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E-commerce of Seafood – A Review of Existing Research

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ABSTRACT

This review presents the current status of knowledge on e-commerce trade of groceries, and perishable foods, and offers highlights of the different important aspects crucial for trading quality seafood through e-commerce channels. The perishable nature of seafood requires particular care to maintain its quality and nutritional content throughout the supply chain to avoid waste and losses. E-commerce of grocery goods is increasing and knowledge about what is needed to secure the quality of highly perishable products through e-commerce channels is lacking. This involves knowledge into several disciplines. Thus, a cross-disciplinary search through 35 databases was conducted that revealed 2575 articles using different search words relevant for the diverse disciplines in combination with e-commerce. Results reveal limited focus on seafood and e-commerce and need for greater cross-disciplinary research attention in the future.


KEYWORDS

E-commerce; review; seafood; supply chain

Introduction

Online grocery shopping (OGS) was first offered in the United States in the late 1980s (Chien, Kurnia, & von Westarp, 2003). Since then, European countries like Switzerland, Sweden, Denmark, Finland, and the United Kingdom and other developed nations such as Australia, Japan, and Singapore have followed suit (Al Nawayseh & Balachandran, 2012). Asia Pacific is the leading region for digital commerce, accounting for 41% of global spending in 2018, and is expected to shape the worldwide trends (Evans, 2018). With the growing number of Internet users, it is anticipated that developing countries, such as Malaysia and India, will become more relevant for online retailers in the future (Alamelu & Meena, 2015; Chin & Goh, 2017; Sreeram, Kesharwani, & Desai, 2017; Yeo, Goh, & Rezaei, 2017; Zaini et al., 2011).

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Both producers and consumers have an interest in adopting e-commerce as it allows them to sell or buy across larger geographical areas than before (Wiengarten, Fynes, Humphreys, Chavez, & McKittrick, 2011). Given the growth, especially in the populous parts of the world this needs to be considered in all business strategies. E-sales are expected to potentially advance the routines of sales organizations and processes in firms, thereby enhancing their efficiency (Falk & Hagsten, 2015).

Due to the high-volume, low-margin characteristics of the sector and net cost savings, online grocery sales (OGS) were expected to be the fastest-growing businesses online around the world. However, in early 2000, the optimism faded as many online grocery businesses failed to make money and experienced bankruptcy (Al Nawayseh & Balachandran, 2012). Today's shopping trends reveal that e-commerce of groceries is growing rapidly again from its small base. The total market volume of OGS is projected to reach more than USD 267 billion by 2021 in Europe (Singh, 2019). Compared to other commodities, like electronics, books, and clothing, grocery goods typically have low value-to-weight ratios, limited delivery time windows and shelf life limitations on perishable goods (Kurnia & Chien, 2003). Consumers are getting more comfortable ordering essentials and certain foods online. Although consumers may not be familiar buying fresh foods online yet, it is expected that this will change as trust in online grocery shopping grow (Businessinsider, 2019). Massive growth requires industries, brands and retailers to leverage an evolving set of skills and competencies to succeed (E-Marketer, 2019a, 2019b, 2019c).

The perishable nature of fresh produce is especially prevalent for seafood. Seafood spoils more rapidly than many other foods, and, thus, requires particular care throughout the supply chain (harvesting, post-harvesting handling, processing, preservation, packaging, storage and transportation) to maintain its quality and nutritional attributes, and avoid waste and losses (FAO, 2016).

To secure the availability of seafood products in the e-commerce supply-chain, specific demands, and traits in the different steps of the chain must be met (Figure 1). This implies a need to understand how the product quality is assessed with only visual information, how it is received and handled and finally how seafood bought online is experienced, to make



Figure 1. Illustration of the steps in a seafood supply chain.

good strategic choices. Further, these choices must be made on reliable economic judgements, to choose the best-suited packaging and transportation solutions that secure the quality of the seafood products throughout the supply chain and create an attractive position for the products online.

This review presents *the current status of knowledge on e-commerce trade of groceries and perishable foods and offers highlights of the different important aspects crucial for trading quality seafood in e-commerce channels*. Even though the focus here is on seafood, it has relevance for all perishable food going through this channel. The paper is structured as follows. First, a description of the concept of e-commerce and what it includes is given. Second, a description of the methodology used in this review is presented. Third, the articles reviewed are divided into different factors related to consumers' online shopping, industrial marketing and economics, and processing and packaging – all relevant aspects in enabling successful trading of seafood through e-commerce.

Conceptual background

There is no consensus on the definition of e-commerce. E-commerce is defined, among other things, as all types of commercial transaction and business activities taking place over electronic online systems. For this review purpose we chose the definition given by OECD (2011) to be relevant:

The sale or purchase of goods or services conducted over computer networks by methods designed for the purpose of receiving or placing of orders. The goods or services are ordered by those methods, but the payment and the ultimate delivery of the goods or services do not have to be conducted online.

This definition is limited to sales transactions happening over the Internet through platforms developed for receiving and placing orders, and includes transactions between companies, households, individuals, governments, or other organizations, and excludes orders performed through phone, fax, or e-mail.

E-commerce concerns alternative channels in which firms can interact with their customers and enter new markets (Falk & Hagsten, 2015). This includes business-to-business (B2B) and business-to-consumer (B2C), both domestic and across borders. At the beginning of e-commerce sales there were mostly B2B platforms, which were later expanded with more B2C platforms. Today, sales with a seamless combination of offline and online platforms, omnichannels, have become more common in B2C (Wang & Ng, 2018). In omnichannels products can be evaluated on- or offline and bought either places at the customers convenience. About 85% of Chinese people do their shopping through omnichannels (McKinsey, 2017).

Table 1. Overview of the search words for the different disciplines.

Consumer marketing	Industrial marketing	Industrial economics	Processing and packaging
Consumer	Marketing channel	Distribution	Preserved food
Customer	Marketing strategy	Trade	Processed food
Shopping	Management	Market access	Distribution chain
Store	Supply chain	Business models	Packaging material
Retail	Competitive advantage	Adoption	Food quality
	Strategy	Business	Seafood quality
		Strategy	Seafood safety
		Vertical integration	
		Market power	
		Profitability	

Methodological approach

This review is based on a study of journals across disciplines. The cross-disciplinary approach was found very important to solve our research problem under scrutiny. By including a review of research conducted on e-commerce of seafood in relation to consumers' perceptions, industrial marketing and economics and processing, one attains an overview and a broader perspective of the existing research, and reveals a lack of research on several aspects relevant to success.

Conference proceedings, master's theses, doctoral dissertations, textbooks, and unpublished working papers are excluded, due to the size of the task. The aim, as previously mentioned, is to review literature on e-commerce, or online shopping, that is relevant for e-commerce of seafood. To secure thematic cohesion across the involved disciplines, a specific set of search words are used in combination with the specific search words for the different disciplines (industrial marketing and economics, consumer marketing, packaging, and processing). The search words used to cover our targeted areas are: "e-commerce," "electronic commerce," "online shopping," and "on-line shopping" combined with "food" or "seafood" or "grocery" or "groceries." See [Table 1](#) for an overview of the search words used for the different disciplines.

The search was made in 34 different databases (see [Supplementary Appendix 2](#)), finding more than 2575 scientific papers. The databases chosen are specialized in the different fields and index many more references within its field than for instance Web of Science (WoS). Due to the dynamic nature of, and rapid changes happening in, the e-commerce business, and the vast number of papers found, the time-period was limited to 2010–2019. A content analysis of all abstracts found 38 relevant consumer papers, 48 on industrial marketing and industrial economics, and only two on processing and packaging. The limited number of relevant papers made us conduct an additional search in google scholar to control our findings. The relevant new articles were then included. A summary of the main

findings for the different topics is presented in more detail below. The research gaps revealed in the review are then discussed for the future development of global e-commerce of seafood.

Review of literature on e-commerce of food products

Consumers' online food shopping

The literature search on consumers' perception of online grocery shopping (OGS) resulted in 390 papers that were published between 2010 and 2019. Thirty-eight of these papers were found to be relevant for this review, and an additional four papers were found using an additional Google Scholar search employing the same search words. Thus, the review on consumers is based on 42 papers. Fourteen of the reported studies were conducted in China (six papers), the United States (four papers), and the United Kingdom (four papers) (see [Supplementary Appendix 1](#) for an overview of all papers and main findings). Our content analysis found that consumer behavior, trust, loyalty, convenience, and segmentation are recurrent themes in the literature, and will be discussed further.

Consumer on-line shopping practices

Online grocery shoppers make larger orders than consumers who buy their groceries in physical stores (Wang, Malthouse, & Krishnamurthi, 2015). They also buy healthier food products than offline customers (Huyghe, Verstraeten, Geuens, & Van Kerckhove, 2017). The explanation is that online channels present products symbolically, whereas offline stores present them physically, which fuels consumers' desire to seek instant gratification, which may lead them to purchase unhealthy foods (Huyghe et al., 2017).

Online grocery customers tend to habitually buy products that they have purchased before (Wang et al., 2015). Online grocery retailers, therefore, need to be aware that launching new products or promoting products that require more consideration during the buying process may not be suitable for online platforms.

Smartphones are increasingly used for grocery shopping by consumers (Wang et al., 2015). Thus, the information on, and design of, web pages need to fit this platform. Lee, Jeong, Cho, Jeong, and Moon (2015) predict an increase in T-commerce, which allows shopping through smart TV. Consumers who are used to buying groceries online and trust online retailers are more willing to buy food through T-commerce (Lee et al., 2015).

Trust and loyalty

There is a consensus in the literature that consumer trust should be a top priority among online food retailers (Faraoni, Rialti, Zollo, & Pellicelli Anna, 2019). When a retailer manages to build trust with the consumers, the latter are more likely to be satisfied with the online distribution channel and stay loyal to the retailer (Sreeram et al., 2017). Satisfied customers are more likely to recommend the online retailer to friends and family, and may help recruit new customers (Kian, Pei, Loong, & Fong, 2019; Moreira, Chauvel, & Silva, 2013). It has been argued that consumers' affective commitment to the online retailer is important for their loyalty (Faraoni et al., 2019). One approach to increasing affective commitment is to establish a relationship between the retailer's delivery personnel and their customers (Alamelu & Meena, 2015).

Some literature indicates that consumers tend to be less loyal to online retailers since the Internet eliminates the geographical boundaries from buying groceries (Dawes & Nenycz-Thiel, 2014). On the other hand, consumers tend to be more loyal to brands when they shop for groceries online than offline (Anesbury, Nenycz-Thiel, Dawes, & Kennedy, 2016; Chu, Arce-Urriza, Cebollada-Calvo, & Chintagunta, 2010). Mass marketing to build brand awareness may be even more important to food producers if they want to be successful in the online market (Anesbury et al., 2016).

Control. Building trust is found to depend on an online retailer's ability to reduce risk for its customers (Huang, Feng, & Yan, 2014; Seitz, Pokrivčák, Tóth, & Plevný, 2017; Moreira et al., 2013; Mortimer, Fazal e Hasan, Andrews, & Martin, 2016; Wang & Somogyi, 2018; Yue, Liu, & Wei, 2017). However, it is worth noting that Chin and Goh (2017) did not find that trust, financial risk, time risk, privacy risk or security risk had any effect on consumers' attitude toward OGS.

Consumers are also found to be reluctant to buy fresh food products online since they are not able to touch, smell or view the products to determine their quality (Alamelu & Meena, 2015; Kim & Kim, 2019; Rogus, Guthrie, & Mancino, 2019; Schnellbacher, Behr, & Leonhäuser, 2015; Seitz et al., 2017). The online grocery retailer must assure the consumer that its products are of high quality and make the customer feel they are in control (Blasco Lopez, Recuero Virto, & San-Martín, 2018; Kim and Kim, 2019; Rogus et al., 2019). Developing easy and efficient return systems is found by Schnellbacher et al. (2015) to be one way of making the customer feel they are in control of the buying process.

Product information. It is considered important that the online retailer provides transparent and reliable information about its products, such as

nutritional value (Zou & Liu, 2019), origin (Blasco Lopez et al., 2018), production methods (Wills & Arundel, 2017) and labels (Gumirakiza & VanZee, 2018), as well as suggesting recipes and preparation methods (Rogus et al., 2019; Tukkinen & Lindqvist, 2015). Photographs should be both informative and appealing (Blasco Lopez et al., 2018). Making unedited consumer reviews of the online retailer and its food products available, as well as product ratings on the web page, is found to create trust (De Kervenoael, Elms, & Hallsworth, 2014; De Kervenoael, Hallsworth, & Elms, 2014; Heng, Gao, Jiang, & Chen, 2018; Lin, Ortega, & Caputo, 2019). Retailers should encourage the customers to write reviews that focus on intrinsic attributes, such as smell and appearance, rather than subjective descriptions such as likes and feelings (Heng et al., 2018). Being able to chat with the retailer to ask questions is also found to be important in replacing physical presence in the store and building trust (Faraoni et al., 2019).

Delivery. Customers are found to expect the same reliable delivery of food groceries as non-food products (Goethals, Leclercq-Vandelannoitte, & Tütüncü, 2012; Kim & Kim, 2019; Seitz et al., 2017; Yeo et al., 2017). Thus, reliable delivery systems are crucial to maintain trust with the customers (Seitz et al., 2017; Zaini et al., 2011). If deliveries do not match their expectation, customers are most likely to avoid OGS in the future (Bauerová, 2018; Harris, Dall'Olmo Riley, Riley, & Hand, 2017; Mortimer et al., 2016). Some studies reveal that some markets, such as France (Goethals et al., 2012), Malaysia (Zaini et al., 2011), and the Czech Republic (Bauerová, 2018), are more reluctant to pay for home delivery than other markets. Seitz et al. (2017) found that Germans are willing to pay for home delivery, but not for collection at pickup points. Schnellbacher et al. (2015) found that home delivery was preferred for non-perishable foods and drinks, whereas pickup points were preferred for fresh products.

Convenience

Research shows that consumers need to perceive OGS as more useful and convenient than shopping in traditional stores (Bauerová & Klepek, 2018; Chin & Goh, 2017; Gunawan, Saleha, & Muchardie, 2018; Harris et al., 2017; Rong-Da Liang & Lim, 2011). The utilitarian aspects of online shopping are important, even for hedonic products such as wine (Habann, Zerres, & Zaworski, 2018). Notably, Kian et al. (2019) did not find a significant relationship between ease of use and intention to buy groceries online. Faraoni et al. (2019) found that websites need to be easy to use, but the design is not as important for customer satisfaction as many may think.

The product range should be large enough to make it possible to buy most of what one needs at one retailer (Sreeram et al., 2017), and navigation through the website to find the preferred products needs to be done quickly to save time (Zaini et al., 2011). Reusing digital shopping lists is found to be one way of making shopping more efficient (Rogus et al., 2019). In addition, online shopping needs to be perceived as fun and enjoyable to make customers feel satisfied (Chin & Goh, 2017; De Kervenoael, Elms, et al., 2014; De Kervenoael, Hallsworth, et al., 2014; Yeo et al., 2017).

Market segments

There appears to be consensus that consumers who are quick to adopt and prefer OGS tend to be married young adults, aged 30–40, with a medium to high income, and a high level of education and job position (Bryła, 2018; Gunawan et al., 2018; Habann et al., 2018; Harris et al., 2017; Sayılı & Büyükköroğlu, 2012; Wang & Somogyi, 2018). These consumers emphasize the utilitarian aspects of OGS such as saving time, money, and convenience, even for hedonic food products such as wine (Habann et al., 2018; Wills & Arundel, 2017). Which gender most uses OGS seems to be culturally conditioned since women are the largest consumer group in Germany (Schnellbacher et al., 2015; Seitz et al., 2017) and men in China (Huang et al., 2014).

Immigrant women with a low income and education level and older consumers may lack the technological skills to order groceries online (Schnellbacher et al., 2015; Seitz et al., 2017). Older consumers, known as “silver surfers,” and disabled people only view online shopping as beneficial if they have reduced mobility (Elms & Tinson, 2012; Seitz et al., 2017). They value the social aspects of traditional shopping and feel that OGS may make them feel more isolated.

Rong-Da Liang and Lim (2011) are the only ones to divide online consumers by psychological characteristics. They found that consumers who order specialty foods online can be divided into two categories: “traditional consumers”—consumers who pay attention to the opinions of others and spend more time browsing websites to acquire information on specialty foods—and the “adventurous and health conscious,” represented by consumers that are younger than the other group and enjoy tasting new foods, spend less time browsing and buy specialty foods more often online.

Industrial marketing and economics in e-commerce

The review of the literature involving industrial marketing and industrial economics revealed several overlapping results and topics. The review of topics related to industrial marketing and business strategy revealed 828

scientific papers. For industrial economics, 1133 references were found by the search engine. In the following section, the relevant results for both industrial marketing and industrial economics are presented together as several results and topics intertwine. In total, 48 articles were found to be relevant. No literature was found focusing directly on e-commerce of seafood. The articles focus on e-commerce of (fresh) food or groceries, competitive aspects, or aspects related to e-business models.

E-business models and strategy

The most current research theme is different aspects of the e-business model, both challenges related to the business model and what model to choose. One study conducted in India looked at the factors influencing grocers' intention to participate or not in online grocery retailing. The study showed that the grocers believed that partnering with e-commerce grocers would lead to a loss of control (Kureshi & Thomas, 2019).

Three out of a total of 10 papers on e-business models address the specific challenges related to this business model, selling fresh produce online (Lingyu, Lauren, & Zhijie, 2019; Wang et al., 2015; Zhang, 2016). The most pertinent challenge is for fresh food, or other perishable foods like seafood, whether frozen, fresh or alive. Zhang (2016) lists the following problems for fresh food e-commerce: large product losses, high distribution costs, non-standardization of products, and a lack of user experience with the channel. The high distribution costs occur as the food must find the customer, and not the other way around. This creates the need for a "longer" cold chain infrastructure, maintaining the quality of the products until they reach the customers. China is one of the most advanced e-commerce countries; however, infrastructure for cold chain products is still lacking. This challenge is highly relevant for the seafood industry. Wang et al. (2015) found that e-commerce infrastructure for on-time delivery needs to be combined with government regulation and heavy investments to create an attractive position for the e-business model. Lingyu et al. (2019) point to the bottlenecks in two different e-commerce solutions: Alibaba's "Fresh Hema" and Amazon's "AmazonFresh." The focus on operational improvements is due to the businesses' challenge of economic profitability. Home delivery, also referred to as "last-mile" delivery, increases costs compared to the traditional grocery store. E-commerce distribution is either home delivery or via the use of pickup points. The population density guides this choice, as highly populated areas are easier for home delivery in terms of efficiencies related to costs and the challenge for customers to reach stores (Lingyu et al., 2019). The authors also point to cultural differences as being relevant for the choice of an e-business model. The AmazonFresh model, without physical stores, can work in markets where the customer is not

insistent on picking their own fresh produce. However, this is not entirely possible in cultures where they prefer to personally pick their food items, to ensure the quality.

Seven out of 10 papers discussed the omnichannel or multichannel strategy (Breugelmans & Campo, 2016; Campo & Breugelmans, 2015; Hsiao & Chen, 2014; Hübner, Kuhn, & Wollenburg, 2016; Verhoef, Kannan, & Inman, 2015; Wang et al., 2015; Wei, Asian, Ertek, & Hu, 2020). An omnichannel (OC) strategy means that a (grocery) company reaches its customers through several channels, where the different contact points with consumers are seamlessly integrated, thus allowing customers to switch across devices and channels in a seamless shopping experience (Verhoef et al., 2015). It could be that a grocer has both traditional and online stores and reaches the customer with promotions through app or e-mail, where finally the customer choose how and where to shop and move seamless between these. It is a strategy deployed by large Chinese e-commerce players like JD and Alibaba. A multichannel strategy could be a food producer that continues to sell through established distribution channels as well as through their own web shop, but also for established grocers like Carrefour. Verhoef et al. (2015) gives a more in-depth explanation of how retail is moving from a multichannel strategy, where the channels are not seamlessly integrated, to an omnichannel strategy.

Studies have mostly focused on how to optimally organize the supply chain and logistics, the internal resources necessary for operating in several market channels and how the consumers divide their shopping across channels, to support retail managers' strategic choices. The biggest difference between traditional and online sales is the last-mile delivery, which is a common term and includes two major operations: back-end fulfillment and delivery of groceries bought online. Hübner et al. (2016) describe the different strategic choices that must be made for these two operations and found that to achieve success, grocers need to make choices that create an appropriate, scalable, and cost-efficient fulfillment and delivery system. Doing so depends on the internal and external resources of the company, as well as country and customer specifics (Hsiao & Chen, 2014; Wei et al., 2020). Wang et al. (2015) found that the optimal time for establishing an online store is dependent on consumers' rate of switching from physical store to e-store and on the urbanization rate.

To allocate category content across channels, managers must consider how consumers' choices are affected by assortment availability, price differences, promotion differences, in-store stimuli, perceived purchasing risk, shopping convenience and online buying experience (Breugelmans & Campo, 2016; Campo & Breugelmans, 2015).

A study on food producers found that producers either facilitate their own sales channel or sell their products through retailers, and that the

former steals demand from the retailers' traditional channel. This indicates that once customers go online, they are more likely to do so again and further go directly to the source and not necessarily stay loyal to the retailer (Hsiao & Chen, 2014).

Competitiveness and profitability

One central theme is the overall factors necessary for success in e-commerce: either sustainable competitive advantage (Aribawa, 2016; Čiarnienė & Stankevičiūtė, 2015; Schubert, Williams, & Woelfle, 2011) or key success factors (KSFs) (Annunziata & Vecchio, 2013; Bodini & Zanolli, 2011; Colla & Lapoule, 2012). Also, some take a closer look at pricing strategy (Cameron, Gregory, & Battaglia, 2012; Cho & Sagynov, 2015; Leong, 2013) and factors affecting profitability (Cleophas & Ehmke, 2014).

A study on a French grocery chain with pickup points showed relationship marketing, purchasing and logistics solutions as KSFs (Colla & Lapoule, 2012). To succeed online, it is important to provide easy-to-navigate websites with meaningful customer interaction, visual and meaningful communication of quality in the web shop, large product variety and avoidance of stock shortages along with time-saving distribution systems (Bodini & Zanolli, 2011; Colla & Lapoule, 2012; Cho & Sagynov, 2015). Overall, it is important to have a specific e-commerce strategy with a strong brand and focus on customer needs (Annunziata & Vecchio, 2013).

According to Čiarnienė and Stankevičiūtė (2015), e-commerce competitiveness is decided at three interrelated levels: company level (e.g. financial and operational capability, market share), industry level (e.g. competition, innovativeness, productivity) and country/global level (macroeconomic, sociocultural, market, technological, and governmental factors). Factors that enabled a sustainable competitive advantage in e-commerce for a pioneer in online groceries focused on the operational processes, the internal processes that they controlled for continued efficiency (Schubert et al., 2011). Further, the e-grocer focused on continued innovation with cautious investment decisions, and despite trials and errors, they continued developing their system and stayed true to the strategy. Along the way they have relied on a strong partner network. An interesting point in the study is that a web shop is not a source of competitive advantage, it is the invisible assets and operational processes behind it that create the advantage (Schubert et al., 2011). A study on the strategic e-commerce opportunities in Indonesia found that to be competitive and attractive, companies must provide a high-quality interface and ordering system for their customers that is fit for mobile technology, and rapid delivery options (Aribawa, 2016). Success is also dependent on an equivalent back-ordering system for logistics, warehouse supply and delivering, with global cooperation in the

supply chain. Further, the study showed that e-commerce success depends on a marketing strategy, with the adoption of local customs in different markets. As regards the external environment, further growth and development of the channel also depends on having surrounding laws and regulations that facilitate buyers' trust in the safety of purchasing online (Bernal & Martínez, 2013). This would increase demand and positively impact the channel's competitiveness relative to traditional shops.

Different pricing strategies are often used to attract customers and gain a competitive advantage over rivals. With the lower cost of searching promotions online compared to offline, one can expect this to be of even greater importance in e-commerce. Cho and Sagynov (2015) find that online stores are more likely to be perceived as useful by consumers if their products are sold at lower prices than through traditional channels. They further state that price sensitivity appears to be higher among consumers in online channels due to the relatively easy comparison of prices between sites and the additional cost of delivery fees. However, price variation exists for online groceries despite relatively low search costs, and it is proposed that this is in accordance with the price-quality relationship (Leong, 2013). The retailers' randomized pricing strategies indicate that, despite low search costs online, it is difficult to attract customers. The studies on sustainable competitive advantage and KSFs do not mention price as a factor, and studies on the effect of pricing indicate that pricing is not a sufficient tool, but dependent on other factors that might be more important.

Profitability is an important criterion for most businesses considering investing time and resources in a new market channel such as e-commerce. To increase profitability in home deliveries, e-commerce retailers should attempt to maximize the value of fulfilled deliveries while minimizing delivery costs (Cleophas & Ehmke, 2014). One potential way to achieve this is to estimate future transport capacity by forecasting expected delivery requests and calculating a cost-minimized routing. Retrieved delivery requests can then be accepted or declined based on transport capacity and each delivery's effect on the value and costs of each trip (Cleophas & Ehmke, 2014). However, such a model should then also take into consideration the long-term value of individual customers and not just single-purchase value (Cleophas & Ehmke, 2014).

Logistics and supply chain management

E-commerce allows both producers and consumers to sell or buy across larger geographical areas than before (Wiengarten et al., 2011). This expansion of the marketplace in both time and space, however, requires a well-functioning logistic system connecting the buyers and sellers, and an overall well-functioning system for managing the supply chain from production to

consumption. This is especially true with fresh food products where careful handling and efficient distribution are essential factors (Yan & Shizhen, 2018). Our review of the e-commerce literature found 10 papers published after 2010 on the topics of logistics and supply chain management that were also aimed against the fresh food industries.

On logistics systems, topics include the challenges of delivering food from the producer all the way to the consumer, while preserving its quality and remaining cost-efficient (Mkansi, Eresia-Eke, & Emmanuel-Ebikake, 2018; Yan & Shizhen, 2018), factors that affect the system (Emeç, Çatay, & Bozkaya, 2016; Pan, Giannikas, Han, Grover-Silva, & Qiao, 2017) and efficiency challenges (Zissis, Aktas, & Bourlakis, 2018). Some also explore the optimal logistics system when operating with two (or more) business models (Chen, 2013; Hübner et al., 2016; Marchet, Melacini, Perotti, Rasini, & Tappia, 2018; Zissis et al., 2018).

One recurring area of study is the last part of the logistics chain, the so-called “last mile” from the seller to the consumer’s doorstep (Emeç et al., 2016; Hübner et al., 2016; Pan et al., 2017; Zissis et al., 2018). Pan et al. (2017) examine the possibility of improving the efficacy of home delivery of e-groceries through customer-related data, more specifically electricity consumption data. The authors point out that a high proportion of home deliveries fail due to the absence of the customer when the delivery is being made. By analyzing data on electricity consumption, they calculate the customers’ probability of being home at any given time, with the goal of improving the delivery success rate. The results show a potential reduction of travel distance by 3–20% and a delivery success rate increase of 18–26%. With their approach, there is the potential for reducing the carbon footprint, increasing the efficiency, and reducing the costs connected with home delivery.

Yan and Shizhen (2018) analyze fruit cold chain logistics and the customer experience of e-commerce in China. According to the authors, in the context of fierce competition among e-grocers, it is imperative for e-retailers to provide the best cold chain logistics system to gain market share. They observe a strong link between the consumers’ perceived risk in purchasing fresh fruits online and their perceived usefulness of this market channel.

One central topic in the literature is the identification of specific logistical challenges facing companies going into e-commerce, and different models for meeting them (Guo, Wang, Fan, & Gen, 2017; Hübner et al., 2016; Mkansi et al., 2018; Marchet et al., 2018). Mkansi et al. (2018) sort the challenges into three broad categories: (1) managing inventory, (2) balancing supply and demand, and (3) managing roles and responsibilities. In their study, the third category is found to hold the largest amount of

challenges, where particularly the need for specialist skills and reliance on few people are identified as challenging factors. The need to always have the product available in stock is another specific challenge identified. This can be particularly challenging for fresh produce with a short shelf life. Most retailers wish to keep inventory levels as low as possible to reduce costs, and with fresh groceries, large inventories are normally not even an option. The retailers also mention the cost of providing substitutes in cases of out-of-stocks. Usually, the substitute will be priced higher than the requested article, a loss the retailer must then carry to avoid charging the customer more than the original price.

Two papers look at logistical challenges in following an omnichannel (OC) strategy (Hübner et al., 2016; Marchet et al., 2018). Hübner et al. (2016) divide the planning process into back-end fulfillment (warehousing) and “last mile” order fulfillment (delivery). They list possible pros and cons connected with different models and show that which model the OC grocers choose is dependent on country specifics (e.g. population density), customer specifics (e.g. possibility of unattended home deliveries), and retailer specifics (e.g. capability for process integration across channels). Through studying 92 Italian companies, Marchet et al. (2018) identify 11 logistics variables divided into four strategic areas: 1. delivery service, 2. distribution setting, 3. fulfillment strategy, and 4. returns management. Based on these categories, the studied companies are classified into four clusters of business logistics models. For companies involved in food manufacturing, they find two distinct models being used: the separated model and the integrated warehousing model. The former treats online warehousing and distribution separately from traditional sales (drawing from specialization), while the latter combines the two activities in one location (drawing from synergies). Food manufacturers often offer home delivery, but within a time frame of two or more days. For companies in food retail they identify what they call the “store-based model.” Here, online, and traditional sales are combined in one location, with “click & collect” being the most common form of delivery. For those that do home delivery, this is commonly done the same day, and only locally. In nonfood retail they find what they call the “multiple-configuration model,” where companies in general are more flexible with regard to delivery mode (pickup, delivery etc.), delivery time and storage options (e.g. both in-store and at separate locations).

Also covered by the literature is the topic of efficiency gains from having well-functioning supply chain relationships and from cooperating on logistics operations (Chen, 2013; Li, Xie, & Xu, 2019; Zissis et al., 2018). Chen (2013) uses sliced raw fish as a case study, traded in a supply chain consisting of a seafood supplier and a store in a large national retail chain. The author shows that in an online market with consignment, revenue-sharing

and a vendor-managed inventory between supplier and retailer, and where the supplier and retailer actively cooperate, the retail prices tend to be lower. Also, stock quantities and channel efficiency tend to be higher, and both supplier and retailer enjoy higher profits. In contrast, in the case of traditional markets without cooperation, retail prices tend to be higher while overall channel profits are lower. Zissis et al. (2018) also identify potential benefits from cooperation. They propose a collaborative logistics model as a way of reducing the economic, environmental, and social costs of logistic operations without reducing the service level. They find that retailers who cooperate and pool distribution resources could save more than 10% of travel distance and 16% of delivery time. One obvious benefit from cooperation would be avoiding different companies visiting the same area at the same time, since these companies can have their product delivered by the same vehicle instead.

Li et al. (2019) find that most of the existing research relating to online shopping focuses on customers' purchase intention and loyalty, and that analysis of other factors influencing online food shopping is lacking. Through a study of 145 online food businesses in China they find that the quality of the relationship between the chain actors affects information sharing, service quality in logistics and supplier management both directly and indirectly.

Adoption and adaptation of e-commerce

Another central topic in the reviewed literature is factors affecting the adoption and diffusion of e-commerce technology (Cagliano, De Marco, & Rafele, 2017; Cagliano, De Marco, Rafele, Bragagnini, & Gobbato, 2015; Kurnia, Karnali, & Rahim, 2015; Kurnia, Choudrie, Mahbubur, & Alzougool, 2015), and how adoption of these technologies might influence the relationship among actors in the supply chain (Barile, Polese, & Sarno, 2018; Canavari, Fritz, Hofstede, Matopoulos, & Vlachopoulou, 2010; Wiengarten et al., 2011). These subjects are touched upon in eight papers. The factors affecting adoption will vary across industries and countries (Kurnia, Karnali, et al., 2015; Kurnia, Choudrie, et al., 2015).

Among producers, consumers and retailers in the fresh food e-groceries sector, the diffusion of mobile services supporting supply chain management (SCM) is found to be driven by the services' efficiency and reliability (Cagliano et al., 2015). The possibility of product traceability, mobile payment and time-based delivery management functionalities further contribute to the adoption of such SCM mobile applications (Cagliano et al., 2017).

Two papers look at factors affecting e-commerce adoption in developing countries (Kurnia, Karnali, et al., 2015; Kurnia, Choudrie, et al., 2015).

Kurnia, Choudrie, et al. (2015) investigate which factors affect B2B e-commerce adoption in the grocery industry supply chain of Indonesia. The impact is investigated in the context of technological, organizational and environmental factors (TOE framework) complemented by four adoption theories (diffusion of innovations theory, resource dependence theory, institutional theory and national culture theory). Their findings show that in the technological context, the most important factors affecting adoption are perceived benefits, compatibility, and costs of technologies. In the organizational context, size and resources, top management support, organizational structure and culture, and expertise/human resources are the most important factors for adoption. In the environmental context, adoption is mainly affected by industry structure, national culture, government regulations, and supporting infrastructure. The authors underline that this study is performed on a single developing country, and that there are multiple social, cultural, economic, political, legal, and technological conditions that influence the relative importance of different adoption factors across countries. One such condition might be the price of technology investments relative to labor, which is found to be quite high in their case study of Indonesia. In a similar study, Kurnia, Karnali, et al. (2015) investigate the influence of organizational, industry and national readiness on B2B e-commerce adoption among SMEs in the grocery retail industry in Malaysia. Their findings show that the overall most important factor for adoption is the perceived environmental pressure, e.g. adoption among trading partners and competitors. However, organizational resources and governance, perceived benefits and supporting services are also found to affect adoption among the SMEs.

Wiengarten et al. (2011) uncover some potential synergy effects throughout the supply chain. They find that the value of a company's e-commerce technology increases significantly when its suppliers have also adopted similar technology. Barile et al. (2018) look closer at how technology adoption in grocery retailing and developments in the production industry can be matched for better value co-creation. Thereby implying that manufacturers, distributors, and retailers both horizontally and vertically must co-create to compete for the customers' attention. They stress how this will demand a deep transformation of how business is run today, which will put even further strain on those playing for margins.

Trust is an important factor in relationship building between buyers and sellers in online markets (Canavari et al., 2010; Cho & Sagynov, 2015). Canavari et al. (2010) show how e-commerce and the use of web services can be positive for trust building by improving the access to information about products, markets, and companies. This in turn will have a positive effect on the adoption of these technologies and of e-commerce as a trading platform.

External impacts of increased e-commerce

A total of 12 papers review the external impacts of e-commerce, with environmental concerns being the main topic. Especially well addressed is the topic of carbon emissions from online retailing in comparison to traditional retailing (Edwards, McKinnon, & Cullinane, 2010, 2011; Van Loon, McKinnon, Deketele, Dewaele, 2014) and the carbon footprint of the “last mile” from shop to consumer (Belavina, Girotra, & Kabra, 2017; Ding & Jin, 2019). Additionally, when zooming in on the groceries sector, food waste also becomes an important environmental concern (Belavina et al., 2017; Carrillo, Vakharia, & Wang, 2014). In addition to the environmental aspect, some authors also study other external impacts of e-commerce, such as its impact on SMEs (Ramanathan, Ramanathan, & Hsiao, 2012), international trade and employment (Terzi, 2011), labor productivity growth (Falk & Hagsten, 2015) and other macroeconomic factors (Cardona, Duch-Brown, Francois, Martens, & Yang, 2015). These studies, however, are more general in scope than most of the literature covering environmental concerns, and their direct relevance for e-commerce of sea-food is less obvious.

In recent years, there has been a growth in the literature focusing on the environmental cost of logistics surrounding e-commerce. Mangiaracina, Marchet, Perotti, and Tumino (2015) perform a literature review on the environmental sustainability of logistics operations in the context of B2C e-commerce, covering 56 papers published in the period from 2001 to 2014. The review shows a shift “... from the mere identification of the wide-ranging environmental effects of e-commerce to the need for a quantitative evaluation of their impact...” over the studied period. From the study, four main areas are identified as sources of environmental impact: (1) transportation planning and management, (2) warehousing, (3) packaging, and (4) distribution network design. Moreover, the authors identify energy use, gas emissions, waste generated and traffic mileage as four main types of indicators that can be used to assess the environmental impact of logistics operations.

Ding and Jin (2019) address the possibility of higher carbon emissions with e-commerce business models, especially with retail products that have a high-frequency purchase rate such as food, as it may be that the current distribution through physical shops is more efficient in terms of carbon emissions. In some cases, the different types of environmental impacts also need to be weighed against each other. This is done by Belavina et al. (2017), who compare two revenue models for online grocery retailing: a preorder model where customers pay separately for each home delivery, and a subscription model where a set fee is paid yearly for an unlimited number of home deliveries. Their results show that the subscription model

incentivizes smaller and more frequent orders. This in turn reduces food waste since the customer can more easily adjust their purchasing to their consumption from day to day. At the same time, delivery-related emissions increase in this model since more trips must be made. Through estimation, the authors conclude that the subscription model is environmentally preferable since the higher delivery emissions in most cases are outweighed by the reduction in food waste emissions.

Two papers look at the link between retailer channel choice and consumers' environmental concerns (Carrillo et al., 2014; Ji, Zhang, & Yang, 2017). Higher environmental awareness among consumers is shown to be positively correlated with the propensity to buy products online (Carrillo et al., 2014). However, for the grocery sector, findings suggest that the environmental cost could in fact be higher for online sales than traditional sales, due to high perishability and the necessary refrigeration capabilities for delivery (Carrillo et al., 2014). Ji et al. (2017) find that the introduction of an online channel is profitable when the carbon sensitivity of consumers is beyond a certain threshold.

Processing, packaging, and traceability

The assortment of seafood products available in the traditional marketplace today is comprehensive, ranging from live to fresh and mildly to heavily processed (e.g. canned seafood). These products are now being offered through many of the existing e-commerce channels both as frozen and fresh products. For traditional seafood trade, a large quantity of literature and guidelines is available on processing, packaging and distribution (Codex Alimentarius, 2012; European Food Safety Authority, 2015; Tsironi & Taoukis, 2018; Yu et al., 2020), focusing on both quality and safety. The literature search (see Table 1) revealed a total of 224 scientific papers. However, only two of these discussed e-commerce of different food products and mentioned challenges related to the processing and packaging of the products sold online, and only one described specifically e-commerce of seafood.

Singh, Gaikwad, and Lee (2018) reviewed methods that provide better control of cold temperature during the transport of fresh products sold online. Their focus was the use of phase change materials (PCMs), i.e. technology that can maintain package temperature by switching the stage of a PCM from liquid to solid or vice versa. While positive effects on temperature control were obtained, some technical aspects like high surface to volume contact with the food still need more research. Hungria et al. (2017) presented an overview of the worldwide market for soft-shell crabs and discussed the challenges related to the value chain of such

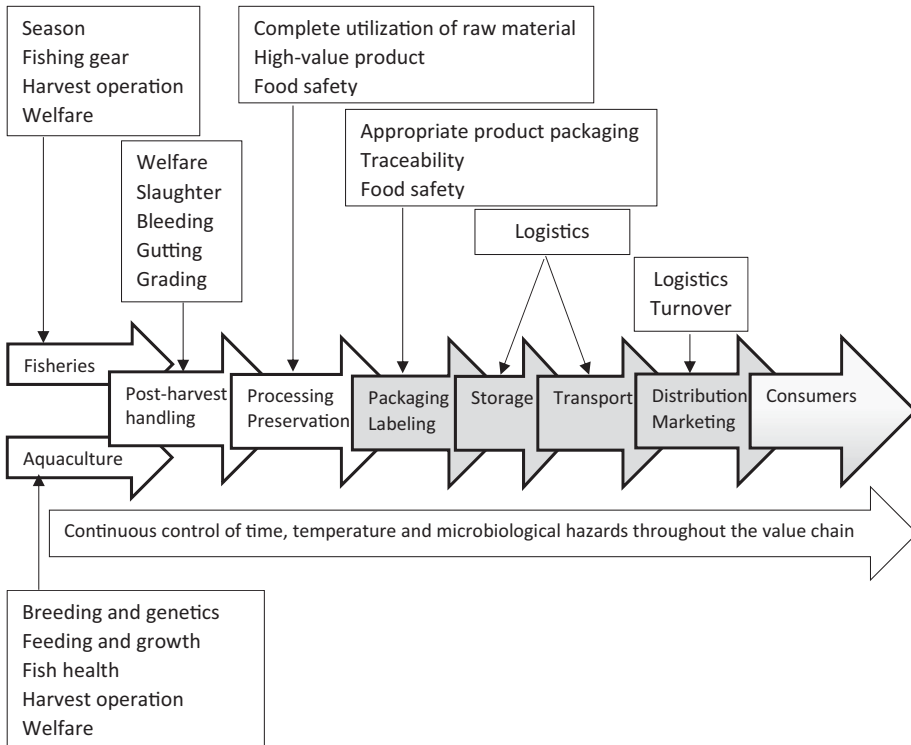


Figure 2. An overview of the seafood supply chain and the different steps and factors that may influence the seafood quality. The gray-colored arrows represent the steps in the supply chain with big potential for innovation related to e-commerce of seafoods.

crabs. Over 70% of commercial-scale crab production is based on capture-based aquaculture, where the wild-caught animals are stored until processing. Natural stocks are strongly affected by climatic and environmental changes, as well as uncontrolled commercial fishing. This leads to large variations in the seasonal supply and the commercialization of crabs. Crab aquaculture, which could solve the dependence on natural stocks, is still under development. However, e-commerce of soft-shell crabs has become increasingly more important in the industrial market, where import and export of crabs occur worldwide. Crabs are sold as fresh, frozen, or processed product, thereby requiring a complex structure of logistics for long-distance distribution and well-established food safety management systems.

The perishable nature of seafood and the complexity in the seafood supply chain with various processing steps make e-commerce of seafood products challenging even compared to other perishable products (Figure 2).

In addition to the primary search, 20 relevant papers were found through a Google Scholar search emphasizing different aspects of processing, packaging,

and traceability, which will be highly important for succeeding with e-commerce of seafood.

The seafood products must be managed appropriately in every step of the supply chain to maintain good quality, nutritional attributes, and safety. A strict hygienic processing combined with low storage temperature throughout the chain will increase the total shelf life and the period of superior quality and reduce food losses (Ndraha, Hsiao, Vlajic, Yang, & Lin, 2018). Among the different seafood species utilized, some factors are more difficult to control, such as seasonal or quality variations in single catches.

Implementation of international regulatory frameworks commenced in the early 1980s when many countries engaged in reforming their fish inspection systems to implement preventive HACCP-based safety, including quality systems, and supporting hygiene and sanitary requirements (Valdimarsson, Cormier, & Ababouch, 2004). While there is strong evidence that the implementation of HACCP-based systems has contributed to improving fish safety and quality significantly, there has been growing awareness of the importance of, and need for, an integrated, multidisciplinary approach to safety and quality, taking the entire fish food chain into consideration (Ramundo, Taisch, & Terzi, 2016). The HACCP-based safety systems are mandatory for all producers and handlers of meat, poultry, fruit and vegetable products, and seafood, and are followed regardless of the types of sales or distribution of seafood, e.g. traditional trade, or e-commerce.

The implementation of a food chain approach requires an enabling policy and regulatory environment at national and international levels with clearly defined rules and standards. In addition, appropriate food control systems and programs at national and local levels, as well as the provision of appropriate training and capacity building, are needed. In contrast to traditional trade with the producer being responsible for the quality and safety of products until delivered to the groceries, e-commerce, e.g. the vertical B2C level of e-commerce, differs in that liability may extend further, until the consumer receives the product (Zhang et al., 2016). The producer has limited control of the products along the long distribution chains until they reach the consumer, and the risk of temperature fluctuations influences the quality and safety of seafood, especially of fresh products. Based on current legislation and guidelines, seafood products can be produced and dispatched from the manufacturer with good food safety and high quality. It is beyond this point that e-commerce has the biggest potential for innovations with transparent and well-documented control systems for the cold chain and traceability up to the consumer as indicated in [Figure 1](#).

Lachenmeier, Löbell-Behrends, Böse, and Marx (2013) found an absence of information in both scientific and marketing literature about food safety and policy aspects of e-commerce of foods. While traditional supermarkets could be regularly subjected to proper inspections, an online shop might lack such assessment. Food safety standards, often supplemented with traceability requirements, are an essential access requirement for the export of fish and fishery products to major consumer markets (Bellmann, Tipping, & Sumaila, 2016). Their findings showed, however, that food safety standards can present both challenges and opportunities for producers. Meeting public and private food safety requirements provides access to large markets but can require significant upfront investment in technology and processes by the fisheries industry, which may be a challenge for smaller producers.

Ramundo et al. (2016) presented available and applicable technologies along the food supply chain and created a picture of the added value that technology brings to the sector and future benefits related to internet of things (IoT) paradigm adoption. Smart packaging and smart labels are promising for securing product quality, monitoring the status of the product, and extending the product's shelf life. For instance, nanosensors may be used in product packages to recognize pathogens, measure pH and detect organic molecules. In addition, sensors allowing the monitoring of temperature, humidity, and levels of different gasses inside the transport chamber can at the same time send the signals to warehouses' management. Badia-Melis, Mc Carthy, Ruiz-Garcia, Garcia-Hierro, and Robla Villalba (2018) present an overview of different temperature-monitoring applications. They conclude that it is important to recognize that technology has a key role to play in improving the global cold chain of a sector driven by a need to reduce product waste and ensure produce safety in line with current global food security threats. However, as with all solutions, there exists no single "out of the box" solution because the composition of product, transport route, method of transport and process efficiency vary greatly across the globe. Adaptation is also possible, e.g. automated pickup terminals with different cooling zones, depending on the format of the seafood products (frozen or fresh) could be used to preserve the seafood products until delivery to the consumers (Lachenmeier et al., 2013).

Previous food scandals and enforced product recalls, e.g. the horsemeat scandal in Europe (Barbarossa, De Pelsmacker, Moons, & Marcati, 2016; Brooks, Elliott, Spence, Walsh, & Dean, 2017) and the *Escherichia coli* outbreak from fresh produce in Germany (Bitsch, Kokovic, & Rombach, 2014), have made food product traceability very important.

Research gaps and suggestions for future research

The literature review reveals several interesting findings and suggestions on important themes and factors important for e-commerce of perishable foods. The review also reveals some research gaps that will be important to explore in further research to improve the availability of highly perishable products such as seafood in e-commerce channels.

While there have been several studies concerning fresh foods, such as fruits, vegetables, and meat (Shi, Xie, & Han, 2018), remarkably few studies can be found discussing the status of e-commerce of seafood specifically.

Our review shows that thematically the different disciplines in the supply chain are at different stages of the commercialization process. Consumer studies and studies on logistics (industrial economics) are the furthest advanced, whereas little to none has been done on packaging (production technology) or processing (seafood quality), indicating research gaps.

The review of *consumer* studies revealed both methodological and empirical gaps in the literature. Of the 42 reviewed papers, only Wang and Somogyi (2018) discussed consumers' preferences for buying seafood, as one of several food categories, from online retailers. Given that fresh food sold through online channels are quite new in many markets, it is interesting that only four papers used qualitative methods to retrieve data for their studies (De Kervenoael, Elms, et al., 2014; De Kervenoael, Hallsworth, et al., 2014; Elms & Tinson, 2012; Moreira et al., 2013; Rogus et al., 2019). Thus, there is room for more qualitative exploration on this topic. Several papers discussed how retailers may build trust with their online customers (Chin & Goh, 2017; Huang et al., 2014; Moreira et al., 2013; Mortimer et al., 2016; Seitz et al., 2017; Wang & Somogyi, 2018; Yue et al., 2017), but we know little about what information and how it is communicated online contribute to increase trust in food products offered. It would also be interesting to investigate how online consumers can become emotionally involved in their seafood products (Alamelu & Meena, 2015; Faraoni et al., 2019). We also need to know more about the psychological characteristics of the different online consumer segments to tailor marketing communication for seafood products (Rong-Da Liang & Lim, 2011). The review reveals that we also know little about the older segments. None of the reviewed papers discuss the potential for, and barriers to, buying food online specifically for the elderly. Since this segment will become larger and develop better computer literacy skills (Długosz, 2011; Hargittai, Piper, & Morris, 2019), we believe they represent large potential for seafood producers to sell their products online.

The review of literature related to *industrial marketing and economics* revealed that a big challenge to making e-commerce a lucrative business is the expensive distribution costs involved in filling the "last mile" (Zhang

et al., 2016). A lack of efficient logistic solutions and customers' wish to see and evaluate products before purchasing them have been proposed as hindering growth. To help ease the logistic barriers it has been suggested that collaborative logistics (Zissis et al., 2018) and co-creation of technology innovation (Barile et al., 2018) can be beneficial to reduce economic, environmental, and social costs of the logistics operations. More research on how to manage and succeed with such collaboration and how to increase the quality of the relationships among the chain actors could improve service and reduce costs (Li et al., 2019). High-quality relationships and cooperation are of even higher importance in the distribution of perishable seafood, as seafood quality is highly dependent on how it is taken care of through the supply chain up to consumption.

The review also indicates a general lack of an e-commerce strategy in many businesses. To succeed with any e-commerce, you need to have a specific e-commerce strategy and a strong brand and market orientation (Annunziata & Vecchio, 2013), and this will need further research attention. Further research on the skills and competencies in management in the whole supply chain is needed to succeed with e-commerce (E-Marketer, 2019a, 2019b, 2019c).

With regards to *processing and packaging*, only two references had e-commerce or a similar expression in the article text. One reason may be that food safety and quality to a large extent will have the same requirements for processing whether traditional trade or e-commerce is used. It is in the distribution chain after production and packaging that innovations can be justified and make a future difference with tracking and delivery systems, including pickup points. These innovations for chilled distribution chains can be used in several food sectors, which may be instrumental in not obtaining many specific articles from the keywords "e-commerce" and "seafood."

To obtain food safety and quality management systems in e-commerce, several types of sensors will be put into practice. The timeliness of sensor information will increase, and the interoperability and thus end-to-end visibility of sensor data need to be improved. Also, more advanced remote control needs to be realized by implementing new actuators. Further, more intelligence needs to be added to the products to secure food safety and quality management, for example to provide early warnings in the case of food incidents, rescheduling in the case of unexpected food quality deviations and simulation of product quality based on ambient conditions (resulting in, for example, dynamic best-before dates) (El Sheikha & Xu, 2017; Ramundo et al., 2016).

This review reveals that there is a general lack of research attention focusing on e-commerce of seafood. The reasons for this may be manifold: the fact that e-commerce of perishable products is in its starting

phase, and with the expansion more research will follow; it may also be that research involving e-commerce of seafood does exist, but the research is conducted in Asian countries such as China and South Korea where the sales figures are higher, and this literature is not available because of language barriers.

The circulation of fresh produce in e-commerce has lagged behind because the cold chain infrastructure and logistics distribution system are underdeveloped, making unit delivery costs high for perishable fresh produce (Jin, Li, & Li, 2017). And we question whether that is the only way forward. Could it be that also changes with the products themselves to make them less sensitive to changes in logistics and lack of cold chains is an option as changing existing global logistics can be extremely costly.

With regard to future important topics, one can expect that the green wave, with the increasing emphasis on sustainability, reducing the carbon footprint and waste, will become much more prevalent in the research involving e-commerce. Several studies in the review have already looked at environmental concerns such as carbon emissions (Belavina et al., 2017; Ding & Jin, 2019; Edwards et al., 2010; Van Loon et al., 2014) and challenges with food waste (Carrillo et al., 2014). With the increased global focus on green development (UN sustainability goals), more focus on these topics will be needed to provide relevant research. The already existing high amount of global trading and the perishable nature of seafood make the sustainability issues particularly interesting. Effective solutions to minimize environmental emissions of e-commerce trade and to maintain the quality of the products all the way to the consumer to avoid waste and achieve customer satisfaction are of utmost importance. For companies dealing with seafood and other perishable foods it is imperative to ensure that products preserve their promised quality all the way to the consumer and finding the best way to communicate quality and product-specific traits in a meaningful manner to consumers.

Today, it is mandatory for food companies to label their products so that the buyers can trace the products back to their origin and track the products through the supply chain (FAO, 2012). Companies worldwide have therefore implemented traceability systems along the food supply chain (Alfnes, Chen, & Rickertsen, 2018; Ruiz-Garcia et al., 2010). New traceability techniques from the primary producer (fisheries or aquaculture, including animal feed and therapeutants used in aquaculture) to the consumer need to be developed (El Sheikha & Xu, 2017). The project “Internet of Food & Farm 2020” explores the potential of IoT technologies for the European food and farming industry (Sundmaeker, Verdouw, Wolfert, & Pérez-Freire, 2016). The project results suggested that tracking and tracing systems will develop toward end-to-end visibility and real-time tracking

and tracing on a fine granularity level, e.g. up to individual products. Moreover, traceability will be increasingly integrated with smart sensing systems and consequently add data about product features, production methods and ambient conditions (Haflidason, Ólafsdóttir, Bogason, & Stefánsson, 2012). Food safety and quality management systems will transform from a defensive, reactive approach to a proactive approach, in which food chains can be monitored, controlled, planned and optimized remotely based on real-time information on a broad range of relevant parameters (Ramundo et al., 2016).

Another important future topic for research is related to cultural differences. To succeed with e-commerce of seafood globally one needs to understand the cultures in the buyer market, regardless of traditional trade and e-commerce. Culture has a profound impact on the way people perceive, think, and behave (Kluckhohn, 1951; Leung, Bhagat, Buchan, Erez, & Gibson, 2005) and may affect how e-commerce develops in different cultures. Thus, cultural understanding is important with regards to what strategy to choose, how to cooperate with chain partners, understanding consumer behavior, marketing choice, website design, product type and packaging. The choice of target markets should thus be carefully evaluated and discussed before entering.

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