Seafood Supply Chain Structure of the Fishing Industry of Yucatan, Mexico

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Chapter 15
Seafood Supply Chain Structure of the Fishing Industry of Yucatan, Mexico

Carmen Pedroza-Gutiérrez

Abstract Today's small-scale fisheries contribute more than half of the total marine fish catch to the world's fishing industries, but they are facing overexploitation, increases in demand, overcapitalization, and new challenges imposed by fish markets and climate change. This work examines how the Yucatan region's fishing industry has organized its resources to face new hurdles and maintain its position in the market. The chapter considers a resource-base-view perspective and a uses a qualitative-exploratory methodology based on interviews with the Yucatan's leading fishing entrepreneurs. This methodology allowed the study to describe the nature of the main industry processes and relationships which give place and continuity to the fish trade. The main findings show that the ownership of major fishing capital such as vessels, boats, and processing plants is not enough to ensure access to seafood in every season, but rather suggests that what is needed is the development of different levels of relations which are long-term and seasonal in nature across different supply chain members (fishers, middlemen and skippers). Furthermore, firm owners' ability to organize fishing effort according to the fish available each season and to link with traders and suppliers according to market demand has been a key resource to maintain this industry in the market. Finally, the chapter shows how small-scale fisheries are part of an important supply chain for large processing plants and make a key contribution to their existence and continuity in the market. At the same time, small producers' participation in the market is limited and controlled by these fishing businesses.

Keywords: Seafood Supply Chain • Yucatan

Introduction

Today's competitive markets are constantly changing, presenting new hurdles for Supply Chain Management (SCM) that must be overcome to ensure effective inter-organizational strategies. In the case of the fishing sector, these hurdles are imposed by market specialization based on increasing consumer knowledge and awareness regarding food quality and

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environmentally friendly products (Miles and Munilla 1997; Wagner and Alderdice 2006); the variety of products and actors that intervene in the fish trade; the shelf-life of products (Anderson 2003); recruitment variability (Sissenwine 1984); natural phenomena such as hurricanes and red tides; natural resource depletion (Mullon et al. 2005); and fisheries management and regulations such as closed seasons or quotas. These common factors, which affect multiple markets, as well as increasing competition, demonstrate a clear need for building dynamic strategies for adapting the seafood supply chain to the changing conditions of supply and demand.

Challenges imposed by market dynamics are also major concerns to be considered in the well-being of the Mexican fishing industry. Mexican fish markets are heterogeneous, given that coastal and inland states do not share the same knowledge about eating fish and that fish markets have specialized and non-specialized consumers. Mexican fish markets are also affected by many of the same problems identified in the fishing sector. Most Mexican fisheries are considered artisanal and small-scale (Salas et al. 2006), and currently face challenges such as biological over-exploitation, overcapitalization, monopoly in commercialization, obsolete fishing capital, social problems associated with fish resources (Hernández and Kempton 2003) and climate change (Arreguín-Sánchez et al. 2015).

In Yucatan, a state in the southeast of Mexico, the commercial fishing industry started to develop in the 1940's and has become an increasingly important part of the economy. The most important seafood products by volume are octopus (*Octopus maya* and *Octopus vulgaris*) and fish (mainly grouper, *Epinephelus morio*), representing 40% and 30% of the state's total catch, respectively. *Octopus vulgaris* has been identified as capable of expansion in effort (Pérez-Pérez et al. 2006; CNP 2012), but the *Octopus maya* has been reported as fully exploited (Solana et al. 2005; CNP 2012), with observed tendencies of catch decrease (Salas et al. 2008), suggesting that stocks may be overexploited (Jurado-Molina 2010). In the case of groupers, overexploitation was-already reported years ago (Giménez-Hurtado et al. 2005). Thus, concern about scarcity among fisher entrepreneurs is not uncommon. In spite of these concerns, Yucatan's commercial fishing industry has been able to maintain a strong position in the market, currently represents 31% of the wealth generated in the state's coastal region (INEGI 2009).

Considering this context, the aim of this chapter is to identify and explain how Yucatan's fishing industry has been able to organize its resources in order to face these hurdles and maintain its position in the national and international fisheries market. This analysis will help improve understanding of the important contributions of small-scale fisheries to large processing plants' existence and continuity in the market.

To accomplish this aim, the main resources of the fishing industry of Yucatan are identified in the following sections. Then, the paper draws upon a theoretical framework rooted in a resource-based view perspective that is used to analyze the regional fishery. The research methodology is presented, followed by the results from Yucatan's supply chain. Finally, a discussion and final reflections are presented in light of the different dimensions and organization of the seafood supply chain.

The Seafood Supply Chain and Organizational Resources

In light of the complexity that currently characterizes the composition and organization of fish markets, and small-scale fisheries' role within them, it is necessary to consider a theoretical approach suitable to framing the dynamics of fish trade phenomena. The resource-based view perspective can be helpful on understanding and explaining how Yucatan's fishing industry has been able to maintain its position in the market through the organization of its resources because firm resources are the base to create and implement strategies to facilitate the production and distribution of goods (Porter 1981).

The resource-based-view (RBV) perspective has been mostly used as a framework in strategic management (Fernández et al. 2000; Rungtusanatham et al. 2003; Sepulveda and Gabrielsson 2013; Nieves and Haller 2014); however, small-scale fisheries are organizations that are also forced to implement new strategies or coping mechanisms to access or to adjust to changing market dynamics. The RBV framework is based on the argument that firms can gain and sustain competitive advantage through the implementation of strategies based on their strengths or assets (Barney 1991). This theoretical approach explains how competitive advantage can be achieved through the use of resources that a firm can acquire or control (Rungtusanatham et al. 2003; Hart and Dowell 2010). These resources can be tangible, such as equipment, or intangible such as processes, capabilities, knowledge, or information (Grant 1991). The sustainability of competitive advantage depends on the extent that resources can be valuable, rare, inimitable, and supported by tacit knowledge or organizational processes (Barney 1991).

Intangible resources have been classified as either people-dependent and independent (Hall 1993; Fernández et al. 2000). People-dependent resources are inseparable from the humans who bear these resources (i.e. employees´ knowledge), while the second type refers to those that remain in the firm even if a particular employee leaves. Fernández et al. (2000) divide these resources into four categories: human, technological, relational, and organizational capital. Human capital is people-dependent because it refers to the knowledge and abilities an employee might have and contribute to the firm. Technological capital refers to the necessary knowledge to access, use, and innovate on production techniques and production technology. Relational capital consists of the potential derived from these types of resources related to the market place (reputation, brands, customers' long-term relationships, distribution channels, etc.). Organizational capital refers to the procedures and organizational knowledge a firm possesses, such as norms or guidelines, organizational routines, corporate culture, or cooperative agreements.

Organizational and relational capitals are resources that relate social factors to organizational strategies because they are derived from cooperative relationships. These cooperative relations can be expressed in supply chain linkages developed by the firm with supply chain partners in order to manage the supply chain (Rungtusanatham et al. 2003), according to the resource needs and social resource opportunities (Eisenhardt and Schoonhoven 1996), that a fishing firm might have while facing market changes.

Linkages, or supply chain interactions, can take the form of long-term relationships with suppliers and customers. According to Kalwani and Narayandas (1995), these interactions can help to reduce uncertainty and improve firm operations in terms of flexibility, costs, and quality (Narasimhan and Jayaram 1998). Supply chain interactions can develop strategic alliances that can be part of the social capital of a firm because they can

provide access to strategic resources for alliance partners. This inter-organizational capability represents a form of social capital because it can create benefits from linking with suppliers or costumers according to the needs and opportunities given in the market place (Eisenhardt and Schoonhoven 1996). Furthermore, organizational capital can be a dynamic capability because it gives place to adapt to changes in the market place. The organizational capabilities that a firm develops are part of the dynamic capabilities that explain how firms can adjust their assets and adapt rapidly to competitive markets (Hart and Dowel 2010). These dynamic capabilities can be constructed through knowledge-based resources, which in turn is the central element to modify assets for adaptation (Nieves and Haller 2014).

Organizational capabilities can derive into organizational routines, which can be understood as a sequence of coordinated actions to face a regular or particular event (Nelson and Winter 1982). These routines can be static or dynamic: static routines follow a determined pattern to perform a task under a continuous repetitive action, and dynamic routines have to be more flexible and able to adapt to changing circumstances in order to improve or create new products or processes (Teece et al. 1994). Thus, supply chain interactions can create linkages with key actors, giving place to opportunities, and organizational routines can improve the flow of fish throughout the seafood supply chain because of the already created social structures that make information and resources available (Granovetter 1973).

In fishing activity, the structure of the seafood supply chain is organized through a number of stages, starting with raw materials (seafood in its primary form) to end consumers. This structure is based on firm resources (vessels, fishing, and processing technology) and the relationships between suppliers (fishers, cooperatives, skippers) and buyers (fishing firms, middlemen), through different types of contracts or trading agreements that can be the base of this organizational structure. In general, a fishing firm could be vertically engaged in harvesting, processing, and trading seafood. At the same time, a group of fishing firms can be horizontally allied to develop or improve the logistics needed to carry out these activities. There is a variety of studies that identify and analyze the different types of resources that enable a firm to develop strategies that create value. In this paper, I identify intangible and tangible resources that form the basis of competitive advantage and thus enable the Yucatan fishing industry to organize different strategies to respond to market changes.

Methodology

The complex interactions that influence Yucatan's seafood supply chain were analyzed through a qualitative case study approach (Yin 2003; Bernard 2006). The main objective of the case study was to illustrate how the different actors organize themselves to coordinate resources along the supply chain in order to get products to market. Multiple information sources were used in this investigation (Yin 2003), including specialized journals, official government statistics, newspapers, and websites. However, the main source of information came from two separate sets of interviews, conducted during fieldwork in 2009 in the main ports of Yucatan (Progreso, Celestún, Dzilam de Bravo, and Telchac Pto), as well as the state capital, Merida. The methodology was of a qualitative-exploratory nature, based on interviews addressed to Yucatan's leading fishing entrepreneurs, which allowed them to describe the nature of the main industry's processes and relationships. Considering that there

are only a few previous works based on this source of information (eg. Pedroza and Salas 2011) and addressed to Yucatan's fishing industry in general, this study represented a new research area that had not been well researched prior to the study.

The first phase of the fieldwork involved unstructured interviews with key stakeholders from the fishing sector, such as government officials and cooperative leaders. The aim of these interviews was to determine the origins of and to understand the socio-economic context of Yucatan's fishing industry. This set of interviews was also used to sketch the composition, location, and structure of the industry across the state.

For the second phase, the sample design was focused to target the leading fishing entrepreneurs with the most resource control in the industry. When fieldwork was carried out, Yucatan's fishing industry was supported by a fleet of 3,771 units, including 633 large vessels and 3,168 small boats, and 57 processing plants. The 20 selected firms own 65% of the large-scale fleet and 29% of the small-scale fleet, and own the largest infrastructure with the capacity to freeze and preserve about 50% of the state production in an average fishing season. This ownership structure demonstrates that the interviewed fishing entrepreneurs control most of Yucatan's fishing industry resources.

In this phase, semi-structured interviews with an open-ended questionnaire (Bernard 2006) were asked to firm owners, all of whom act as the business managers in these family businesses. One of the main areas of interest in these interviews was to understand the company's organizational strategies at different levels that could have an impact on seafood supply chain performance. The questionnaire was divided into sections. Section one referred to how the fishing industry of Yucatan was formed, how each individual firm was created, and individual firm characteristics such as plant size and capacity, fleet size, and date of creation. From the information obtained, three categories of firms were defined: large firms (N=7), medium-sized firms (N=8), and small firms (N=5), which were based on common characteristics held between firms, even though each firm has its own particularities. By knowing the plants' features, it was possible to identify firms' importance and position in the supply chain and identify key resources and the characteristics of advantage-creation. Section two of the questionnaire was focused on understanding the nature and dynamics of relations by asking how these business managers operate their plants, how and when they interact with other channel members, and how they face unexpected changes in supply or demand. The aim of section three was to identify the sources of internal and external uncertainties within the industry. Internal uncertainty was identified in terms of labor and tasks. Questions asked included 'how reliable is fishers' participation and commitment with fishing firms, and which factors contribute to this reliability?' and 'how are labor agreements and the different levels of relations developed?' The interviews showed how business managers have built a few large processing plants and maintain their market position using the small-scale fisheries of Yucatan as a main source of human and raw materials.

In addition to documentary sources and interviews, direct observation of fish selling and receiving, processing, and administration was also employed on site at individual plants (Yin 2003). This observation gave deeper understanding of each company's processes and organizational strategies.

Study Area

Yucatan´s Main Fishing Ports

Yucatan's fishing industry relies mostly on production from eight landing sites (Fig. 15.1), although the largest landings occur in the ports selected for study. Progreso is the most important port, followed by Celestún. Progreso has a pier, an inner harbor, 60% of the freezing factories in the state, and 30% of the state's fleet including 84% of the large-scale fleet and 20% of the small-scale fleet (Table 15.1). Progreso also has the largest processing plants in the state, with 12 out of 20 included in this study, which are considered the most important plants because of their production and sales capacities.

Insert Figure 15.1

Table 15.1 Main resources of the port.

Ports	No. of Fishers	Large-Fleet	Small-Fleet	Freezing Factories	%Average Landing
Progreso	5631	518	634	35	52 %
Celestún	2292	35	994	5	14 %
Dzilam	2455	48	735	5	10 %
Others	5818	32	805	12	24 %
Total	16196	633	3168	57	100%

Source: CNP 2012; SAGARPA-CONAPESCA 2013.

Main Seafood Products

Octopus is the most important fishery by volume, and second in terms of value, in the Gulf of Mexico. Yucatan is responsible for 80% of the total national octopus catch, and in this region the most important products by volume are octopus (*Octopus maya* and *Octopus vulgaris*) and fish (mainly grouper, *Epinephelus morio*), representing 40% and 30% of the state's total catch, respectively. About 60% of the octopus catch goes to Europe and Japan, and about 80% of the grouper production goes to the United States market.

As it can be observed in Figure 15.2, octopus and grouper catch variability has been important in the last 20 years. Grouper has been in a trend of decline, while octopus catch can have an important variability from one year to the other.

Insert Figure 15.2

Fishing Firms

Even though modern commercial fishing began to develop in the mid-1940s, most of the studied fishing firms were created during the 1980s and 1990s (Table 15.2). The growth of the fishing industry was delayed mostly because it was not until the 1970s that formal fishing infrastructure was built. The government considered it necessary to remove pressure from agriculture and support other sectors, leading to the transformation of fishing from being a marginal economic activity to a primary industry in the state of Yucatan (Pedroza and Salas 2011). Table 15.2 presents the main resources and characteristics of each of the studied firms.

Table 15.2 Main resources and characteristics of firms.

Group	Firm	Location	Period of creation	Fleet		Infrastructure			Initiating capital		A W*	Quality control	Brand	Export mks.		
				Large	Small	Freezing	International trading bureau	Ice factory	Own %	Credit %		HACCP		E	J	USA
Large	1	Progreso	1980s	X	X	X	X		20	80	40	X	X	X		X
	2	Progreso	1980s	X		X	X		100		12	X	X			X
	3	Progreso	1980s	X	X	X		X	40	60	30	X		X	X	X
	4	Celestún	1990s	X	X	X			100		22	X	X	X	X	X
	5	Progreso	1990s	X	X	X				100	25	X			X	
	6	Celestún	1950s	X	X	X			100		25	X	X	X	X	X
	7	Mérida	1950s			X			100		110	X	X	X		X
Medium	8	Progreso	1980s	X		X			20	80	21	X				X
	9	Progreso	1980s	X		X		X		100	30	X	X			
	10	Progreso	1970s	X		X		X	100		23	X	X	X		X
	11	Telchac	1970s	X	X	X		X	50	50	25	X				
	12	Progreso	1990s	X	X	X			50	50	20	X	X	X		X
	13	Progreso	1970s	X		X			100		16	X	X			X
	14	Progreso	1990s	X	X	X			100		21	X				
	15	Mérida	1990s		X	X			100		29	X		X	X	X
Small	16	Dzilam	1980s	X		X			100		27	X				X
	17	Celestún	1990s		X	X			100		7	X				X
	18	Progreso	1990s		X	X			100		8					
	19	Celestún	2000s		X					100	1	X				X
	20	Progreso	1990's		X	X			100		5					X

*AW= Administrative Workers, during octopus season workers increases two fold; E=Europe, J=Japan, USA= United States.

Table 15.3 groups the firms according to size: large (7), medium (8), and small (5). For each group, data are presented on firm share of fleet ownership and the proportion of total catch and total sales per year 2008.

Table 15.3. Yucatan's main fleet ownership and proportion of total catch and sales.

Group of firms	Fleet ownership	Percentage (%) of total reported catch (2008)	Percentage (%) of total sales (2008)
Largest 7	264 Large-scale fleet 604 Small-scale fleet	57% octopus 43% grouper	81% octopus 43% grouper
Medium 8	127 Large-scale fleet 149 Small-scale fleet	21% octopus 16% grouper	25% octopus 16% grouper
small 5	27 Large-scale fleet 163 Small-scale fleet	12% octopus 8% grouper	10% octopus 8% grouper

The annual average volume sold of octopus was 16% greater than the volume caught in 2008 in the state of Yucatan (Table 15.3). This can be explained because the studied firms control up to 90% of the total state octopus catch but also import octopus from the neighboring state of Campeche, which sells about 60% of its total octopus catch to Yucatan's freezing plants. Therefore, these firms can process and sell more octopus than can be caught in the state. They are able to do this because they are the owners of the export licenses and the infrastructure to freeze and preserve octopus. Moreover, they operate a dynamic and complex system of multiple and flexible sources of supply. These system and forms of organization are explained in the following section.

Supply Chain Partners

In order to understand the organization and nature of human capital in Yucatán's seafood supply chain, it is necessary to identify the role of the main actors involved and their relation to the resources involved in fishing and trading. In Yucatan's fishing industry, there are three groups of actors who organize the production and trade of seafood (Fig. 15.3). The first is the producers, who are fishing entrepreneurs and also the owners of fleets and fishing permits. They range from large fleet owners to micro-fleet owners, depending on the number of vessels or boats they possess. Normally large, medium, and small fleet owners also own at least one processing plant, and they also harvest, process, preserve, and market seafood. The micro-fleet owners have very few vessels or boats and do not own processing plants. As a result, they fish and then sell their catch to one of the larger firms or to a middleman.

The second major group is the traders, who can be divided into two types. Type 1 consists of those who have the infrastructure (a processing plant) to collect, process, preserve, and market seafood. They range from small to large (Fig. 15.3). Type 2 includes middlemen who peddle seafood in an informal market setting. They do not possess the necessary infrastructure to preserve fish, so they must sell whatever they purchase the same day, offering fresh quality products. They buy any kind of seafood, even if it is under the legal size or out of season. None of these actors have fishing permits.

The third group is the fishers themselves, who work for firm fleet owners, cooperatives, or operate independently as 'free fishers'. Fleet fishers work on boats or vessels owned by the producers group. Cooperatives or free fishers have their own fleet but normally sell their catch to firms and middlemen.

Each actor can supply different market segments (Fig. 15.3). Large firms export most of their products to the U.S., Europe, or Japan, and only sell a small part of their production on the local or national market. Medium-sized firms export or sell on local or national markets depending on price variability. In some cases, they sell to larger local firms. Meanwhile, small producers sell to local large firms or directly on local or national markets. The micro-traders, who engage mostly in informal trade, dominate the local market supply.

Insert Fig. 15.3

The interactions of the actors in this supply chain result in multiple levels of relationships, with the role and importance of each actor within the supply chain dependent on the resources they own and their ability to coordinate them.

Results

Supply Chain Processes

The interviews with targeted fishing industry managers showed that the firms' main objectives have been to accumulate as much seafood as possible and sell it at the best possible prices. The 20 largest firms catch up to 90% of the allowed fishing quota in the state, while at the same time micro-producers also participate in fishing because they also hold fishing permits. In general, this trend suggests that competition for fish is intense in both the octopus and grouper fisheries and may also signal excess fishing capacity. Recruitment variability and an unpredictable demand environment motivate all the actors in the market to make use of their organizational and relational capital in order to adapt the fishing industry's assets and to use each of the different markets strategically to sell their catch quotas in the most favorable conditions.

These actions are carried out by the different levels of relationships within each step of the seafood supply chain: harvesting, processing, and trading. Here, all the actors of the supply chain organize and integrate in terms of fleet, permits, and infrastructure ownership, which are the industry's key tangible resources. Using these resources at different steps of the supply chain, each firm can create advantages through the development of organizational capabilities for their most efficient use. The purpose of this behavior is to interact and coordinate with fishers and traders in the supply chain and to manage information exchange in order to acquire the necessary knowledge to have access to fish.

Multiple Sourcing

One way that the investigated companies respond to supply and demand variability is through the ownership and control of their resources. This strategy can influence the organizational structure of the seafood supply chain where different types of relationships configure different organizational strategies to have efficient sourcing mechanisms and to fulfil clients' demands. One important variable is the ownership of key tangible resources such as the possession and/or control of fishing fleets, permits, and plant infrastructure with conservation and processing facilities. The possession of a fleet and fishing permits requires the creation of sourcing routines, while holding a processing plant implies the development of adaptable processing routines. This section describes these sourcing routines and the following section explains processing routines.

Sourcing Routines

The companies investigated in this study build competitive advantage by combining tangible and intangible resources. They created three configurations of sourcing routines by organizing coordinated actions for the use and control of supply links, fleets, and permits.

The first sourcing routines refer to firms that own fishing permits and a fleet and rely solely on them for their entire seafood supply, which implies a more static routine because they maintain a set of less variable supply patterns. All of their production and commercialization is based on their fleet's fishing capacity alone. In total, 35% of the largest companies belong to this category (Fig. 15.4). Their strategic advantage relies on the way they organize their fleet to go fishing and they believe quality control is more reliable in this arrangement because there is only one source of supply. The second type of sourcing routine is more dynamic, involving firms that own fishing permits and fleets but who also buy seafood from different external suppliers such as smaller firms, fishers' cooperatives, micro-producers, free fishers, or middlemen to increase their production. 55% of the firms examined belong to this category of companies, which must be more flexible to adapt to the changing circumstances of supply and demand (Fig. 15.4). The most flexible sourcing routine was found in the third type, which includes firms without a fleet or permits that engage only in trading (10%, Fig. 15.4). They buy their entire production from different producing firms and any supplier in the market. In this case, their strategic advantage is mostly based on intangible resources such as sourcing capabilities.

In cases where a firm is both a producer and also a buyer from external suppliers, the number of additional sources of external supply depends on the particular seasonal production level. When fish availability is low, sourcing routines require large and medium-sized firms to link together to build a network of relationships with fishers and cooperatives to organize multiple sourcing, which is the only way to amass the necessary volume to supply their markets. By contrast, in years of high catch, firms spend more time on fleet maintenance, processing, and wholesaling their own products than trying to increase the number of external suppliers. Therefore, the advantages of these sourcing routines range from organizing multiple sourcing during resource shortage to in-house sourcing when there is enough fish available.

Consequently, in the fishing industry of Yucatan the ownership of tangible resources such as a fleet or fishing permits does not necessarily assure a reliable supply of fish for continuous operation. Thus, linking with additional sources of supply or keeping inactive relations with suppliers which can become active at opportune times are key resources required to build strategic advantage and adapt to catch variability. For firms that have no fleet or also rely on external suppliers, developing dynamic supply routines through seasonal linking can be seen as a coordination and cooperative mechanism that allow them to access fish resources and achieve efficient levels of supply through multiple sourcing.

Insert Fig. 15.4

Processing Routines

Another important resource for firms is the ownership of a plant with processing and preservation facilities. Product processing is an important potential source of competitive advantage that starts in vessels since fishers typically gut and ice fish and octopus before

returning to port. However, the type of processing that each firm performs in-house depends on its size and capacity, as well as the type of products and their market destinations, all of which influence the level of flexibility that individual firms develop in their processing routines. Small producers and micro-producers have normally developed more limited processing capabilities because they have less resources, which limits their ability to conduct more manufacturing processes. These producers typically only clean and ice seafood and sell it immediately to a larger producer or trader (Fig. 15.5).

Only large (N=7) and medium (N=8) sized firms that are certified to export fisheries products have developed more complete processing routines. Therefore, to be able to access export markets in Europe and Japan, companies must possess valuable resources such as fishing permits, the necessary infrastructure to process seafood, exporting licenses, as well as the ability to fulfil the long list of requirements asked by their international clients. These resources are used to build competitive advantage through product transformation and allow them to sell their products wholesale to both national and international markets, in the form of frozen and fresh (about 90% of octopus is sold frozen and about 80% of fish is sold fresh) (Fig. 15.5).

Insert Fig. 15.5

Thus, large and medium firms have developed flexible processing routines, which allow them to influence supply chain organization by aligning their manufacturing strategy to clients' requirements. These producers must adjust their processing routines each season, processing fish from January to July, and octopus from August to December. Each species requires different manufacturing processes, resulting in quality control procedures that must be adjusted according to each product and its final destination (Fig. 15.5). Thus, manufacturing strategies must be aligned with the external environment of the firm. For example, European and Japanese clients require quality controls to be based on the HACCP system (Hazard Analysis Critical Control Points), whereas the USA market specifically demands an analysis of water, ice, and plant environment, while the national market requires simpler quality standards based on cleanliness. Thus, processing routines must be adaptable to different types of products, quality controls, and catch variability.

Trading Relations Between Buyers and Suppliers

In the fishing industry of Yucatan, relational capital is built through credits or loans used as a type of oral contract or trading agreement. These agreements are a linking mechanism that create commitment in the attempt to manage access to labor and multiple sourcing.

During the interviews, firm owners stressed that the way they build partnerships with fishers depends on the needs and availability of seafood. Fleet owners implement a strategy based on backup labor agreements to select and keep a permanent small crew composed of the best and most loyal fishers. In order to ensure their loyalty, they maintain this crew even during periods when fishing does not occur such as seasonal closures or seafood shortages.

These agreements allow firm owners to keep long-term relationships and also recruit other fishers through this permanent crew at opportune times.

Firm owners pointed out that they employed multiple levels of relationships to have access to different sources of supply, including fishers working on the company's fleet, free fishers, cooperatives, and middlemen. For cooperatives and fishers who work in a company's small-scale fleet, firm owners give loans to these actors who use these loans to cover their expenses, purchase fishing gears, buy motorboats, or cover personal needs and illnesses. Large-scale fleet owners provide advance payments to skippers who use the money to recruit fishers and ensure their boats have crews. A partial advance payment is made before going to sea and is deducted from the fishers' payment upon returning.

Loans and advance payments commit fishers to work for the financing firm, with debt functioning as a control mechanism. Debt also gives fishing entrepreneurs bargaining power over fishers, and only free fishers without debt can obtain better selling prices for their catch than those committed to firm owners because they can sell their catch to whomever pays the best prices. In these informal contracts, penalties are not explicit, but implicit in price, and these credits have double returns for firm owners who profit from both higher prices and labor commitments.

During the octopus season, twice as many fishers are required than when fishing grouper, which leads to a large amount of seasonal octopus fishers. However, firm owners do not commit to recruit fishers, and unemployment can be high if the season is not good. These labor-credit relationships create commitment only for fishers, while still affording considerable sourcing flexibility to firm owners which helps them reduce supply uncertainty by adding the necessary sources of supply whenever needed. Moreover, this linking strategy diminishes costs because firm owners do not have to maintain the whole crew during seafood shortages.

However, this type of control mechanism can also have a negative impact on firm owners when fishers try to evade or profit from firm owners' crew maintenance strategies. Some fishers take two or even three advance payments from different skippers, but fish from a different ship, which leaves the skipper with a debt with the fleet owner. Accordingly, the skipper must promise part of the boat's production to a middleman, who usually pays a better price. The middleman becomes another source of credit by providing the skipper with the funds to complete advance payments, recruit a crew, and pay any debts. Fleet owners, however, decry this as a disloyal practice because they lose between 10% and 30% of production in this type of transaction.

Thus, middlemen represent another level of industry relationships with fishing enterprises. Besides being a competitor, middlemen can also be a trading partner because they sometimes supply firms directly. This happens especially during periods of seafood shortages, during which middlemen gain much higher importance. Middlemen are an itinerant link in the supply chain, representing higher transaction costs for firm owners since they ask for higher prices. Middlemen obtain a certain degree of bargaining power during resource shortages, and, due to their itinerant nature, through their abilities to adapt flexible routines in commitment and sourcing. However, they are also another key resource in inter-organizational strategy because they are able to buy and sell large amounts of any kind of seafood. All these characteristics make them the actor with the most adaptable sourcing routines in the supply chain.

Furthermore, these dynamic organizational routines imply another shift of bargaining power during resource shortages, since middlemen are at the center of the supply chain and

can affect the amount and time delivery of seafood. Integrating middlemen into the multiple sources of supply strategy gives firm owners more possibilities to bulk seafood and supply its markets. However, this can be seen as a reactive coordination mechanism, which represents a short-term vision of fisheries and business management strategy.

Thus, firm owners develop long-term relations and seasonal relations with different supply chain members. On the other hand, the decision whether to fish or buy relies not only on the availability of fish and the firm's ownership of tangible resources, but also on firm owners' ability to coordinate the organization of multiple adaptable source of supply, allowing them to control volume, storage, and freezing capacity, aligned with recruitment and market variability.

Horizontal Relations and Supply Chain Logistics

One source of collaboration in Yucatan's fishing industry has been the fact that the industry consists of compounded family businesses. Most large firm owners inherited their plants and fleets from their parents or grandparents. In certain cases, these assets were divided among siblings. Under these conditions, some partial owners decided to establish separate firms, whereas others continue to work together, increasing their capacity by organizing horizontally with family members. This familial organization has been one of the sources of capital or richness transactions that has sustained the economic structure of the industry. Thus, family business organization has been a key resource for accumulating capital and bargaining power because large firm owners, many of which have benefited from intergenerational capital accumulation, normally have more political power and dominate industry decision making, limiting small producers' participation.

In addition, firm owners have also created three different and horizontally related organizations as a corporate strategy to face new challenges in the fishing industry. These organizations are the *Asociación de Armadores* (Large-Scale Fleet [LSF] - Owners Association, LSFOA), *Cámara Nacional de la Industria Pesquera* (CANAIPESCA) (National Chamber of the Fishing Industry), and the *Asociación de Exportadores* (Exporters Association). This group of firms is a logistic alliance that aims primarily to improve source supply mechanisms such as fishing regulations and permitting, as well as lower fishing costs. Secondly, they wish to improve and assure space in airfreight shipping and the necessary sanitary, quality, and administrative measures to improve the efficiency of the flow of products to national and international markets. Third, they also manage volume variability because they have to negotiate prices in good years and must also decide where to channel surplus volumes of octopus. However, during seafood scarcity these firms demand subsidies of the local government, which they use to support a joint marketing plan especially to gain visibility in export markets. Moreover, it is within these organizations that information, technology, and data from international customers are exchanged.

This logistic alliance, in addition to working to improve some processes and lower costs, is another source of control over the fishing industry for large and medium firm owners. Through this control, they can limit the participation of smaller stakeholders (e.g. small firms, cooperatives, micro-fleet owners) in the industry and maintain their status as the major leaders in the sector. Thus, in this form of horizontal collaboration, firm owners share

resources (family business networks) and capabilities (associations) to improve the fishing industry's performance and satisfy client demands.

Discussion

This case illustrates the characteristics and challenges that the fishing industry is currently facing as its small-scale fisheries base struggles to maintain a reliable seafood supply chain while confronting volatile supply conditions and new market requirements. The analysis of the relationship structure and use of firm resources in the seafood supply chain in Yucatan's fishing industry has allowed us to understand the interactions among the complex array of actors competing for seafood and the nature of control exerted by the studied firms over the fishing activity, which allow us to understand the importance of competitive and cooperative relations in the seafood supply chain. This analysis also shows how small-scale fisheries play an important role in sourcing for large processing plants, thus allowing them to exist and continue in the market. At the same time, the analysis has revealed that small producers' participation is limited and controlled by large fishing firm owners.

The RBV approach allowed us to frame the organizational responses that serve as the adjustment of firm resources, both tangible and intangible, to the dynamic and unpredictable conditions of recruitment variability. Thus, firms organize and adapt the resource base and relationship strategies according to fish availability. The key organizational strategies that have been identified as responsible for maintaining this fishing industry in the market are multiple sourcing, flexible processing routines, and linking mechanisms.

Multiple sourcing systems are maintained through dynamic sourcing routines, which at the same time depend on multiple levels of relationships expressed in long term relations or seasonal linking. This relational capital in the form of inter-organizational capabilities has served as a dynamic capability that has allowed firms to maintain their competitive advantage by modifying their assets in order to adapt to the changing environment (Helfat and Raubitschek 2000).

In order to develop the necessary partnership links with fishers and assure the required sources of supply, firm owners develop different types of trading relations. They create debt through loans and advance payments as an appropriation mechanism that substitutes formal legal contracts (Fernández et al. 2000). This type of commitment provides firm owners leverage over fishers and access to seafood. Through this relational social capital, firm owners construct a portfolio of suppliers and can sometimes increase their bargaining power as debtors are more likely to be committed and accept lower payment for fish. This is a strategy to bulk seafood but is not intended to centralize access to fish because all producers, both large and small-scale, engage in both fishing as well as selling to fleet owners. This practice is not an accumulation of harvest rights but rather a way of increasing control in access to markets.

At the same time, processing routines have proved to be flexible and adjustable to sourcing routines, the product, the quality required by each market, and the particular nature of each season. The supply management system adopted by each company must consider the different features of each season and act accordingly. Thus, through knowledge, which is the central element to modify assets for adaptation (Nieves and Haller 2014), business managers have been able to remain in the market by making use of experience acquired through

generations of fishing entrepreneurs. Using this knowledge, they have been able to coordinate the use of all the fishing capital they possess (including vessels, boats, and processing plants) while availing of their social capital.

Therefore, fish recruitment variability acts as a source of uncertainty (Sissenwine 1984), influencing the organizational structure of the seafood supply chain because different types of sourcing and processing routines have to be rearranged accordingly. These routines are based on the ownership and control of tangible and intangible resources. Thus, the organization of these types of resources depends on fish availability, but also on firms' organizational knowledge, because they have to decide how to arrange fishing effort according to each fishing season's characteristics as well as link with traders according to market demand.

This situation also shows how tangible resources can become integral to decision-making because the way they can be organized can make them unique and inimitable (Rungtusanatham et al. 2003). At the same time, coordinating intangible resources such as multiple sourcing, carried out through multiple levels of relationships, shows how the base of competitive advantage also relies on capability development through partnering and managing relations as a value-adding activity (Fernández et al. 2000; Francis & Bessant 2005).

The capacity to make decisions over the use and organization of resources is based on knowledge, which is the greatest ability that contributes to differentiation and thus the development of competitive advantage (Nieves and Haller 2014). Thus, knowledge and the ownership of tangible and intangible resources facilitate the exertion of more control over the fishing industry. Therefore, the logistic alliances formed by large firm owners provide these actors with more elements to control small producers who would have to adjust to recruitment variability and demand, in addition to the control mechanisms (e.g. debt) imposed by large firm owners.

In Yucatan's fishing industry, horizontal relations have been developed to design and reinforce the industry's logistics, demonstrating that collaboration between independent firms is key to creating superior value-adding solutions (Mason et al. 2007). This logistic alliance has contributed to the maintenance of catch levels and distribution channels and has allowed firm owners to remain major leaders in the industry.

Management Implications and Recommendations

Firm owners are so busy trying to keep their system functioning that they have dedicated no attention to incorporating alternative ideas which could be more environmentally friendly and thus would allow fishing activity to be a more sustainable and resilient business. This oversight is a result of the failure of firms to engage in self-critical examination, which allows their unintended and potentially negative effects to be-overlooked (Lotti 2010). Probably the most important threat to fishing activity has been that business managers have considered fish variability without considering its biological characteristics, since they have cared only about fishing but not about maintaining fish. The supply chain system, supported by vertical and horizontal relations, continues to focus on mass production and in maintaining the quality required for the export markets without due regard to considerations of volume and supply management over the long term.

One of the most important management implications is that the mass production strategy carried out so far enhances overexploitation because, in order to keep this system functioning, fishing quotas are routinely exceeded (Salas et al. 2006). In addition, the supplying mechanism through middlemen works under informal conditions, which allows for unregistered catch that is not considered in the fishing quota issued by the National Fisheries Institute. Therefore, this informal supply channel might be enhancing illegal, unregulated, and unreported (IUU) fishing (Pedroza 2013).

Seafood supply chain management can be the source to reconfigure opportunities for competitive advantage by using firm owners' ability to organize. Firm owners could also use their predominant controlling position in the fishing activity to guide fisheries management towards sustainability instead of focusing only on capital transactions and reinforcing logistics to improve seafood flows. The strategic use of resources and capability development should consider ecosystem conservation as a new dimension affecting organizational capital in the management of the seafood supply chain.

Business managers should actively participate in fisheries management since they exert an important level of control on fishing activity. Their control can influence the industry's profitability and fisheries sustainability since proper management of the seafood supply chain requires the participation not only of fishers but also of business managers and government officials in resource-use policy measures and market demands.

Firm owners are making efforts to change from a production-oriented to a customer or market-oriented business philosophy, but much work must still be done to make this a reality (see Pedroza and Salas 2011 for more details). Firm owners work to satisfy their clients by maintaining the quality required by international markets, but they have failed thus far in implementing a traceability system based on sustainable practices which can contribute to biodiversity conservation.

Nonetheless, new strategies should include conservation measures in addition to market-oriented mechanisms. It is necessary to find new approaches that respond to the new challenges imposed by this sector. To face the challenges coming from both within and outside the fishing industry, not only is intervention of large fishing businesses necessary, but also the involvement of governmental and social institutions such as fisher's cooperatives.

Fishing entrepreneurs need to implement a market-oriented approach based on customer satisfaction, considering the growing customer awareness about sustainable fisheries products and practices. A new approach informed by environmental and social aspects in the fisheries could address some of the problems associated with natural resource overexploitation while simultaneously meeting customer demand (Faulkner et al. 2005). An environmental marketing orientation has proved to be beneficial, while at the same time having the potential to attract more customers with an environmental conscience who are willing to support environmentally friendly production (Miles and Munilla 1997).

New strategies could consider the already adaptable mechanisms that have worked for the industry thus far, such as multiple sourcing, flexible processing routines, and linking mechanisms, while also adding a sustainable perspective. There are opportunities to learn from alternative movements such as the Slow Food movement, which might contribute to the design of a sustainable market-oriented strategy. The Slow Food movement seeks to safeguard food and agricultural heritage (Jones et al. 2003), promoting a preservation and education function by stressing preservation to producers and education to consumers. The preservation function refers to the need to catalogue and safeguard animal breeds, plant

varieties, and agricultural methods and techniques in danger of extinction; the educational function aims to educate people about improving their tasting ability and increasing their knowledge about food (Nosi and Zanni 2014). In the case of fisheries, this approach has been used for the preservation of the Delaware Bay Oyster and the Loire Salmon. Part of the ideas from this movement might be borrowed and adapted to propose actions for a sustainability marketing plan for Yucatan's fishing industry. Some of the following ideas have been inspired in some of the activities carried out within the Slow Food movement.

In Yucatan's fishing industry, an innovation in sales is required. This could be achieved by targeting different national market segments, since people are becoming aware of fish consumption benefits and the increase in fish consumption is creating new opportunities for the industry. Market diversification by targeting new market levels might provide new opportunities even for low value species which currently are not economically attractive. Instead of continuing with a mass production approach, new products should be identified that can be suitable for market segmentation based on people's lifestyles rather than demographic criteria. Informing and educating consumers about fish qualities and how to cook different species might be an important marketing strategy. In Mexico, many people do not eat fish either because they do not know the wide variety of fish that exist in the country, they think it is expensive, they do not know how to prepare it, or because fish is not available in some areas. A simple example is sardines, which are a cheap, tasty, and nutritious fish that are impossible to find fresh in the market.

A new design of distribution channels with reduced intermediation might reduce transaction and travel costs. This might include more direct participation in the market from small producers, such as small producers selling directly to final consumers. Multiple sourcing should be built into a traceability system where all producers participating must commit to respect conservation measures and avoid participating in IUU fishing activities to contribute to the preservation of Yucatan's fisheries. Targeting new species might also help to reduce travel costs and overcapitalization. A very important measure to be considered within a new multiple sourcing approach, as it has already been suggested, would be to extend the grouper seasonal closure to 90 days instead of 45 as it is now. This extension would be more consistent with the reproduction period of these species, thus protecting the future of these stocks (DOF 2014). In the case of octopus, measures would be more related to the prevention of IUU fishing, since at least the *Octopus vulgaris* has been reported as capable of expansion in effort.

Flexible processing routines should also include better technologies and transformation processes to position the industry as a socially and environmentally responsible business cluster. These routines should also consider innovations in processing raw materials to diversify products instead of only offering fresh fish. In other words, an approach based on more food design and less fishing should be considered, and quality should also be focused not only on the freshness of products but on the defense of biodiversity.

Horizontal collaboration among business partners should consider the creation of a regional brand highlighting the characteristics of regional seafood with the aim of showing people why they are buying value when they are buying seafood from Yucatan. At the same time, products should be distinguished by incorporating their main characteristics and highlighting that fish is a fundamental product to maintain human health. Yucatan's heritage in fishing traditions, as well as new commitments to the environment, should be considered among these characteristics. Firm owners should keep in mind that the ability to diffuse

information therefore represents a valuable asset that influences the potential business development of the organization (Nosi and Zanni 2012). However, it is perhaps most important that all actors consider the implications of their actions in these fisheries and collaborate in the enforcement of the already implemented rules and management practices to avoid IUU fishing activities. Without collaborative efforts to prevent this activity, any attempt for the enforcement of sustainable measures might be unsuccessful.

Final Remarks

This case study explains how Yucatan's fishing industry functions in terms of its supply chain organization, as well as showing the interdependency between small producers and the owners of large processing plants. The chapter also shows how these fishing entrepreneurs have the necessary resources (tangible and intangible) to limit and control most actors involved in fishing activity.

Organizational routines, in terms of number of sources of supply, processes, technology, and quality, mostly depend on firm needs for seafood, capabilities, resources, and supply and market changes. Firm owners have developed several coordination mechanisms to access multiple sources of supply in an attempt to balance catch variability and maintain their dominance in the industry. However, even though the current business management model has achieved balance thus far, little has been done to maintain the ecosystems and fish resources upon which this industry depends, or the well-being of fishers. Firm owners most likely will remain in the activity as long as they can obtain benefits from their participation because even in times of scarcity no formal initiative has been proposed from them.

This lack of a common vision towards the implementation of sustainable practices continues to have negative impacts on fish resources. These implications will be reflected in future biological and socioeconomic impacts. Some of the current high value species might disappear, and others of less economic value will be targeted. In Yucatan, this shift is already happening with red grouper (*Epinephelus morio*) being substituted by black grouper (*Mycteroperca bonaci*). Fishing less commercially value species will decrease fishers' income and might motivate overfishing as fishers try to compensate for the lower prices with higher fishing volumes. Scarcity will be a larger problem for small producers or micro-producers, who are highly dependent of fishing, but probably will not be as detrimental for large firm owners who have already developed other economic activities.

These vertical and horizontal relations have influenced the adaptability of fishing firms' organizational structure in order to respond to unpredictable sources of supply and market specialization. Nevertheless, this set of strategies has failed to address fisheries management problems and fishers' conditions which are key to the survival of the industry and the overall sustainability of the region.

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