14
40–49 y/o	15.96
50–59 y/o	18.31
≥60 y/o	32.16
Children living at home	
Yes	27.23
No	72.77
Level of education	
Primary and lower secondary school	7.04
Upper secondary school	33.16
University or university college (1–3 years)	31.69
University or university college (4 years or more)	27.80

Fig. 2. Wakame (left), sea grapes (middle), Nori (right).

Table 2
Reliability of latent constructs in the NAM model.

Constructs and indicators	Indicator loading	Composite reliability	Average variance extracted
Awareness of health consequences		0.87	0.70
Seaweed products can be considered as superfood	0.78		
Seaweed products are good for your health	0.87		
Seaweed can be considered as the vegetable of the sea	0.85		
Ascription of responsibility		0.89	0.74
Eating seaweed can contribute to the fight against climate change	0.83		
I feel that people should eat (more) seaweed to reduce the impact of food on the climate	0.88		
Every person should eat seaweed to reduce the pressure on land resources	0.88		
Personal norm		0.92	0.81
I believe I have a moral obligation to eat more seaweed	0.90		
People like me should do whatever they can to maximise their consumption of seaweed in order to have a positive impact on the climate	0.89		
I have a good conscience when I buy seaweed known for their positive impact on the environment	0.91		
Intention (to eat seaweed)		0.95	0.87
I intend to eat products containing seaweed in the future	0.93		
I expect to eat products containing seaweed in the future	0.96		
I will try to eat products containing seaweed in the future	0.92		
Consumer food innovativeness		0.87	0.69
I am constantly sampling new and different foods	0.77		
I try new foods before other people do	0.83		
Compared to my friends, I try more new foods	0.90		

indicators: χ^2 (chi-square), CFI (comparative fit index), Tucker–Lewis index (TLI), root mean square error of approximation (RMSEA) and standardised root mean residual (SRMR). According to Brown (2015), model fit is good when CFI and TLI indices > 0.90, RMSEA < 0.08 and SRMR < 0.08.

Two structural models were specified and compared to examine if the extended model outperformed the NAM model. In addition to awareness of health consequences, ascription of responsibility, personal norms, and intention, the extended model included consumer food innovativeness and future consumption of seaweed.

A mediation analysis was run using the STATA package Medsem (Mehmetoglu, 2018), which provides a post-estimation command testing mediational hypotheses for use with structural equation modelling, using Baron and Kenny's (1986) approach adjusted by Iacobucci et al. (2007). Medsem is an effective method for conducting mediational analysis of fairly complex models, including multiple moderators and dependent variables (Mehmetoglu, 2018).

Finally, consumer food innovativeness was proposed as a moderator to the intention and behaviour relation. Cortina's et al. (2001) single-step estimation approach was adopted and applied to STATA as this method is considered conceptually and operationally straightforward. The interaction term was first calculated by multiplying mean-deviated values of the independent variable with the moderator variable (intention by consumer food innovativeness) to avoid multicollinearity. The interaction was then included in the structural model, and all variables were analysed simultaneously.

4. Results

4.1. Measurement model

The measurement model was estimated by conducting a CFA with a maximum likelihood estimation method. The results of the measurement model, including the five latent variables with a total of 15 indicators and one observable variable, indicated a good fit to the data χ^2 (80) = 218.51, p < 0.001, RMSEA = 0.06, CFI = 0.97, TLI = 0.96, and SRMR = 0.04).

The validity and reliability of the measurements were assessed. There was convergent and discriminant validity of latent variables as AVE > 0.5 and AVE > SC, respectively. In addition, the CR of the latent variables were all>0.7, indicating good construct reliability, as shown in Table 2.

The loadings revealed that the indicators were strongly related to their purposed factors, which is consistent with the position that the items adapted from the literature are reliable indicators of the constructs.

Finally, the results indicated that 26% of the participants had consumed seaweed food during last month (between t1 and t2). The results also showed significant correlations between all the factors (Table 3).

4.2. Structural model

The two models were tested using structural equation modelling (SEM) with a maximum likelihood estimation (Table 4). The results of the NAM and extended NAM, including consumer food innovativeness and future consumption, indicated adequate goodness of fit (RMSEA = 0.07–0.06, CFI = 0.97–0.96, TLI = 0.96–0.96, and SRMR = 0.04–0.06). Personal norm (β = 0.19, p < 0.001) was significantly positively associated with intention, supporting H1. Awareness of health consequences

Table 3
Construct means, standard deviations and correlations.

	M	SD	1	2	3	4	5	6
1. Awareness of health consequences	4.61	1.27	1.00					
2. Ascription of responsibility	4.04	1.41	0.68***	1.00				
3. Personal norm	3.31	1.55	0.55***	0.75***	1.00			
4. Intention (to eat seaweed)	3.72	1.89	0.64***	0.65***	0.59***	1.00		
5. Consumer food innovativeness	3.89	1.39	0.18***	0.26***	0.23***	0.30***	1.00	
6. Future consumption	0.26	0.43	0.14**	0.13**	0.18***	0.22***	0.17**	1.00

*p < 0.05, ** p < 0.01, *** p < 0.001.

Table 4
Structural equation models and indices.

Relationships	Hypothesis testing	NAM		Extended NAM	
		β	z	β	z
Personal norm → Intention	H1 supported	0.19	2.63**	0.19	2.67**
Ascription of responsibility → Personal norm	H2 supported	0.82	39.65***	0.82	39.69***
Awareness of health consequences → Ascription of responsibility	H3 supported	0.75	27.26***	0.75	27.77***
Ascription of responsibility → Intention	H4 supported	0.23	2.43*	0.22	2.28*
Awareness of health consequences → Intention	H5 supported	0.41	6.77***	0.42	6.85***
Intention → Future consumption	H7 supported	–	–	0.22	4.58***
Consumer food innovativeness → Future consumption	H8 supported	–	–	0.12	5.27***
Intention × Consumer food innovativeness → Future consumption	H9 supported	–	–	0.25	5.24***
R^2(%) Ascription of responsibility		56.5		57.4	
R^2(%) Personal norm		67.5		67.6	
R^2(%) Intention		58.3		58.6	
R^2(%) Future consumption		–		9.2	
Model fit indices					
χ2(df)		165.56 (49)			271.52 (97)
RMSEA		0.07			0.06
CFI		0.97			0.96
TIL		0.96			0.96
SRMR		0.04			0.06
*p < 0.05, ** p < 0.01, *** p < 0.001					

(β = 0.75, p < 0.001) was significant in explaining ascription of responsibility, while ascription of responsibility (β = 0.82, p < 0.001) significantly explained personal norm, supporting H3 and H2. Moreover, the model confirmed that ascription of responsibility was positively related with intention (H4: β = 0.23, p < 0.05) as well as the positive relation of awareness of health consequences with intention (H5: β = 0.41, p < 0.001). The model explained 67% of the variability of personal norm, and 58% of the variability of the variance of intention (Table 4).

The mediation analysis results showed that ascription of responsibility also partially mediated a proportion of the relationship between awareness of health consequences and intention. There was statistically significant bivariate relation between awareness of health consequences and the mediator ascription of responsibility with (β = 0.75, p < 0.001), as well as between the mediator ascription of responsibility and intention (β = 0.33, p < 0.05). Moreover, the test confirmed the significant relationship between health consequence and intention (β = 0.64, p < 0.001) as well as the Sobel's test was significant.

The results supported H7 that intention predicted future consumption of seaweed (β = 0.22, p < 0.001) and that consumer food innovativeness is positively associated with future consumption of seaweed (H8: β = 0.12, p < 0.001). Furthermore, the results revealed that consumer food innovativeness plays a moderating role in the relationship between intention and future seaweed consumption (β = 0.25p < 0.001), supporting hypothesis H9. Finally, intention and consumer food innovativeness together explained 9.2% of the variance of future consumption of seaweed.

5. Discussion

The primary aim of this study was to examine the ability of an extended NAM framework in explaining the consumption of seaweed foods in Norway. Hence, the study proposed and tested the NAM to explain intention to consume seaweed. The results confirmed that intention to eat seaweed is the activation of personal norms by ascription of responsibility. Ascription of responsibility was found to be highly associated with personal norm. Moreover, we also confirmed a high relationship between awareness of health consequences and ascription of responsibility, indicating the importance of health information in forming ascription of responsibility. These results corroborate with other studies that used NAM to predict diverse environmentally friendly intention (Han et al., 2020; Kim & Hwang, 2020; Park & Ha, 2014) and indicate that health benefits are important for explaining the formation of food attitudes, intention, and behaviour concerning foods like seaweed (Hwang et al., 2016; Lee et al., 2013; Rana & Paul, 2017).

The second aim of this study was to explore the direct relationship between awareness of health consequences and intention as well as the direct relationship between ascription of responsibility and intention. In this regard, the model confirmed that both awareness of health consequences and ascription of responsibility have a direct positive relationship with intention. Moreover, the results showed that ascription of responsibility partially mediated the relationship between awareness of health consequences and intention. Partial mediation implies that there is not only a significant relationship between ascription of responsibility and intention, but also a relationship between awareness of health consequences and intention. This empirically confirms that awareness of consequences is a key variable when predicting intention to eat seaweed. These results are in accordance with Vaske et al. (2015) and previous NAM studies opening up for those alternative relationships (Kim et al., 2018; Rezaei et al., 2019; Zhang et al., 2017). Moreover, the awareness of health consequences construct has a stronger influence on intention to eat seaweed than sustainable or environmental responsibility. These results align with Magnusson et al. (2003), who showed that egoistic motives, such as health are stronger predictors of organic food consumption than altruistic or biospheric motives. As indicated above, the study also confirmed a strong positive relation between awareness of health consequences and ascription of responsibility. Indicating that as people become aware of the health consequence of seaweed, they feel personally responsible for its

consumption. This finding is in accordance with Asif et al. (2018), as they indicated that health consciousness is a more significant predictor of consumer behaviour towards organic foods than environmental concern. Birch et al. (2018) also indicate that health consciousness may influence local food consumption decisions more strongly than sustainable motivations.

The strong positive relationship between personal norm and sustainable intentional behaviour is confirmed in various contexts, such as recycling, environmentally friendly travel alternatives, and electricity saving (Eriksson et al., 2008; Jansson et al., 2011; Wiidegren, 1998). In the context of seaweed food consumption, personal norm affects intention, but the results suggest that personal norm has the lowest path coefficient of the factors affecting intention. Following Green (2016), personal norm generally changes at a slow pace. In the case of novel food consumption, we argued that the novel and unfamiliar aspect of seaweed hinders the formation of personal norms regarding seaweed. In other words, the weaker effect of personal norm on intention could be explained by the difficulty of individuals' self-expectation regarding seaweed consumption due to unfamiliarity and lack of knowledge about seaweed.

The study extended the NAM model to use a prospective design and to include consumer food innovativeness. The first aim was to verify the ability of intention to predict and explain future consumption of seaweed. Assessed one month after prediction, the results confirmed the positive effect of intention on future consumption. However, the results showed that intention only explained 9% of the variance of the consumption of seaweed during the last month. This confirmed that the gap between intention and pro-environmental behaviour (ElHaffar et al., 2020) and between intention and behaviour in the context of novel foods (Chekima et al., 2017; Schäufele & Hamm, 2018) can be problematic. There can be different reasons for this. For example, individuals can expose an optimistic intention of positive behaviour as a social desirability effect (Grimm, 2010), lack of knowledge on how to prepare or use novel food and low availability of seaweed in the Norwegian market.

The final aim of this study was to investigate the relationship between consumer food innovativeness and seaweed consumption and moderating effect of consumer food innovativeness on the intention-future consumption relationship. The results first confirmed that consumer food innovativeness is positively related to future consumption, indicating that food innovative consumers are more likely to consume seaweed. This result provides positive news to the seaweed industry as food innovative consumers are more likely to spend time and money to find new food products (McCarthy et al., 2001). Moreover, food innovative consumers are also likely to spread positive feedback or to introduce the food to other consumers (Goldsmith, 2001; Payini, Ramaprasad, Mallya, Sanil, & Patwardhan, 2020). Furthermore, the results showed that the relationship between intention and behaviour is stronger when consumers are food innovative, confirming that food innovative consumers are more likely to bridge the gap between intending to consume seaweed and consuming seaweed.

In practical or managerial terms, this study confirms previous NAM studies demonstrating that the activation of personal norm increases intention. Hence, the feeling of environmental obligation to eat seaweed is activated by consumer feeling of environmental responsibility and awareness of health consequences. Second, this study underlines the important role of health consequences on consumer intention to eat seaweed. Additionally, the feeling of responsibility to reduce environmental problems plays a role in consumers' intention to eat seaweed. This finding is important for the development of seaweed products that provide good nutritional value. Targeting campaigns should target food innovative consumers with higher levels of health and environmental consciousness as they are more likely to eat seaweed foods. Finally, seaweed food marketers should target food innovative consumers by underlining the novelty and uniqueness of seaweed food products as they are more likely to consume seaweed.

5.1. Limitations and future research

The current research suffers from some limitations that could provide future research opportunities. First, this study relies on self-reported data which causes social desirability bias (Cerri et al., 2019; Fisher & Katz, 2000). Hence, we believe that respondents may overestimate their intention to eat seaweed food as it can be socially desirable to display pro-environmental behaviour. The social desirability bias might also explain the gap between intention and behaviour since social expectations, that is approval of consumption, may play a role in explaining seaweed consumption. A few NAM studies have shown a direct effect of social norms on pro-environmental intention (Kim & Hwang, 2020; Kim et al., 2018; Rezaei et al., 2019; Shin et al., 2018). However, future research is needed to study the moderating effect of social norms on the relationship between intention and behaviour.

Regarding the causal relationship in the NAM, this study found similar results to Onwezen et al. (2013); we observed high path coefficient between awareness of health consequences-ascription of responsibility and ascription of responsibility- personal norm. The study also showed that a high path coefficient between personal norm and intention was revealed when applying the original linear NAM, which is similar to that of previous NAM studies (e.g., Han, 2014; Han et al., 2019; Kim & Hall, 2020). However, when extending the causal relationships, we observed a decrease in the personal norm-intention relationship, indicating that other variables explain the variation in variance of intention. Hence, future studies should extend the causal relationships of the NAM to verify any change in the variance of intention. Several studies that have extended the NAM with the help of the TPB (Kim & Hwang, 2020; Rezaei et al., 2019; Shin et al., 2018) have shown the relevance of attitude and perceived behaviour control in explaining the variance of intention. Therefore, it would be of interest to associate the NAM with TPB in the context of seaweed food consumption.

Moreover, intention and consumer food innovativeness only explained 9% of the variance. This result has to be put in perspective, as factors, such as seaweed foods' availability (Vermeir & Verbeke, 2006) might also explain the gap between intention and (future) behaviour. In Norway, seaweed foods are difficult to access as they are only available in international and high-end stores. Hence, future studies should also examine if the variance of behaviour is explained when using factors such as actual behaviour control. Future studies could also examine the difference between the consumers living in urban and rural areas, as the consumers living in cities have higher access to seaweed foods.

Furthermore, as consumers are unfamiliar with seaweed, they could have preconceived ideas and attitudes about its taste and smell, which are two of the most important attributes of food choice (Clark, 1998). Hence, future research will also need consumer test studies with sensory tests (Lawless & Heymann, 2010) to explore consumer preferences, attitudes, expectations, willingness to pay, and experiences after trying seaweed products. There is also a possibility to explore reasons why innovative individuals are more motivated to try seaweed products.

Finally, this study focused on Norway, where seaweed is considered a new and unfamiliar product. However, consumer behaviour varies according to country, culture, availability, knowledge, and experiences. Explaining and understanding environmental and sustainable values (De Groot & Steg, 2008; Schwartz, 1992), attitudes and behaviour across borders (Milfront et al., 2010; Olsen et al., 2008), cultures, and contexts could be an interesting and necessary future research stream (Morren & Grinstein, 2016; Tam & Chan, 2017). Comparing countries with low seaweed consumption experience (e.g., Europe) and long traditions of seaweed consumption (e.g., China, Vietnam, Japan, and South Korea) using the NAM can be a topic of future research.

6. Conclusion

This study contributes to explaining seaweed food consumption by

using the norm activation framework. The results of the structural equation analysis performed on a sample of Norwegian consumers confirmed the overall robustness of the norm activation framework. Furthermore, the extended model increased the explained variance in intention by 13% and provided a clearer understanding of consumers' motivation to consume seaweed food. This study also highlighted the relevance of awareness of health consequences on intention to eat seaweed, suggesting that consumers are motivated to consume seaweed if they believe that seaweed has positive health consequences. In addition, the association of ascription of responsibility and personal norm with intention to eat seaweed indicated that environmental consideration plays an important role in the formation of intention. Intention and consumer food innovativeness are associated with future seaweed consumption, suggesting that food innovative consumers are more likely to consume seaweed food. However, there remains an explanatory gap between intention and future behaviour that should be studied further.

Finally, this study provides practical implications for seaweed marketers, as they should target innovative food consumers as well as consumers who are aware of their health and are environmentally conscious. As health awareness and environmental considerations are important factors in explaining consumer intention and consumption, the seaweed industry should concentrate on developing and promoting healthy and environmental seaweed food products.

7. Author statement

This manuscript has not been published or presented elsewhere in part or in entirety and is not under consideration by another journal. All study participants provided informed consent, and the study design was approved by the appropriate ethics review board. We have read and understood your journal's policies, and we believe that neither the manuscript nor the study violates any of these. There are no conflicts of interest to declare, and the manuscript has been proofed by a professional company.

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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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Paper 2

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Consumers' values, attitudes and behaviours towards consuming seaweed food products: The effects of perceived naturalness, uniqueness, and behavioural control

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ABSTRACT

Seaweed has great potential as a natural, healthy, and sustainable food. Seaweed as food is novel in Western countries; thus, few studies have focused on the factors influencing consumers' behavioural tendencies towards seaweed food products. This study aimed to fill the gap by investigating the antecedents for consumers' attitudes towards as well as their consumption of seaweed food products in a representative sample of Norwegian consumers (N = 426). An extended version of the value-attitude-behaviour (VAB) theory was employed as a conceptual framework to study seaweed consumption, assessing hedonistic values and perceived uniqueness versus biospheric values and perceived naturalness. Structural equation modelling was used to test the hypothesis. Our results showed that attitude significantly affected the consumption of seaweed food products and that perceived behavioural control positively moderated the attitude–consumption relationship. Perceived naturalness and uniqueness were associated with attitudes towards seaweed. Biospheric values directly influenced attitude, while perceived uniqueness positively moderated the hedonistic values–attitude relationship. In conclusion, this study indicates that Norwegian consumers form their positive attitudes towards seaweed food products based biospheric values and their beliefs that these products are healthy and natural.

1. Introduction

Seaweed is considered a pro-environmental food source since its cultivation does not need fertilisers, pesticides, or fresh water. Seaweed is a unique food source as it can extract the minerals found in seawater, allowing it to become a nutrient-dense food when harvested. Seaweed species contain protein and are low in lipids and calories. Seaweed is also known for being rich in iodine, antioxidants, vitamins, and minerals (Mabeau & Fleurence, 1993; Roohinejad et al., 2017). This study presents seaweed as a naturally grown, environmentally friendly, and healthy food category free from additives, artificial chemicals, or ingredients. The category shares its attributes with naturally grown (Román, Sánchez-Siles, & Siegrist, 2017) and organic food (Rana & Paul, 2017).

The consumption of seaweed eaten raw, dried, or as an ingredient in other food products is increasing. Vincent, Stanley, and Ring (2020) reported that the seaweed food market is projected to be worth €600–1,800 million in 2030 and will significantly benefit from the strong growth in plant-based diets in Europe. Seaweed is predicted to play an important role in a more sustainable diet in the future. Thus, there is a need for new studies to understand which factors influence consumers' attitudes towards as well as their consumption of seaweed. A few studies have looked at seaweed from a consumer behaviour perspective. For example, previous studies that profiled seaweed food consumers in Australia (Birch, Skallerud, & Paul, 2019) and Italy (Palmieri & Forleo, 2020) revealed that seaweed food consumers are educated, adventurous and health interested. Wendin and Undeland (2020) and Losada-López, Dopico, and Faíña-Medín (2021) analysed the influence of neophobia on consumer attitudes towards seaweed food. All these studies underlined the negative effect of food neophobia on consumer attitudes towards seaweed and are mostly based on convenience samples and sensory experiments. Finally, Govaerts and Olsen (2022) studied a representative sample of Norwegian consumers about their health awareness, perceived environmental responsibility, personal norms, and food innovativeness (which is similar to food neophobia), as well as those constructs' associations with seaweed's consumption.

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The present paper will examine how environmental values, attitudes, and product attributes affect seaweed consumption. Environmental values and attitudes are considered the most salient motives for consuming organic food (Aertsens, Verbeke, Mondelaers, & van Huylenbroeck, 2009; Kushwah, Dhir, & Sagar, 2019), an established food category similar to seaweed in that it involves environmental attributes. Values are assumed to be an essential motivational force for forming beliefs about sensory preferences, as well as health, nutrition, safety and quality, in addition to providing a stable basis for influencing attitudes and (sustainable) behaviours (De Groot & Steg, 2008; Milfont, Duckitt, & Wagner, 2010; Stern, 2000). Therefore, understanding if and how values are associated with consumers' expectations, attitudes, and behaviour towards seaweed products is vital.

In this context, this study is based on the value-attitude-behaviour (VAB) causal framework (Homer & Kahle, 1988). The VAB model has been successfully applied to explore a variety of pro-environmental behaviours and purchasing practices (Cheung & To, 2019; Jacobs, Petersen, Hörisch, & Battenfeld, 2018; Sharma & Jha, 2017), and its main components are considered to be of vital importance in exploring (sustainable) organic food consumption and willingness to pay (Katt & Meixner, 2020; Kushwah et al., 2019; Vermeir & Verbeke, 2006). The VAB model has so far not been used as a theoretical framework for exploring seaweed attitudes and consumption. The VAB theory proposes the causal hierarchical structure between more general and stable individual values and more context-specific attitudes and behaviours. Hence, this study explores if and how values and attitudes are related to consumers' consumption of seaweed.

The structures of universal core values (e.g., Schwartz, 1992) or the more domain-specific environmental attitudes and values (e.g., Milfont et al., 2010) are classified according to many different formats and constructs. Several studies confirm that biospheric and hedonistic values are the most robust conflicting types for explaining or predicting environmental attitudes, intentions, or behavioural tendencies (Balundė, Perlaviciute, & Steg, 2019; Steg, Perlaviciute, van der Werff, & Lurvink, 2014; Thelken & de Jong, 2020). This study contributes to the existing literature by investigating the conflict between immediate individualistic motives or values (hedonism) and longer-term collectivistic ones (biospherism) (Van Lange, Joireman, Parks, & Van Dijk, 2013) and its relationship to attitudes towards as well as the consumption of seaweed.

When consumers look for novel and exciting food products, perceived uniqueness and naturalness have been suggested to be the most important factors in successfully marketing new food products (Stewart-Knox & Mitchell, 2015). First, the consumer perception of seaweed as a unique type of food (Jaeger et al., 2017) could be vital for its commercial success as a new food product in Europe. Second, perceived naturalness is an especially relevant factor, as it integrates the attributes of environmental friendliness and healthiness (Román et al., 2017). Hence, this study incorporates perceived uniqueness (associated with hedonism) and perceived naturalness (associated with biospherism) as a relevant extension of the VAB framework to study seaweed consumption.

Finally, other constructs or variables can affect the strength of the relationship between attitude and seaweed consumption (Padel & Foster, 2005). Previous studies showed that food neophobia (Birch et al., 2019) or food innovativeness (Govaerts & Olsen, 2022) could hinder or encourage seaweed consumption. Hence, the last contribution of this study is to extend the VAB framework by introducing perceived behavioural control as a moderator on the attitude–behaviour gap in the context of sustainable food consumption (ElHaffar, Durif, & Dubé, 2020; Vermeir & Verbeke, 2006). Using perceived behavioural control as a moderator for the VAB framework is novel but not unrealistic, based on the previous studies of specific barriers for seaweed and theoretical foundations in the context of environmental behaviour (La Barbera & Ajzen, 2020).

In summary, this study first aims to contribute to the current literature by assessing the relationship between values, attitudes, and behaviours in the context of seaweed food products. Second, it proposes a model emphasising the conflicts between individualistic/hedonistic and collectivistic motives to extend the VAB theoretical framework. Third, this study explores if and how two specific product attributes, namely perceived naturalness and perceived uniqueness, affect consumers' attitudes towards seaweed. Finally, this study also includes perceived behavioural control, as a moderator for the relationship between attitude and seaweed consumption, the attitude–behaviour gap.

2. Theoretical framework

2.1. The value-attitude-behaviour approach (VAB)

The VAB theory, developed by Homer and Kahle (1988), proposes a causal model integrating values, attitude, and behaviour. The VAB model posits the existence of a hierarchical influence from the more abstract cognitions (values) to mid-range cognition (beliefs and attitudes) to a specific behaviour (Homer & Kahle, 1988). The model assumes that values directly influence attitude and indirectly influence behaviour through attitude. The VAB model has subsequently been used extensively in the literature in various contexts of pro-environmental behaviour, such as recycling, nature preservation (Milfont et al., 2010), and organic food consumption (Grunert & Juhl, 1995; Sharma & Jha, 2017; Shin, Moon, Jung, & Severt, 2017; Vermeir & Verbeke, 2006). Based on these previous works, this study applies and extends the VAB model to understand the possible antecedents of attitudes towards seaweed consumption in Norway. Our extension of the VAB hierarchy involves two relevant and specific attributes associated with new and environmentally friendly food products (perceived uniqueness and naturalness).

The VAB model and the hypotheses are presented in Fig. 1. The figure highlights the conflict between general individualistic and collectivistic motivations. In the following sections, we will argue that perceived uniqueness is associated with hedonistic/individualistic values, and perceived naturalness is associated with biospheric/collectivistic values.

Values are defined as 'desirable trans-situational goals varying in importance, which serve as a guiding principle in the life of a person or other social entity' (Schwartz, 1992, p. 21). Values are stable beliefs and can be thought of as accumulated global attitudes influencing context-specific attitudes and behaviour (Homer & Kahle, 1988; Stern, 2000). Whereas, attributes (belief-evaluation) can be defined as the subjective probability that a particular object has a particular trait or characteristic (Fishbein & Ajzen, 2010). Hence, we define perceived uniqueness as the probability that consumers perceive seaweed food products as unique. Similarly, perceived naturalness refers to consumers' probability of perceiving seaweed food products as natural. Attitude is defined as an individual's overall positive and negative evaluation of an attitude object. Attitude is based on the sum of expectancy of relevant attributes (or beliefs) forming the individual's general evaluation of an attitude object (Eagly & Chaiken, 1993; Fishbein & Ajzen, 2010). Finally, behaviour results from consumers' attitude towards engaging in the specific behaviour. This study defines behaviour as the tendency to consume seaweed food products during the previous year.

In the following section, we will argue more deeply for the hypotheses we presented in Fig. 1.

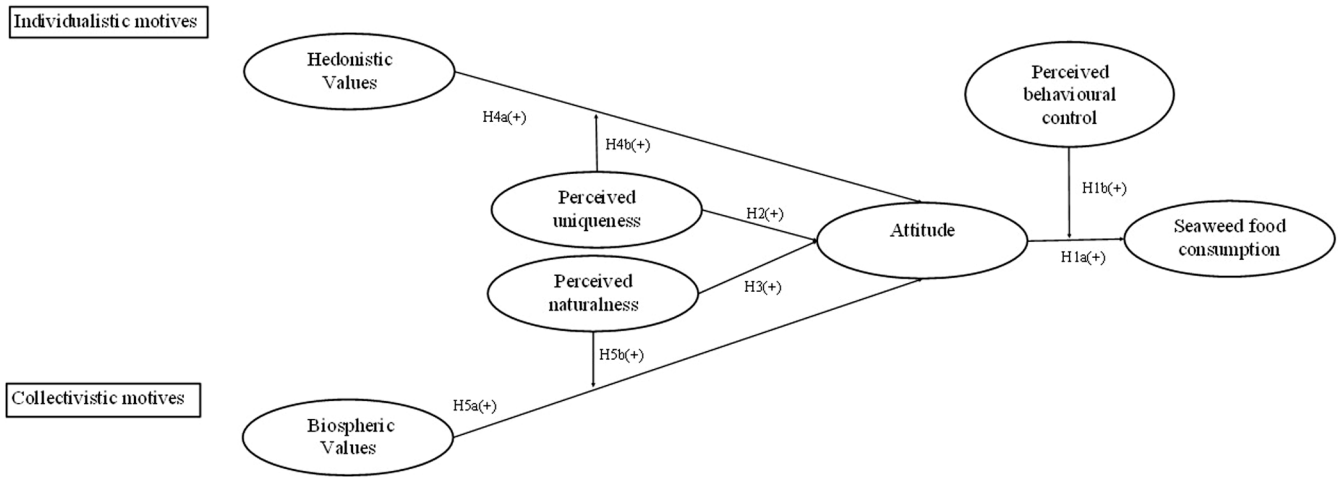

Fig. 1. The proposed structural model with hypotheses.

2.2. The gap between attitude and seaweed consumption

The positive causal relationship between a pro-environmental attitude and pro-environmental behaviour is in accordance with established general attitude models, such as the TPB (Fishbein & Ajzen, 2010) and VAB (Homer & Kahle, 1988), as well as with other models focusing on environmental attitudes, concerns, and engagement (e.g., Bamberg, Hunecke, & Blöbaum, 2007; Rodríguez-Casallas, Luo, & Geng, 2020; Zerbini, Vergura, & Latusi, 2019). Wendin and Undeland (2020) demonstrated an overall positive attitude of Swedish consumers towards seaweed food products. This study expects that positive attitudes towards seaweed food products positively influence individuals' seaweed consumption. Accordingly, this study proposes the following hypothesis:

H1a: Attitude is positively related to the consumption of seaweed.

However, despite having positive attitudes towards the given behaviour, people do not always perform the intended behaviour (the attitude–behaviour gap) (Aschemann-Witzel & Niebuhr Aagaard, 2014; Yamoah & Acquaye, 2019). To reduce the gap between attitude and behaviour, various individual, social, and contextual factors have been used in the literature as antecedents and moderators between attitude and pro-environmental behaviour, such as social factors/norms, environmental involvement and concern, trust, habit, price, and contextual factors (ElHaffar et al., 2020; Vermeir & Verbeke, 2006). With inspiration from the most-used theoretical framework for exploring health, food, and pro-environmental behaviour (Fishbein & Ajzen, 2010), this study uses perceived behavioural control to moderate the attitude–behaviour gap.

2.2.1. The moderating role of perceived behavioural control

Perceived behavioural control refers to a person's beliefs about how easy or difficult it is or likely or unlikely they are to perform a specific behaviour (Ajzen, 1991). Past studies have often used perceived behavioural control as an antecedent to various food and environmental behaviours (Fishbein & Ajzen, 2010; Yuriev, Dahmen, Paillé, Boiral, & Guillaumie, 2020). Although perceived behavioural control was initially used as a moderator in the theory of planned behaviour (TPB) framework (Ajzen, 1985), there has only recently been a renewed interest in using perceived behavioural control as a moderator of the different relationships of the TPB (e.g., La Barbera & Ajzen, 2021; Redondo & Puelles, 2017). However, the literature shows contrasting findings, as some studies show positive moderating effects, while others show negative ones, and in some cases, there are no significant moderating effects (Kothe & Mullan, 2015; La Barbera & Ajzen, 2021). This study differs from previous studies on seaweed consumption by using perceived behaviour control as a possible facilitator to consuming seaweed (e.g., Birch et al., 2019; Govaerts & Olsen, 2022).

Theoretically, there is still a lack of evidence that perceived behavioural control moderates the relationship between attitude towards pro-environmental food and (novel/unfamiliar) pro-environmental food consumption. Hence, this study explores the moderating effect of general perceived behavioural control on the attitude–seaweed consumption relationship. We believe that the higher the perceived behavioural control, the stronger the association between attitude and consumption. In other words, people with a positive attitude towards seaweed food products will be more likely to consume them if they believe they can easily buy them.

In line with the theoretical considerations and the results of previous research outlined above, it is hypothesised that:

H1b: Perceived behavioural control positively moderates the relationship between attitude and seaweed consumption.

2.3. Perceived uniqueness and naturalness as salient product attributes

Attitude theory refers to belief as an association of some characteristic or attribute, usually evaluative, with an attitude object (Eagly & Chaiken, 1993). According to Ajzen (2011), beliefs about attributes reflect the information people have about the performance of a given behaviour. Salient associations, beliefs or attributes provide the cognitive foundation for attitudes. When activated, they generate different attitudes, subjective norms, and/or perceptions of control, which then impact a given behaviour (Ajzen, 2011; Armitage & Conner, 2001). Which product attributes are most salient differs between food categories and individuals (Aikman, Crites, & Fabrigar, 2006).

In this study, we argue that perceived uniqueness and naturalness are two salient product attributes influencing attitude towards seaweed food products. Choosing perceived uniqueness and naturalness is based on the salient characteristics of seaweed as a naturally grown, environmentally friendly, healthy, new, and unique food category. Moreover, perceiving a product as natural or unique is not so dependent on sensory experience (e.g., taste). Thus, assessing naturalness and uniqueness as salient product attributes is probably more valid across subjects with low or no sensory experiences with seaweed (Olsen, 1999).

Thus this study uses the construct of naturalness (Román et al., 2017) and uniqueness (Stewart-Knox & Mitchell, 2015) to function as salient attributes associated with seaweed values and attitude.

2.3.1. Perceived uniqueness

According to the *Oxford Dictionary*, uniqueness is defined as 'the quality of being very special or unusual' or 'by the fact of being the only one of its type'. In the food consumption literature, Cardello et al. (2016, p. 24) define unique food as 'food that is highly differentiated from other products of the category based on sensory, image, functional, emotional characteristics that are positively valued by consumers'. However, product characteristics not only define the concept of uniqueness, but can also be defined in terms of consumer responses. From a consumer perspective, a unique product is unusual, novel, or unfamiliar (Jaeger et al., 2017). Unique products also evoke positive emotions (Favalli, Skov, & Byrne, 2013) and are associated with high quality (Jaeger et al., 2017).

Following Jaeger et al. (2017) conception of food product uniqueness, consumers might consider seaweed food products unique. This is the case because, first, seaweed remains new to Western consumers. Second, seaweed presents unusual and unique flavours and textures (Figueroa, Farfán, & Aguilera, 2021). Finally, it remains challenging in Norway to obtain seaweed food products, as they are available only in high-end or international stores.

Regarding seafood consumption, Olsen and Tuu (2021) indicated that perceived uniqueness influences the intention to eat luxury seafood products. Moreover, in the context of ethnic food and restaurants, the perceived uniqueness of ethnic food/menus is particularly appealing to consumers as it has a positive relationship with consumer attitudes and intentions towards such restaurants (Liu & Mattila, 2015).

For the emerging seaweed industry in Europe, it is crucial and relevant to evaluate whether consumers' perceived uniqueness impacts their food attitudes. Few studies have measured the influence of perceived uniqueness on consumers' food attitudes and choices (Jaeger et al., 2017). Thus, the following hypothesis was formulated:

H2: The perceived uniqueness of seaweed food products is positively related to attitudes towards seaweed.

2.3.2. Perceived naturalness

The concept of naturalness is highly abstract (Román et al., 2017) and lacks a clear definition (Hemmerling, Canavari, & Spiller, 2016). Naturalness is frequently associated with healthiness and minimally processed and organic food (Román et al., 2017; Rozin, 2005). Moreover, consumers perceived natural food as healthier than conventional food (Michel & Siegrist, 2019; Román et al., 2017). This study defines perceived naturalness following Román et al. (2017) as the 'belief that seaweed food products are safe, healthy, organically grown, and natural/no additives' (Table 2).

In general, a consumer's positive attitude towards natural food is an important factor in food choice (Román et al., 2017). Moreover, beliefs regarding naturalness can have important managerial implications since consumers are less willing to buy food perceived as less natural (Etale & Siegrist, 2021). Previous studies have also demonstrated the positive effect of naturalness on consumers' attitudes and intentions. For instance, Aschemann-Witzel and Grunert (2017) showed that Danish people have a more positive attitude towards food perceived as natural than towards processed food. Hence, the following hypothesis is proposed:

H3: The perceived naturalness of seaweed food products is positively related to attitudes towards seaweed.

2.4. Hedonistic versus biospheric values

Values are cognitive representations of basic motivations. They are abstract, desirable goals, which are relatively stable over time and across situations (Schwartz, 1992). Values vary in importance; the higher the importance a person attributes to a value, the more likely the person is to act in ways that promote attaining that value.

Based on Schwartz (1992) 56 universal values, recent studies have identified and reduced the number to four key values which are particularly relevant in relation to pro-environmental behaviours: two egoistic, hedonistic, altruistic and biospheric values (Steg et al., 2014). However, this study will limit its focus to the effect of hedonistic and biospheric values because previous studies have suggested that those two are the most salient values in understanding pro-environmental (food) consumption (Balundė et al., 2019; Steg et al., 2014; Thelken & de Jong, 2020).

Consumers with hedonistic values define pleasure or sensuous gratification for oneself as their defining goal (Schwartz, 1992). Moreover, typically, they tend to make pro-environmental decisions based on a concern to improve their feelings and reduce effort.

Theoretically, hedonic values should also be negatively related to pro-environmental attitudes and behaviour, as acting pro-environmentally requires effort or reduces comfort (Steg et al., 2014). However, pro-environmental food can also be associated with pleasure (e.g., Bryła, 2016) and positively related to beliefs, attitudes, and behaviours. In their study, Vermeir et al. (2020) emphasise the positive influence of hedonism on attitudes towards food consumption.

Moreover, according to Barrena and Sánchez (2013), consumers adopt new food for hedonic reasons, regardless of the level of fear towards novel foods. In this case, seaweed's novel and unique organoleptic and nutritional characteristics might be positively associated with hedonism.

Accordingly, the following hypothesis was formulated:

H4a: Hedonic values are positively related to attitude towards seaweed.

In opposition to individualistic motives, collectivistic ones, like biospheric values, play an important role in pro-environmental food consumption as people with such values tend to make pro-environmental decisions based on a concern for preserving the ecosystem and the biosphere as a whole (De Groot & Steg, 2008).

Biospheric values are positively related to pro-environmental beliefs, attitudes, and behaviours (De Groot & Steg, 2008; Nilsson, von Borgstede, & Biel, 2004; Schultz, 2001). Biospheric and sustainability values also directly influence how people shape their beliefs and attitudes towards environmentally friendly food products (Ateş, 2020; Hayley, Zinkiewicz, & Hardiman, 2015; Shin et al., 2017; Zhang, Grunert, & Zhou, 2020).

Moreover, increasing consumer environmental awareness is followed by a trend towards naturalness and healthy and environmental food, from which seaweed food products may benefit (Figueroa et al., 2021; Wendin & Undeland, 2020). Two recent studies have shown a positive relationship between consumers' environmental awareness and seaweed consumption. Palmieri and Forleo (2020) found that consumers who are aware of their environmental impact are more willing to consume seaweed than other consumers. Similarly, Lucas, Gouin, and Lesueur (2019) indicated that French seaweed consumers are conscious of the environmental impact of their food choices.

After integrating the theoretical and empirical background, the proposed hypothesis is as follows:

H5a: Biospheric values are positively related to attitudes towards seaweed.

Finally, studies have shown that salient attributes also moderate the relationships between values, attitudes, intentions, and behaviours. Depending on constructs, relationships and context, salient attributes had a positive or negative effect on the relationships (Asif, Xuhui, Nasiri, & Ayyub, 2018; Cooke & Sheeran, 2004; ElHaffar et al., 2020; Vermeir & Verbeke, 2006).

This study argues that consumers' specific product attributes will strengthen the relationship between values and attitudes. In other words, we assume that if people believe that seaweed is sustainable and natural, consumers with biospheric values are more likely to have a favourable attitude towards seaweed food products. Similarly, we argue that as people believe that seaweed food products are unique, consumers with hedonistic values are more likely to have a favourable attitude towards seaweed food products.

Therefore, our model will estimate the moderating effects, for which the following hypotheses are proposed:

H4b: Perceived uniqueness positively moderates the relationship between hedonistic values and attitudes.

H5b: Perceived naturalness positively moderates the relationship between biospheric values and attitudes.

3. Materials and methods

3.1. Data collection and sample

An online survey was conducted in June 2020 in Norway to measure the different concepts. The sample, which was collected through the YouGov consumer online panel, consisted of 426 adult participants and was representative of gender, age, and region. Six hundred YouGov consumer panel members were contacted to participate in the survey. The respondents were required to answer all the questions to complete the survey. The respondents were aged 18–74 (see Table 1), the majority (60%) were well educated (university or university college), and most lived in households without children present (73%). The survey consisted of biospheric values, hedonistic values, attitudes, seaweed consumption, perceived naturalness and uniqueness, and other constructs not reported in this study.

Seaweed as a source of food is little used in Norwegian culture. Therefore, at the beginning of the survey, we introduced pictures of seaweed food products available in the Norwegian market (Appendix 1: e.g., dried seaweed, sushi, chocolate, chips, and drinks with seaweed) with a description of seaweed: 'Seaweed is a form of algae that grows in the sea. There are various species of edible seaweed, the colour range of which varies from red to green to brown. Seaweed helps to capture CO_2. Seaweed is a good source of nutrients, such as proteins, vitamins, minerals, and dietary fibre'.

Table 1
Sociodemographic characteristics (N = 426).

Variables	Per cent
Gender	
Female	52
Male	48
Age	
18–29 y/o	17
30–39 y/o	17
40–49 y/o	16
50–59 y/o	18
≥ 60 y/o	32
Children living at home	
Yes	27
No	73
Level of education	
Primary and lower secondary school	7
Upper secondary school	33
University or university college (1–3 years)	32
University or university college (4 years or more)	28

Table 2
Standardised factor loadings, reliability, and validity.

Constructs and items	Mean	Standard deviation	Indicator loading	Composite reliability	Average variance extracted
Attitude				0.93	0.82
'Bad /Good'	3.98	1.91	0.95		
'Negative/ Positive'	4.36	2.00	0.89		
'Unpleasant/ Pleasant'	3.72	1.83	0.87		
Perceived behavioural control				0.74	0.63
'How easy or difficult is it for you to choose seaweed food products?'	3.83	1.81	0.63		
'If I wanted to, I could easily choose seaweed food products'.	3.80	2.06	0.92		
Perceived uniqueness				0.66	0.52
'Ordinary/ Unique'	4.65	1.77	0.93		
'Traditional/ New'	5.02	1.91	0.53		
Perceived naturalness				0.84	0.60
'Non-organic/ Organic'	5.42	1.60	0.81		
'Synthetic/ Natural'	5.44	1.69	0.82		
'Unhealthy/ Healthy'	5.22	1.61	0.78		
Hedonistic values				0.81	0.60
'Pleasure'	7.38	1.38	0.78		
'Enjoying life'	7.10	1.60	0.82		
'Self-indulgent'	6.49	1.75	0.71		
Biospheric values				0.90	0.70
'Preventing pollution: protecting natural resources'	6.62	1.82	0.87		
'Unity with nature: fitting into nature'	6.27	1.88	0.75		
'Protecting the environment: preserving nature'	6.73	1.79	0.87		
'Respecting the earth: harmony with other species'	6.74	1.81	0.83		

3.2. Measures

Biospheric values and *hedonistic values* were measured using a scale developed by Steg et al. (2014); three items measured the hedonistic values. Following Schwartz (1992), the respondents were asked to rate the importance of each item on a scale from 1 ('opposed to my principles') to 9 ('extremely important'). Table 2 shows the measurement items used to measure biospheric and hedonistic values.

Perceived behavioural control was measured with the following two items (Table 2): 'How easy or difficult is it for you to choose seaweed food products?', on a scale from 1 ('very difficult') to 7 ('very easy'), and 'If I wanted to, I could easily choose seaweed food products', ranging from 1 ('very unlikely') to 7 ('very likely'). These items are regularly

used in the literature to assess perceived behavioural control within social psychology (Armitage & Conner, 2001), and pro-environmental behaviour (Park & Ha, 2014).

Attitude was assessed using three items preceded by the stem 'To eat products that contain seaweed is …'. The respondents were asked to range each item along a 7-point semantic differential scale (bad/good, negative/positive, and unpleasant/pleasant). These items are commonly used in food-related studies (e.g., Hayley et al., 2015; Honkanen, Olsen, & Verplanken, 2005), and cover general, cognitive, and affective evaluations of attitude (Crites, Fabrigar, & Petty, 1994; Fishbein & Ajzen, 2010).

In the same manner, to measure *perceived uniqueness,* respondents were asked to range two bipolar items along a 7-point semantic differential scale (1 = ordinary/7 = unique or 1 = traditional/7 = new). The items were adapted from Jaeger et al. (2017).

Perceived naturalness is a latent construct which is measured by three theoretically based items (healthy, natural, and organic). Based on Michel and Siegrist (2019), we measured *perceived naturalness* by asking participants to evaluate the following characteristics of food with seaweed on a 7-point semantic differential scale (unhealthy/healthy, non-organic/organic, synthetic/natural).

Seaweed food product consumption was measured by a single item asking the frequency at which respondents bought seaweed food products over the past year. The latter scale was originally scored from 1 (never) to 11 (more than three times a week). However, as the data were not normally distributed, the scale was changed into a dichotomous variable: 0 = has not consumed seaweed in the past year vs 1 = has consumed seaweed in the past year.

3.3. Analytical procedures

The statistical analyses were performed using Stata 16. A principal component analysis with Varimax rotation was first conducted to verify the validity of the concepts used for this study. Then, a maximum likelihood confirmatory factor analysis (CFA) with maximum likelihood estimation and multivariable structural equation (SEM) was conducted. The convergent and discriminant validity of the constructs were assessed using Fornell and Larcker (1981) methodology. The convergent validity of the constructs was established when the estimation of average variance extracted (AVE) was > 0.5, and there was discriminant validity when the AVE value of a latent construct was larger than the squared correlation (SC) of any other latent construct in the model. Composite reliability (CR) was used to evaluate the reliability of the scales (Hair, Anderson, Babin, & Black, 2010).

Multiple indicators are reported to evaluate the goodness of fit: χ^2 (chi-square), CFI (comparative fit index), TLI (Tucker–Lewis index), RMSEA (root mean square error of approximation), and SRMR (standardised root mean residual). According to Brown (2015), model fit is good when CFI and TLI indices are > 0.90, and RMSEA and SRMR are < 0.08.

Finally, Cortina, Chen, and Dunlap (2001) single-step estimation approach was adopted and applied with Stata, as this method is considered conceptually and operationally straightforward. The interaction term was first calculated by multiplying the mean-deviated values of the independent variable with the moderator variable to avoid multicollinearity. The interaction was then included in the structural model, and all the variables were analysed simultaneously.

4. Results

4.1. Reliability and validity of measures

A CFA with a maximum likelihood estimation method was conducted to estimate the measurement model. The results of the measurement model, including five latent variables with a total of 15 indicators and one observable variable (see Table 2), indicated a good fit to the data (χ^2 (120) = 303.34, $p < 0.001$, RMSEA = 0.06, CFI = 0.96, TLI = 0.94, SRMR = 0.05).

The convergent and discriminant validity assessment results showed no convergent and discriminant validity problems between the latent variables attitude, perceived behavioural control, perceived uniqueness, perceived naturalness, hedonistic values, and biospheric values with AVE > 0.5 and AVE > SC, respectively. The CR were all>0.5 (0.93, 0.74, 0.66, 0.84, 0.81, and 0.90, respectively), indicating good construct reliability.

The results (see Table 3) showed that less than half (seaweed consumption = 0.44) of the participants had consumed seaweed food products over the past year. The participants showed a positive attitude regarding seaweed food products (attitude = 4.02). Regarding participants' beliefs, seaweed was perceived as being natural (perceived naturalness = 5.36) and, to a lesser extent, unique (perceived uniqueness = 4.83). Regarding the values profile of the respondents, biospheric and hedonistic values were leading principles in their lives (biospheric values = 6.54; hedonistic values = 6.99). Moreover, the results showed that the variables biospheric values, hedonistic values, and perceived uniqueness did not correlate with seaweed consumption. Table 3 displays the intercorrelations and descriptive statistics.

4.2. Structural model analysis and indirect effects

SEM with a maximum likelihood estimation methodology was used to test the two models (see Table 4). The basic VAB model showed a good data fit ($\chi2 = 107.24$ with df = 51, RMSEA = 0.05, CFI = 0.98, TLI = 0.98, SRMR = 0.03). The extended VAB model had an acceptable data fit ($\chi2 = 259.66$ with df = 109, RMSEA = 0.05, CFI = 0.96, TLI = 0.95, SRMR = 0.04). Attitude ($\beta = 0.46$, $p < 0.001$) significantly explained seaweed consumption, thereby supporting H1a. Attitude explained 22% of seaweed consumption. Biospheric values ($\beta = 0.17$, $p < 0.001$) were

Table 3
Mean, standard deviation, and correlations.

	Mean	Standard deviation	1	2	3	4	5	6	7
1. Seaweed consumption	0.44	0.49	1.00						
2. Attitude	4.02	1.79	0.45***	1.00					
3. Perceived behavioural control	3.82	1.72	0.36***	0.54***	1.00				
4. Perceived uniqueness	4.83	1.59	0.02	0.30***	0.17***	1.00			
5. Perceived naturalness	5.36	1.43	0.14**	0.51***	0.27***	0.41***	1.00		
6. Hedonistic values	6.99	1.35	−0.02	0.05	0.04	0.11*	0.11*	1.00	
7. Biospheric values	6.54	1.63	0.06	0.25***	0.26***	0.13**	0.20***	0.31***	1.00

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

Table 4
Results of testing the proposed model.

Relationships	Hypothesis testing	Original VAB		Extended VAB	
		β	z	β	z
Attitude → Seaweed consumption	H1a supported	0.45	11.34***	0.46	11.85***
Hedonistic values → Attitude	H4a not supported	−0.04	−0.74 (n.s.)	−0.08	−1.56 (n.s)
Biospheric values → Attitude	H5a supported	0.29	5.47***	0.17	3.43***
Perceived naturalness → Attitude	H3 supported	–	–	0.45	7.78***
Perceived uniqueness → Attitude	H2 supported	–	–	0.13	2.08*
Hedonistic values × Perceived uniqueness → Attitude	H4b supported	–	–	0.10	2.24*
Biospheric values × Perceived naturalness → Attitude	H5b supported	–	–	0.07	2.45*
Attitude × Perceived behaviour control → Seaweed consumption	H1b supported	–	–	0.07	2.41*
R^2*(%) Seaweed consumption*		20%		22%	
R^2*(%) Attitude*		8%		35%	
Model fit indices					
χ2(df)		107.24(51)		259.66(109)	
RMSEA		0.05		0.05	
CFI		0.98		0.96	
TLI		0.98		0.95	
SRMR		0.03		0.04	

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

significantly related to attitude, thus confirming H5a. However, we have to reject H4a, as hedonistic values (β = -0.08, p = n.s.) had no significant relationship with attitude. Biospheric values explained 8% of the variance in attitude. H1b proposed that the positive effect of attitude on seaweed consumption would be stronger when perceived behavioural control increases. As expected, this hypothesis was supported by a significantly positive effect of the interaction between perceived behavioural control and attitude towards seaweed consumption (β = 0.07, $p < 0.05$).

Perceived uniqueness (β = 0.13, $p < 0.05$) was significantly related to attitude, thus confirming H2. Perceived naturalness (β = 0.45, $p < 0.001$) was also significantly related to attitude, confirming H3. Together, hedonistic and biospheric values and perceived uniqueness and naturalness explained 35% of attitude. H4b proposed that the positive effect of hedonistic values on attitudes towards seaweed would be stronger when perceived uniqueness increased. This hypothesis was supported by the significantly positive effect of the interaction between perceived uniqueness and hedonistic values (β = 0.10, $p < 0.05$). Finally, the moderation analysis results showed that perceived naturalness moderated the relationship between biospheric values and attitude, confirming H5b. There was a statistically significant positive effect of the interaction between perceived naturalness and biospheric values (β = 0.07, $p < 0.05$).

5. Discussion

The first aim of this study was to examine the ability of the extended VAB model to explain the consumption of seaweed food products among Norwegian consumers. The results indicated a good data fit. The first hypothesis was confirmed, as attitude is highly associated with seaweed consumption. This finding corresponds to previous consumer studies on seaweed food products (Palmieri & Forleo, 2020; Wendin & Undeland, 2020). Perceived behavioural control leads to a higher predictive power of attitude with regard to seaweed consumption. This result is in line with previous studies (La Barbera & Ajzen, 2021; Redondo & Puelles, 2017) and confirms the contribution of perceived behavioural control to reducing the gap between attitude and pro-environmental behaviour.

The results highlight the importance of biospheric values in the formation of attitude. This is consistent with previous findings, which showed a positive relationship between biospheric values and pro-environmental food consumption (Shin et al., 2017) or other pro-environmental food behaviours (Ateş, 2020; Nguyen, Lobo, & Greenland, 2016). However, the results also showed no significant direct relationship between hedonistic values and attitude. This result contrasts with Steg et al. (2014) findings, which suggested a significant effect of hedonistic values on pro-environmental attitude. This might be explained by consumers' lack of familiarity with seaweed, which, like other unfamiliar foods, might hold little sensory appeal for consumers (Tan, Tibboel, & Stieger, 2017). Moreover, consumers' reluctance towards unknown products may dissociate seaweed as a sensory-appealing type of food, as supported by previous studies confirming consumers' neophobia regarding seaweed food products (Birch et al., 2019; Chapman, Stévant, & Larssen, 2015; Losada-López et al., 2021).

The second aim of this study was to investigate the relationship between two specific product attributes (perceived uniqueness and perceived naturalness) and attitude. The model explained 35% of the variation in attitude. Together, perceived uniqueness and perceived naturalness increased the explained variation in attitudes by 27%; thus, the addition of perceived uniqueness and attitude improved the model's explanatory power. The explanatory capability of assessing specific attributes associated with the general evaluation (attitude) of food products is in accordance with previous studies (Ham, Pap, & Stanic, 2018).

Seaweed food products were perceived as unique and natural; they thus generated a favourable attitude from the respondents. This finding is interesting because consumers' perception of a food product as healthy, not artificial, and more environmentally friendly significantly positively affects the general acceptance of a given food (Román et al., 2017). Moreover, in this study, consumers' perception of seaweed food products as unique, natural, healthy, and sustainable is positively associated with their general attitudes. With the high production costs and limited availability of seaweed food products, marketers should present and promote (through packaging and stories) seaweed food products as unique quality products and should emphasise their naturalness.

The third objective of this study was to investigate the effect of specific attributes on the relationship between values and attitude. The results confirmed that consumers with hedonic values are more likely to have a positive attitude towards seaweed if they perceive seaweed food products as unique. This result is in line with that of Cardello et al. (2016), who showed that types of beer which are perceived as highly unique are strongly associated with hedonism. The outcome also confirmed the expected moderating effect of perceived naturalness on the relationship between biospheric values and attitude, which to our knowledge has not been demonstrated before in the literature. Theoretically, this result shows that salient product attributes affect the relationship between values and attitudes, as shown by Aertsens et al. (2009) and Dreezens, Martijn, Tenbült, Kok, and De Vries (2005), and indicates that specific product attributes can be used to activate the values–attitude relationship.

These results are also of practical relevance for the seaweed stakeholders. Marketing campaigns should emphasise the positive consequences of seaweed on the climate and its naturalness. These

consequences are regarded as important for consumers who endorse biospheric values. Regarding hedonistic values, the results indicate that consumers with hedonistic values may have an ambivalent attitude (Olsen, 1999) towards seaweed. However, the moderation of the hedonistic values–attitude relationship implies that when consumers perceive seaweed food products as unique, they are more likely to have positive attitudes towards them.

Finally, overall, the results show that the model's biospheric part is more related to attitude than the hedonistic element of the model, which means that consumers with biospheric values are more likely than people with hedonistic ones to consume seaweed food products. This result is congruent with the results of Steg et al. (2014), as it confirms the relevance of biospheric values in pro-environmental consumption and strengthens Katz-Gerro, Greenspan, Handy, and Lee (2017) view that biospheric values are an essential value type for explaining environmental behaviour.

5.1. Limitations and future research

Although this study contributes to increasing the understanding of which factors explain attitudes and seaweed consumption, limitations remain, and further studies are necessary. First, like other studies based on self-reported questionnaires, this study is prone to biases. For example, as there is an increasing focus on the environment, respondents could be susceptible to overestimating biospheric values and perceived naturalness, as doing so may be more socially desirable.

Second, compared to other more complex models, the VAB model is a straightforward one that presents the advantage of preventing overfitting, and is easier to interpret. However, there remains a large per cent of the variance that the model does not explain. The addition of perceived behavioural control as a moderator of the relationship between attitude and consumption slightly decreased that gap. This underlines that explaining novel food behaviour is complex. Besides perceived behavioural control, there are still many factors influencing the attitude–seaweed consumption relationship that have yet to be explored. Among these, we would recommend extending the model by including, for example, price (Padel & Foster, 2005) as a potential barrier.

Third, we believe that this study provides a good indication regarding consumers' attitudes, perceived naturalness, and perceived uniqueness of seaweed food products. However, as only 55% of the respondents had consumed seaweed food products, the attitude and beliefs of 45% of the respondents were not based on actual experience, but on expectations and beliefs. We believe consumers' attitudes and beliefs may differ after trying seaweed. Therefore, it would be interesting to study eventual variations in attitudes and beliefs before and after trying seaweed food products.

Fourth, this study focuses on seaweed food products as a general category. This study is a first step towards increasing our knowledge regarding variables affecting the consumption of seaweed food products. However, there might be differences between specific seaweed food products. Moreover, as there is no direct relationship between hedonistic values and seaweed consumption, future studies should test different seaweed food products to evaluate what type of products consumers associate the most with pleasure. For example, hedonistic values might be strongly related to attitudes towards snacks with seaweed rather than seaweed salads. Therefore, further research studying and comparing the key factors influencing attitudes towards specific food products would be interesting.

Finally, since seaweed is perceived as a unique product, future studies should examine the relationship between perceived uniqueness and consumers' need for uniqueness (Ham et al., 2018), in addition to other dimensions of personal values (Steg et al., 2014).

6. Conclusion

The current research used an extension of the VAB framework to explain seaweed consumption in a Norwegian context. The findings expanded our understanding of the factors affecting seaweed food consumption directly and indirectly. Despite not being familiar to all consumers, the respondents had positive attitudes and expectations towards seaweed food consumption. Moreover, the positive relationship between attitude and consumption is stronger when consumers perceive it is easy to consume seaweed food products.

Norwegian consumers perceived seaweed as unique and natural. Both perceived uniqueness and naturalness trigger a positive response towards seaweed foods from the public. Moreover, consumers with hedonistic values are more likely to have positive attitudes towards seaweed food products when they perceive them as unique. Similarly, consumers with biospheric values are more likely to have positive attitudes towards seaweed when seaweed products are perceived as natural. Consumers with biospheric values are more likely to consume seaweed than those with hedonistic ones; however, customers possess different combinations of values. Thus, a product that activates different values is advantageous because values are positively related to attitudes. This indicates that most Norwegian consumers form their attitudes towards seaweed according to biospheric values and health considerations.

Beyond the theoretical contributions, these findings will help the seaweed industry develop its marketing strategy by promoting seaweed's naturalness and healthiness. Marketers should also make an effort to encourage consumers to associate seaweed with pleasure. Finally, since seaweed food products are perceived as unique, seaweed food products can be positioned as high-quality or luxury products. By extension, the conclusions can be used to promote seaweed to policymakers and investors. The European seaweed sector remains new and requires more private investment and public support to develop. Therefore, promoting seaweed uniqueness and naturalness and emphasising positive biospheric consequences are ways in which policymakers and investors can be positively influenced.

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CRediT authorship contribution statement

Florent Govaerts: Conceptualization, Methodology, Software, Formal analysis, Formal analysis, Data curation, Writing – original draft, Writing – review & editing. **Svein Ottar Olsen:** Conceptualization, Methodology, Supervision, Writing – original draft, Writing – review & editing.

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.

Data availability

Data will be made available on request.

Appendix A:

Pictures of seaweed food products:

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Paper 3

Title:

- Consumer values and self-identity as a basis for identifying segments of consumers of seaweed in the UK

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Abstract: This study aimed to identify and profile segments of seaweed consumers in the United Kingdom. Hierarchical k-means cluster analysis was used to identify consumer segments based on consumers' self-identity and values. In addition, the study used knowledge, attitudes, intentions, and consumption in profiling different consumer segments. Data were collected in 2022 through a consumer survey with a representative sample from the United Kingdom (n = 1110). Cluster analysis segmented consumers into three groups: progressive (39%), conservative (33%), and egoistic (28%). The progressive segment was most likely to consume seaweed food products. Consumers in the progressive segment identify themselves as food innovative and healthy; they also highly value the environment and their pleasure. Conservative and egoistic consumers were significantly less likely to consume seaweed food products. The results suggest that public policy officers and marketers promote seaweed food products by emphasizing environmental values for innovative (younger) consumers, as well as seaweed's good taste and nutritional/health qualities.

Keywords: *Seaweed consumption, food innovativeness, environmental values, macroalgae, cluster analysis, novel food, consumer behavior.*

1. Introduction

Seaweed is a natural source of nutrients such as antioxidants, minerals, proteins, vitamins, and omega-3 fatty acids. Seaweed culture is also sustainable as it does not require fertilizers, heating, or watering (Pereira, 2016). In the context of increasing demand from consumers for environmental and healthy food sources, the food industry has shown renewed interest in using seaweed in food products (Birch, Skallerud, & Paul, 2019; Vincent, Stanley, & Ring, 2020). Few studies have focused on seaweed consumers and the variables influencing seaweed consumption (Birch et al., 2019; Govaerts & Olsen, 2022; Palmieri & Forleo, 2022). For example, Govaerts and Olsen (2022) considered seaweed consumption to be driven by health awareness, environmental considerations, and food innovativeness. Birch et al. (2019) revealed that, in Australia, early seaweed food product adopters have higher educational levels, are health conscious, and consider seaweed food consumption as an expression of their personality.

This study contributes to the existing seaweed literature by describing consumers based on their shared and distinct individual characteristics to determine the optimal number of subgroups within a population. In general psychology, this is termed a person-centered approach (Howard & Hoffman, 2018), or in consumer behavior and food science, segmentation or cluster analysis (Grunert, 2019). The advantage of sorting consumers into homogeneous clusters based on individual differences in their beliefs, values, norms, identities, and personalities is that these differences are integrated within the individuals (Donnellan & Robins, 2010). Hence, instead of studying the effect of determining variables on behavior, this study aimed to understand seaweed consumers' underlying motivational drivers and consequences (e.g., consumption).

Within the consumer segmentation approach, this study contributes to identifying segments based on the importance of consumer values and self-identity. Values are frequently used to segment consumers in consumer food research (Grunert, 2019). For example, Brunsø et al. (2021) used Schwartz's (1992) universal core values to profile consumer segments. This study extends the literature on international segmentation in the food domain (Grunert, 2019) by combining personal value theory (Schwartz, 2012) and self-identity (Stryker & Burke, 2000) in the context of consumer food research. The combination of using personal values and identity is scare in general consumer studies (Trudel, 2018), but there is a growing tendency to integrate value and identity theories in, for example, sustainable behavior (Bouman, van der Werff, Perlaviciute, & Steg, 2021; Wang & Mangmeechai, 2021; Zeiske, Venhoeven,

Steg, & van der Werff, 2021). However, to our knowledge, no study has combined values and self-identity to segment consumers in the context of (sea)food or seaweed.

Segmentation studies typically use several additional profiling constructs and variables to further enrich consumer characteristics and profiles when clusters or segments are identified. Profiling variables vary across studies but mostly include individual differences in attitudes, goals, involvement, behavior, demographics, and consumer situations (Nie & Zepeda, 2011; Witzling & Shaw, 2019). Our study focuses on the relationship between the identified consumer segments and their knowledge, attitudes, norms, intentions, socio-demographic characteristics, and consumption of seaweed food products. These constructs have previously been used in consumer studies of seaweed (Birch et al., 2019; Govaerts & Olsen, 2022, 2023; Palmieri & Forleo, 2020, 2022; Wendin & Undeland, 2020).

Finally, to our knowledge, this study is the first to focus on seaweed consumer behavior in the United Kingdom (UK). The UK is one of the leading countries in the introduction of new food products and is considered a highly relevant market for seaweed food consumption. In 2019, the UK was the first European importer of seaweed for human consumption (CBI Ministry of Foreign Affairs, 2022). Despite growing consumer demand, growing interest, and development of the seaweed industry in the UK, there is limited knowledge about seaweed food product consumers in the UK and their psychological and demographic profiles. This study contributes to filling this knowledge gap. The current results are based on a nationally representative sample of 1110 UK consumers. Thus, the external validity of the cluster solution using representative samples is more valuable for the purposes of the seaweed industry, for example, in realistically estimating the size of different segments.

In the following sections, the theoretical framework introduces the constructs used as bases for identifying segments, and the constructs and variables used to further profile the segments.

2. Theoretical framework

The segmentation approach involves grouping consumers based on their individual differences and similarities in character traits, values, identity, habits, and other psychological and personal characteristics (Grunert, 2019). In consumer research, this is a popular approach, as it allows marketers to identify homogeneous groups of consumers sharing the same motivations (Wedel & Kamakura, 2000). The selection of variables on which to segment

consumers is essential for defining the groups. Previous studies have used various segmentation bases; for example, Legendre (2021) used consumer value as a segmenting axis regarding insect consumption in the USA. Different lifestyles associated with food, health, and ways of shopping are frequently used in food science literature (e.g., Nie & Zepeda, 2011; Witzling & Shaw, 2019). Similarly, in a more general context, Brunsø et al. (2021), segmented consumer food choice based on core values (Schwartz, 1992), food involvement, food innovativeness, and food responsibility. Finally, in the context of seaweed food consumption, Palmieri and Forleo (2020) based their groupings of Italian consumers on food habits and attitudes towards food. This study contributes to the existing literature by using some facets of food-related self-identity (innovative and health) and some relevant facets of environmental values (egoistic, hedonistic, and biospheric) (De Groot & Steg, 2007; Steg, Perlaviciute, van der Werff, & Lurvink, 2014) to explore segments of seaweed consumers in the UK. The choice of these facets is based on previous studies suggesting that seaweed is novel in Western countries (Birch et al., 2019), as well as healthy (Chapman, Stévant, & Larssen, 2015; Pereira, 2016) and sustainable (Govaerts & Olsen, 2022; Sondak & Chung, 2015). This choice is also based on studies indicating a positive attitude (anticipating pleasure) influences consumer intention and consumption (Govaerts & Olsen, 2022, 2023; Wendin & Undeland, 2020; Young, Paul, Birch, & Swanepoel, 2022).

2.1. Environmental and individualistic values

Values refer to “desirable trans-situational goals varying in importance, which serve as a guiding principle in the life of a person or other social entity” (Schwartz, 1992, p. 21). Schwartz's definition encompasses three fundamental value characteristics: abstractness, desirable goals, and stability over time and situations. A total of 56 values have been validated as universal beliefs guiding people’s behavior, which can be grouped into two dimensions (openness to change versus conservatism and self-enhancement versus self-transcendence) (Schwartz, 1992). Based on Schwartz’s inventory, (Steg et al., 2014; Stern, 2000) four core values have been suggested that are particularly relevant to environmental concerns: egoism, hedonism, altruism, and biospherism. While the first two types of values (hedonism and egoism) are classified as individualistic values, the latter two are considered collectivistic (Steg et al., 2014; Stern, 2000). Seaweed production has a positive impact on the environment because it does not need freshwater, fertilizers, or pesticides (Duarte, Wu, Xiao, Bruhn, & Krause-Jensen, 2017). Previous studies suggest that consumers perceive seaweed as

sustainable (Blikra et al., 2021; Govaerts & Olsen, 2022, 2023; Palmieri & Forleo, 2022; Young et al., 2022) and found positive associations between pro-environmental values and seaweed attitudes and consumption (Govaerts & Olsen, 2023).

Hence, consumers with hedonic values seek pleasure or sensuous gratification (Schwartz, 2012). Pro-environmental behavior often requires effort or reduces comfort (Steg et al., 2014). Nevertheless, food is associated with pleasure (Aertsens, Verbeke, Mondelaers, & van Huylenbroeck, 2009; Bryła, 2016); therefore, consumers with high hedonic values are positive towards unique and novel food experiences (Govaerts & Olsen, 2023).

Egoistic value reflects concern for one's own resources (Steg et al., 2014). Sustainable products are often associated with egoistic benefits such as better health. Seaweed food provides many health benefits as it is rich in minerals, vitamins, antioxidants, and proteins. Govaerts and Olsen (2022) showed that consumers are motivated to eat seaweed by its perceived positive health consequences. Therefore, we believe it is possible to segment consumers based on their egoistic value.

Biospheric value reflects concerns about the quality of nature and the environment for its own sake (De Groot & Steg, 2008). Biospheric values are positively correlated with pro-environmental behavior. Seaweed products are often promoted as sustainable food because they do not use fertilizers, freshwater, or soil. Hence, consumer groups characterized by their concern for preserving the environment may consume seaweed as a pro-environmental contribution.

2.2. Consumers' self-identity is associated with food innovativeness and healthy lifestyle.

More recently, the value-identity-personal norm theory underlined the significant role of self-identity in understanding consumer norms and behavior (Ruepert et al., 2016). Self-identity is the label people use to describe themselves (Cook, Kerr, & Moore, 2002). Consumers can have many different and sometimes conflicting identities, which can be salient, depending on the context (Stryker & Burke, 2000). For instance, food innovative self-identity, referring to how much people see themselves as a person who likes to try new food, is an especially salient factor in the context of novel food consumption (Bouman et al., 2021). Indeed, food innovativeness is positively related to consuming novel foods (Huotilainen, Pirttilä-Backman, & Tuorila, 2006), such as seaweed (Govaerts & Olsen, 2022), functional food products (Nystrand & Olsen, 2021), and organic food products (Bartels & Reinders, 2010).

Health identity is another relevant construct in the context of seaweed food product consumption. Health identity is a construct that deals with the degree to which individuals see themselves as someone who has a healthy lifestyle (Quaye, Mokgethi, & Ameyibor, 2021). Seaweed is evaluated as healthy because it is rich in minerals and vitamins, low in calories, and contains dietary fiber (Blikra et al., 2021; Stévant, Rebours, & Chapman, 2017). Previous studies have underlined the importance of consumer health motives in the consumption of organic food (Kushwah, Dhir, Sagar, & Gupta, 2019). Govaerts and Olsen (2022) found a positive relationship between consumers' knowledge of seaweed's health benefits and their intentions to consume these products. We believe that consumer groups characterized by a higher self-perception of having a healthy lifestyle are more likely to consume seaweed food products.

We are not aware of any previous studies that have used self-identity as a basis for consumer segmentation (Grunert, 2019). Thus, the current study contributes to the food consumer literature by examining whether food innovativeness and health identities are appropriate as a basis for identifying and profiling consumer segments in a food context.

2.3. Profiling consumers based on attitudes and consumption of seaweed.

Previous research showed that several factors affect consumers' seaweed consumption, such as personal norms (Govaerts & Olsen, 2022), values, health and environmental beliefs (Govaerts & Olsen, 2023), food neophobia (Palmieri & Forleo, 2022), as well as attitudes (Govaerts & Olsen, 2023) and intention (Govaerts & Olsen, 2022), which are among the most influential ones. Thus, this study examines the differences between consumer groups in knowledge, attitudes, personal norms, intentions, and behavior towards seaweed food products. These variables are all considered important in the context of seafood consumption behavior (Govzman et al., 2021; Olsen, 2004).

In Asia (for example, China, Japan, and Korea), the taste and health qualities of seaweed make it very popular in Asian food culture and traditions. In Europe, consumers remain unfamiliar with seaweed. The level of knowledge about a product is a critical factor in consumers' adoption of a new product, as consumers evaluate product attributes based on their knowledge before purchasing (Fu & Elliott, 2013). Product knowledge refers to "the amount of accurate information held in memory and self-perceptions of product knowledge" (Rao & Sieben, 1992, p. 258). As seaweed food products remain unfamiliar, consumers

should have relatively little knowledge of seaweed. Despite the low familiarity, we believe that the level of knowledge will vary between groups or segments.

Personal norms or moral obligations are important factors that explain (food) consumption (Aertsens et al., 2009; Klöckner & Ohms, 2009). Personal norms refer to an individual's beliefs about their moral obligation to engage in a behavior (Schwartz, 1977). Seaweed is perceived to be both healthy and environmentally friendly (Govaerts & Olsen, 2022, 2023; Palmieri & Forleo, 2022). A recent study using the norm activation model (Schwartz, 1977)) showed that health and environmental motivations activate consumers' feelings of being morally obliged to eat seaweed food products (Govaerts & Olsen, 2022).

Attitudes reflect whether engaging in a behavior is evaluated positively or negatively (Ajzen, 1991). Attitude has been suggested to be a strong predictor of food consumption, dietary behavior, and food choice (Aertsens et al., 2009; Köster, 2009; Kushwah et al., 2019). Attitude is also a central factor in studies of seaweed food consumption. Hence, Lucas, Gouin, and Lesueur (2019) showed that attitude strong affected seaweed consumption among French consumers. Wendin and Undeland (2020) indicated that Swedish consumers have positive attitudes towards seaweed for environmental reasons, and Govaerts and Olsen (2023) found positive associations between values, attitudes, and seaweed consumption. Finally, Palmieri and Forleo (2020) used attitudes towards seaweed as a factor to segment Italian seaweed consumers.

Behavioral intention refers to a person's specific aim to engage in a particular behavior (Fishbein & Ajzen, 2010). This study included consumers' intention to eat seaweed in the next month as a profiling variable. Behavioral intention is a strong predictor of an individual's behavior across contexts (Fishbein & Ajzen, 2010), including food behavior (Carfora, Cavallo, Catellani, Giudice, & Cicia, 2021), seafood consumption (Olsen, 2004), and seaweed consumption (Govaerts & Olsen, 2022). In this study, seaweed consumption refers to the frequency with which people have eaten a product containing seaweed over the past year.

3. Materials and methods

3.1. Sample and procedure

The sample consisted of 1110 adult consumers from the UK and was representative of gender, age, and region (See Table 1). YouGov conducted the recruitment online. Respondents were required to answer all the questions to complete the survey. The survey initially included a

small introduction, which contained the following text: “Seaweed is a form of algae that grows in the sea. There are various species of edible seaweeds, the color range of which varies from red to green to brown. Seaweed helps capture CO2. Seaweed is a good source of nutrients such as proteins, vitamins, minerals, and dietary fiber.”

Table 1 Socio-demographic characteristics (N = 1110)

Variables	Percent
Gender	
Male	48
Female	52
Age	
18-29	18
30-39	18
40-49	17
50-59	13
60-69	19
70+	15
Income	
Lower income	25
Middle income	36
Higher income	14
Prefer not to say/ Don’t know	25
Education	
Low	15
Medium	38
High	47

3.2. Measurement of the constructs

The following section presents five segmentation and six profiling variables. All variables, except *consumption*, are composed of multiple items and are listed in Tables 2 and 3 with their reliability (internal consistency) coefficients.

3.2.1. Segmentation variables

Food innovative identity was adapted based on a recent study on consumer identity (Chan, Pong, & Tam, 2020) and adapted to food innovativeness. The three items were “Trying new and different food is an important part of who I am,” “I am the type of person who takes pleasure in trying new foods,” and “I see myself as a person who likes to try new food.”

Participants were asked to respond to each item on a 7-point Likert scale ranging from totally disagree to totally agree.

Health identity was measured using three items adapted from past studies (Chan et al., 2020), the items were "Having a healthy lifestyle is an important part of who I am," "I am the type of person who takes pleasure in having a healthy lifestyle," "I see myself as a healthy person." All items were rated on a 7-point Likert scale.

Pro-environmental values were measured using a scale developed by Steg et al. (2014): a total of 16 items measuring *egoistic* (5 items), *biospheric* (4 items), and *hedonic* values (3 items). Following Schwartz (1992), respondents were asked to rate the importance of each item on a scale from 1 ("opposed to my principles") to 9 ("extremely important"). See Table 2.

3.2.2. Profiling variables

Knowledge (about seaweed food products) was adapted based on Fu and Elliott (2013). We used four items on a scale ranging from 1 ("very unknowledgeable") to 7 ("very knowledgeable"). The following items were used: "How knowledgeable a person are you about seaweed consumption?"; "Rate your knowledge of seaweed consumption compared to the average consumer"; "How familiar are you with seaweed consumption?"; "Rate your knowledge of seaweed consumption compared to your knowledge of other food products that you buy."

Personal norms were measured using the following five statements: "I feel personally obliged to eat seaweed," "I would be a better person if I ate seaweed," "People like me should do whatever they can to eat seaweed," "I feel guilty if I do not eat seaweed," "It is morally correct for me to eat seaweed." These items were adapted from past studies (Jakovcevic & Steg, 2013; Kim & Seock, 2019) to the context of seaweed food consumption and were measured on a 7-point Likert scale.

Attitude towards seaweed was assessed using five items preceded by the stem "To eat products that contain seaweed is … " The respondents were asked to place each item along a 7-point semantic differential scale (bad/good, negative/positive, boring/exciting, unpleasant/pleasant, and something I dislike/something I like). These items are commonly used in food-related studies (e.g., Hayley, Zinkiewicz, & Hardiman, 2015; Honkanen, Olsen,

& Verplanken, 2005), and cover both general, cognitive, and affective evaluations of attitude (Crites, Fabrigar, & Petty, 1994; Fishbein & Ajzen, 2010).

Intention to consume seaweed food was measured by rating four items on a scale from 1 to 7 (extremely unlikely/extremely likely). The items were adapted from past studies (Honkanen et al., 2005; Menozzi, Sogari, Veneziani, Simoni, & Mora, 2017). The four items used to assess behavioral intention were: "I intend to eat products containing seaweed in the next month," "I expect to eat products containing seaweed in the next month," "I plan to eat products containing seaweed in the next month," and "I will try to eat products containing seaweed in the next month."

To measure *consumption* of seaweed food products, respondents were asked to answer the following question: "Over the past year, how many times have you eaten a product containing seaweed?" The question was assessed on a scale from 1 (less often/never) to 9 (3+ times per week).

3.3. Analytical procedures

First, we conducted an exploratory factor analysis (EFA) using principal factor analysis (PFA) with varimax rotation. Subsequently, a maximum likelihood confirmatory factor analysis (CFA) with maximum likelihood estimation was conducted. The convergent and discriminant validity of the constructs were assessed using Fornell and Larcker's (1981) methodology. The convergent validity of the constructs was established when the estimation of the average variance extracted (AVE) was > 0.5, and discriminant validity was found when the AVE value of a latent construct was larger than the squared correlation (SC) of any other latent construct in the model. Cronbach's alpha was used to measure internal consistency. In the analysis, Cronbach's Alpha values should not fall below 0.6, as recommended by Hair, Anderson, Babin, and Black (2010).

Multiple indicators were used to evaluate the goodness of fit: χ^2 (chi-square), comparative fit index (CFI), Tucker–Lewis index (TLI), root mean square error of approximation (RMSEA), and SRMR (standardized root mean residual). Model fit is good when CFI and TLI indices are > 0.90, and RMSEA and SRMR are < 0.08 (Brown, 2015).

A hierarchical cluster analysis was based on Ward's method to identify the appropriate number of clusters. The Calinski-Harabasz analysis stopping rule was used to determine the number of clusters. A stopping rule was computed for each cluster solution. Larger values of

the Calinski-Harasz pseudo-F index indicate more distinct clustering (Calinski & Harabasz, 1974). One-way analysis of variance (ANOVA) was performed to compare differences between clusters in terms of the segmentation variables (identity and values) and profiling variables (i.e., attitude, intention, personal norms, knowledge, and consumption). All analyses were performed using Stata software (17).

4. Results

4.1 Factor analysis

We ran EFA separately for the segmentation variables. The EFA revealed five factors. However, the rotated component matrix indicated cross-loadings. Hence, the following modification was made: one of the three items measuring hedonic value (self-indulgence) was omitted because of its cross-loading with egoistic value.

Finally, we performed CFA for the segmentation and profiling variables. CFA confirmed the validity of the structure of the latent variables, with a total of 16 indicators for the segmentation variables (see Table 2). Regarding the profiling variables, CFA indicated that one item used to capture knowledge ("Please rate your knowledge of seaweed products compared to the average consumer you know") had a low factor loading (<0.5) and was then omitted. CFA confirmed the validity of the structure of the four profiling latent variables with a total of 18 indicators (see Table 3). Thus, the results of CFA indicated a good data fit for the segmentation variables (χ^2 (109) = 623.03, $p < 0.001$, RMSEA = 0.06, CFI = 0.96, TLI = 0.96, SRMR = 0.06). In addition, for the segmentation variables, the final results of the CFA indicated good data fit (χ^2 (113) = 499.31, $p < 0.001$, RMSEA = 0.05, CFI = 0.97, TLI = 0.97, SRMR = 0.03).

Moreover, for both the segmentation and profiling variables, CFA indicated convergent and discriminant validity between the latent variables with AVE > 0.5 and AVE > SC, respectively (Fornell & Larcker, 1981). Cronbach's alpha scores were greater than 0.6, indicating good construct reliability (Hair et al., 2010).

The results (Table 5) indicate that the participants had, on average, low knowledge of seaweed. Regarding personal norms, the results showed that the participants had a low feeling of moral obligation to eat seaweed. However, the participants showed a positive attitude towards seaweed food products. Participants' level of intention to eat seaweed food products and actual consumption was low.

Table 2 Confirmatory factor analysis of the segmentation variables

Construct and item	Factor loading	Cronbach's α	Average variance extracted
Food innovative identity		0.95	0.86
Trying new and different foods is an important part of who I am	0.86		
I am the type of person who takes pleasure in trying new foods	0.95		
I see myself as a person who likes to try new foods.	0.95		
Health identity		0.91	0.79
Having a healthy lifestyle is an important part of who I am	0.80		
I am the type of person who takes pleasure in having a healthy lifestyle	0.83		
I see myself as a healthy person	0.78		
Egoistic value		0.80	0.52
Social power: control over others, dominance	0.69		
Wealth: material possessions, money	0.58		
Authority: the right to lead or command	0.88		
Influential: having an impact on people and events	0.71		
Hedonic value		0.87	0.78
Pleasure	0.83		
Enjoying life	0.92		
Biospheric value		0.95	0.83
Preventing pollution: protecting natural resources	0.87		
Respecting the earth. Harmony with other species	0.93		
Unity with nature. Fitting into nature	0.91		
Protecting the environment: preserving nature.	0.93		

Table 3 Confirmatory factor analysis of the profile variables

Construct and item	Factor loading	Cronbach's α	Average variance extracted

Knowledge about seaweed		0.87	0.70
How knowledgeable about seaweed food products	0.79		
How familiar are you with seaweed food products	0.90		
Please rate your knowledge of seaweed food products compared to your knowledge of other food products that you buy	0.80		
Personal norms		0.90	0.61
I feel personally obliged to eat seaweed	0.83		
I would be a better person if I eat seaweed	0.81		
People like me should do whatever they can to eat seaweed	0.79		
I feel guilty if I do not eat seaweed	0.71		
It is morally correct for me to eat seaweed	0.67		
I feel morally obliged to eat seaweed, regardless of what other people say	0.85		
Attitudes		0.93	0.73
Bad/Good	0.84		
Negative/Positive	0.87		
Boring/Exciting	0.78		
Unpleasant/Pleasant	0.90		
Something I dislike/Something I like	0.87		
Intentions		0.96	0.86
I intend to eat products containing seaweed in the next month	0.93		
I expect to eat products containing seaweed in the next month	0.94		
I plan to eat products containing seaweed in the next month	0.96		
I will try to eat products containing seaweed in the next month	0.89		

4.2. Consumer segmentation

A hierarchical Ward's linkage cluster procedure was applied to the five identified factors (food innovation identity, health identity, egoistic, hedonic, and biospheric values) to identify homogenous respondent groups within the survey sample. The Calinsky-Harabsz pseudo-*F* stopping rule limits the number of clusters to two. The Calinski-Harabasz pseudo-*F* value

dropped from 315.21 for the solution with three clusters to 222.53 for the solution with three clusters and decreased monotonically to 117.96 for the solution with 15 clusters. Thus, the three-cluster solution was retained as the most internally consistent grouping.

The first group (39% of the sample) was characterized by higher mean scores on innovative identity, health identity, biospheric value, and hedonic value higher than the respective sample means of these factors. This group was called progressive, as they had higher food innovative identity, health identity, and biospheric and environmental values than consumers in the other two segments. The second segment (33% of the sample) demonstrated a high level of biospheric value and an average level of hedonic value; however, they had the lowest scores on food innovation, health identity, and egoistic value. Thus, this group was labelled conservative. The final and smallest group (28% of the sample) was called the egoistic group because they have the highest score on egoistic value and the lowest score on biospheric (collectivistic) value. The egoistic group are close to the conservative group in their health identity and relatively close in their innovativeness. They had the lowest scores for hedonistic values of all segments.

Table 4 Differences in segmentation variables across segments

Variable	Overall Mean (SD)	Progressive Mean (SD)	Conservative Mean (SD)	Egoistic Mean (SD)	*F*	Sig.
	n = 1110	n = 437 (39%)	n = 364 (33%)	n = 309 (28%)		
Food innovative identity	4.27 (1.64)	5.63 (1.03)[a]	3.17 (1.28)[c]	3.63 (1.46)[b]	440.41	<0.001
Health identity	4.20 (1.46)	4.99 (1.28)[a]	3.64 (1.44)[b]	3.74 (1.21)[b]	128.74	<0.001
Egoistic value	4.22 (1.47)	4.33 (1.53)[a]	3.94 (1.30)[b]	4.40 (1.53)[a]	10.08	<0.001
Hedonic value	7.07 (1.55)	7.83 (1.03)[a]	7.67 (1.16)[b]	5.96 (1.61)[c]	173.89	<0.001
Biospheric value	7.03 (1.73)	7.95 (1.08)[a]	7.11 (1.44)[b]	5.00 (1.35)[c]	633.17	<0.001

Note: Different superscripts [(a, b, and c)] indicate significant differences in means between segments found by the Bonferroni post hoc test.

4.3. Profiling the segments

Following segment definition and naming, a one-way ANOVA with Bonferroni multiple comparison tests was performed to test the differences in consumers' knowledge about seaweed food products, personal norms (regarding seaweed food products), attitudes towards, intention to eat seaweed food products, and behavior (seaweed food

consumption) across segments. Significant differences between the groups were observed for all five variables analyzed (Table 4).

The progressive and egoistic consumers showed significantly better knowledge about seaweed food products than conservative consumers. The results also indicated that the egoistic cluster had significantly higher mean knowledge than the conservative cluster (Table 5). Moreover, progressive respondents showed significantly higher personal norms than the other two groups (Table 5). Progressive respondents also had significantly more positive attitudes, intentions, and a higher consumption of seaweed food products in the three groups (Table 5). Finally, the conservative and egoistic groups did not differ in their knowledge, personal norms, attitudes, intentions, and seaweed food product consumption.

Table 5 Profiling consumer segments based on seaweed food consumption behavior

Variable	Overall Mean (SD)	Progressive Mean (SD)	Conservative Mean (SD)	Egoistic Mean (SD)	*F*	Sig.
Knowledge	2.15 (1.31)	2.40 (1.43)[a]	1.79 (1.06)[b]	2.22 (1.30)[a]	22.70	<0.001
Personal norms	2.33 (1.33)	2.64 (1.46)[a]	2.02 (1.13)[b]	2.25 (1.25)[b]	22.83	<0.001
Attitudes	3.89 (1.61)	4.52 (1.56)[a]	3.55 (1.56)[b]	3.41 (1.45)[b]	60.87	<0.001
Intentions	2.42 (1.76)	2.98 (1.92)[a]	1.95 (1.49)[b]	2.17 (1.60)[b]	40.34	<0.001
Consumption	2.36 (2.00)	2.81 (2.09)[a]	2.03 (2.03)[b]	2.13 (1.92)[b]	18.27	<0.001

Note: Different superscripts [(a, b, and c)] indicate significant differences in means between segments found by the Bonferroni post hoc tests.

4.4. Socio-demographic characteristics

The three segments were further compared based on their sociodemographic characteristics. The results of the one-way ANOVA with Bonferroni multiple comparison tests indicated that the characteristics differed significantly between clusters (Table 6); the egoistic segment was composed of more males than the other two segments (Table 6). On average, the conservative segment was older than the progressive and egoistic segments (Table 6). Finally, the progressive segment showed higher education levels than the other two segments (Table 6).

Table 6 Socio-demographic characteristics of the segments

Variable	Overall Mean (SD)	Progressive Mean (SD)	Conservative Mean (SD)	Egoistic Mean (SD)	*F*	Sig.

Sex	1.52 (0.49)	1.55 (0.49)[a]	1.57 (0.49)[a]	1.41 (0.49)[b]	11.03	<0.001
Age	3.24 (1.34)	3.24 (1.31)[n.s]	3.37 (1.31)[n.s]	3.09 (1.41)[n.s]	3.54	<0.001
Education	2.22 (0.04)	2.35 (0.03)[a]	2.19 (0.04)[b]	2.06 (0.05)[b]	10.52	<0.001

Note: Different superscripts [(a, b, and c)] indicate significant differences in means between segments found by the Bonferroni post hoc tests; n.s., not significant.

5. Discussion

This study aimed to extend the established literature on seaweed food consumers by segmenting them based on their values and self-identity. A combination of five variables, including food innovative identity, health identity, and three values (egoistic, hedonic, and biospheric), successfully identified three clusters among the 1110 respondents. The three groups resulting from the cluster analysis were called progressive, conservative, and egoistic. The clusters varied in size. The largest group was progressive (39% of the sample), followed by the conservative (33% of the sample) and egoistic groups (28% of the sample).

Table 7 Summary characteristics of U.K. consumers segments

	Progressive (39%)	Conservative (33%)	Egoistic (28%)
Self-identity	Identifies as • being food innovative • Having a healthy lifestyle	Does not identify as • being food innovative • having a healthy lifestyle	Does not identify as • being food innovative • having a healthy lifestyle
Values	Values • the environment • pleasure • egoistic	Values • the environment • pleasure	Values • Egoistic
Knowledge	Have the highest knowledge about seaweed	Have the lowest knowledge about seaweed	Have low knowledge about seaweed
Personal norms	Have the highest personal norms regarding seaweed	Have the lowest personal norms regarding seaweed	Have low personal norms regarding seaweed
Attitude	Are the most positive towards seaweed	Negative towards seaweed	Are the most negative towards seaweed
Intention	Have the highest intention to eat seaweed	Have the lowest intention to eat seaweed	Have low intention to eat seaweed
Seaweed consumption	Have the highest seaweed consumption	Have the lowest seaweed consumption	Have low seaweed consumption

Demographics	• Mostly women • Hight level of education	• Mostly women • Oldest segment	• Mostly men • Youngest segment • Lowest level of education

Greater food innovativeness and health identity characterized the progressive cluster. In terms of values, progressive consumers consider protecting the environment essential but also highly value pleasure. The second cluster, called conservative, differentiates from the first because they have the lowest self-perception of being food innovative and having a healthy lifestyle. The conservative group gave the least importance to egoistic values. However, similar to progressive consumers, the conservative segment highly values the environment and pleasure. Finally, we called the last group egoistic because their values were the most self-centered (Table 6). They placed the lowest importance on preserving the environment, indicating low collective and high individualistic values. However, both the progressive and conservative scores are relatively higher than the egoistic group on hedonic values, indicating that egoistic and hedonistic values are somewhat different individual values as a basis for the segmentation of consumers, even though both are highly individualistic (Schwartz, 1992). Thus, our results contribute to the literature on environmental values by considering individual differences in hedonistic and egoistic values (Steg et al., 2014).

It is difficult to compare our segmentation findings with those of other studies because of our novel choice of segmentation basis. However, the groups that emerged after segmentation were relatively similar to those usually found in previous studies segmenting Western food consumers (e.g., Brečić, Mesić, & Cerjak, 2017; Brunsø et al., 2021; Palmieri & Forleo, 2020). Hence, the results confirm the presence of a progressive consumer segment (also referred to as adventurous or non-phobic and open) (Brunsø et al., 2021; Palmieri & Forleo, 2020). In contrast to the more progressive segment, the food-conservative segment has also been reported in the literature (Brunsø et al., 2021). The segment that we call egoistic shares similarities with segments referred to as self-centered and indifferent (Brečić et al., 2017; Brunsø et al., 2021; Nystrand & Olsen, 2021) because this segment highly values themselves and places little importance on other values, health, and food innovativeness.

Regarding seaweed food products, one segment distinguishes itself from the others, as it scores significantly higher on knowledge, personal norms, attitudes, intentions, and consumption. From the results, we first observe that the group with the highest food

innovative and healthy identity scores (the progressive) had the best knowledge. Conversely, the conservative group, who identified as the least innovative and did not feel that they had a healthy lifestyle, had the lowest knowledge about seaweed. Thus, a high level of food innovativeness seems to be related to higher knowledge about seaweed. Innovative consumers may be more curious and have a higher level of interest, and thus, may have heard or better remember information about seaweed. These results contribute to earlier findings indicating that innovative consumers engage more in ongoing information searches and have weaker perceptions of risk; thus, they have better product knowledge than low-innovative consumers (Zhang & Hou, 2017). Nevertheless, it is important to emphasize that the level of knowledge remained low among all three groups, as most UK consumers have little knowledge about seaweed. This result is not surprising, because seaweed is novel and unfamiliar to Western consumers.

The results indicated that a higher level of knowledge was also followed by a higher feeling of obligation to eat seaweed and more positive attitudes towards seaweed. Indeed, progressive consumers felt significantly more obliged to eat seaweed than did conservative and egoistic consumers. It is not surprising that progressive consumers also have higher personal norms about seaweed; the more people know about it and its environmental consequences and health qualities, the more likely they are to develop a feeling of moral obligation to eat it (Govaerts & Olsen, 2022). The results confirm that consumers' personal norms in the segments vary depending on salient self-identity, as argued in the value-identity-personal norms framework (Ruepert et al., 2016; van der Werff & Steg, 2016). Moreover, the results show that, despite high biospheric and hedonistic values, conservative consumers show the lowest level of personal norms regarding seaweed. This finding shows that a combination of environmental values and salient self-identity (food innovativeness and health identity) activates consumers' moral obligation to eat seaweed. This finding confirms the importance of salient identities in activating personal norms (Ruepert et al., 2016).

Progressive consumers were positive towards eating seaweed, whereas egoistic consumer segments were the most negative. Again, we indicate that a combination of seaweed's environmental, health, and hedonistic characteristics positively influenced consumers' perceptions of seaweed food products. Moreover, this result is in line with Govaerts and Olsen (2023), who showed a positive relationship between biospheric and hedonistic values and motivation and consumers' attitudes towards eating seaweed. However, consumer egoistic values stood out as being negatively related to attitudes towards eating seaweed. This

finding is consistent with previous studies that indicate a negative relationship between egoistic values and pro-environmental food consumption (Qian, Yu, & Gao, 2019; Steg et al., 2014). In addition, the progressive group intended to eat and actually consumed the most seaweed food products, while the conservative group had the lowest intention and consumption. This confirms that higher intentions to eat seaweed are followed by higher consumption (Govaerts & Olsen, 2022, 2023). However, we emphasize that seaweed consumption in the UK remains very low for all segments.

Differences in age, sex, and education were observed between the clusters. Hence, on average, the conservative group was older than the progressive and egoistic groups. This result is in accordance with that of Birch et al. (2019), who identified young consumers as the demographic most likely to eat seaweed in Western countries. The egoistic group contrasted with the two other groups, being mainly composed of men, and the youngest and less educated (Table 6). The progressive group was the most educated. Similar to previous studies (Birch et al., 2019; Palmieri & Forleo, 2020), we also found that the more favorable segment towards seaweed food products is also the most educated. It is also worth noting that the most favorable group (progressive) towards seaweed food products was also the largest (39%).

Finally, from a practical perspective, this study shows that progressive consumers should be reached by stimulating their pro-environmental and hedonistic values, food innovativeness, and health self-identity. Marketers will encounter more substantial motivational adoption barriers from conservative and egoistic segments. In addition, this segment is estimated to cover almost 40% of UK consumers. Both conservative and egoistic segments are less likely to consume seaweed, as they are not interested in eating new or unfamiliar foods such as seaweed. Moreover, the conservative and egoistic groups do not identify as having a healthy lifestyle, which means, at first glance, they may be less sensitive to seaweed's health qualities. To target the conservative segment, marketers should emphasize that it is sustainable because its culture does not require fertilizers, heating, or watering (Pereira, 2016). Seaweed food producers should also propose a variety of exciting snacks containing seaweed to introduce seaweed to (younger) consumers. Healthy, high-value snacks are food products highly associated with pleasure, and as they are eaten in small amounts between meals, consumers are likely to try novel snacks containing seaweed (Palmieri & Forleo, 2020). Regarding the egoistic segment, marketers should promote seaweed to maximize individual benefits. Hence, marketers should target interest in superfoods by promoting seaweed as beneficial, especially for well-being.

6. Limitations

This study had several limitations. First, the focus of this study was limited to a representative sample of consumers from the UK. Future research in other potentially important Western markets (e.g., the USA, France, and Germany) is recommended. It would also be interesting to compare consumer segments in, for example, Asia with those in Europe. Previous research on seaweed food consumption has focused on Western consumers (Birch et al., 2019; Lucas et al., 2019; Palmieri & Forleo, 2020; Young et al., 2022) and lacks consideration of cross-cultural differences between Asian and Western cultures. Therefore, future studies should explore cross-cultural consumer perceptions and cognitive associations with seaweed. This study provides an extensive overview of the seaweed food market by focusing on consumer behavior towards seaweed food products as a general category of food products. Future research should examine consumer segments of specific seaweed food products.

The present study used three facets of core values and two specific dimensions of self-identity. Future studies could extend these findings to other dimensions of both values and self-identity as a basis for segmentation. For example, is it possible to use broader value dimensions such as self-enhancements and self-transcendence (Schwartz, 1992) in combination with social-identity (Brieger, 2019), environmental identity (Van der Werff, Steg, & Keizer, 2013), or other relevant self-identities to food consumption (e.g. ethical self-identity (Talwar, Jabeen, Tandon, Sakashita, & Dhir, 2021)). Moreover, this study did not compare consumption attitudes and consumption of other food products (e.g., organic foods and seafood) with attitudes and consumption of seaweed. Future studies could include these issues as profiling together with other relevant profiling variables (e.g., ways of shopping, cooking habits, and convenience orientation).

7. Conclusion and practical implications

This study provides new insights into individual differences in segments of seaweed consumers in the UK. Based on theoretical constructs from value theory (Schwartz, 1992) and self-identity theory (Stryker & Burke, 2000), we demonstrated that consumers could be divided into meaningful groups: progressive, conservative, and egoistic consumers. Then, we showed that consumers' knowledge, attitudes, personal norms, and intention/behavior towards seaweed vary depending on the group to which they belong. Hence, the progressive group, the largest segment (approximately 40 %), stood out in our representative UK study. Progressive consumers undoubtedly had the best knowledge about seaweed and felt the most morally

responsible for eating seaweed food products. In addition, they had the most positive attitudes and the highest intention to consume seaweed food products. This group was younger, more educated, and characterized by a higher self-identification of being food innovative and having a healthy lifestyle. These consumers also placed great value on the environment and their own pleasure. In other words, consumers (the conservative and egoistic) who did not show this combination of food innovativeness identity, health identity, and environmental values are less likely to consume seaweed in the present and future.

Finally, these insights are of great importance to the emerging seaweed food sector. By providing a better understanding of market segments, marketers can use their limited resources more efficiently, by focusing on consumers who are more likely to eat seaweed in the future. These early consumers could open the market and positively influence their social networks. Such an effect could potentially increase the social acceptance of consuming seaweed products in the UK. In the long run, this change could lead to the emergence of a seaweed consumption culture that can grow in the UK and spread to Europe, generating market demand and growth. To encourage conservative and egoistic segments to consume seaweed, the seaweed industry should increase their exposure to the public by focusing on promotional campaigns in the media and social media. Promotional materials should emphasize the nutritional, environmental, and sensory qualities of seaweeds to satisfy consumers' interest in the environment or their own personal benefits, respectively.

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