Assessment of strategies for value chains using an extended Structure-Conduct-Performance (SCP) framework: an application to the honey business in Brazil

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Abstract

Competition for the end-customer nowadays takes place more among networks of firms than among individual firms. The analysis of competing firms, thus, has to go beyond the limits of each firm to incorporate the analysis of the entire chain(s) in which the firms participate. An approach is lacking to integrate the relations between strategy and structural issues, such as regulations, demand trends and concentration of clients/suppliers, and economic performance in terms of the contribution to local development. The general objective of this research was to make ex-post and ex-ante assessments of strategies for honey value chains in Brazil. The honey chain was chosen because of the importance of honey production and trade to Brazil, which was among the top ten world honey exporters in terms of volume. This thesis extended the Structure-Conduct-Performance (SCP) framework to value chains, identifying categories of structure, conduct and performance for value chain streams (segment of a value chain in a territory) and providing an integrated approach to explore possible interactions among those categories. The empirical applications of this research used this value chain SCP framework and focused on three honey value chain streams, located in the northeast of Brazil, all in top producing areas: two in Ceará State (Limoeiro do Norte and Santana do Cariri) and one in Piauí State (Picos). First, likely successful strategies of those value chain streams to their performance were identified for the 2007-2011 period, in a multi-case study. Then, the contributions of individual strategies of those streams to their performance were quantitatively assessed, also for the 2007-2011 period, using conjoint analysis. Finally, using adaptive conjoint analysis, promising strategies in terms of their contribution to chain competitiveness and local development were identified, under different scenarios. The results of this thesis reveal that the value chain SCP framework allows for ex-ante and ex-post integrated assessments of strategies for a segment of a value chain in a territory. The results also show that the relative importance of strategies to enhance performance of the studied honey value chain streams in Brazil depends on industry structure and varies among performance goals. In addition, the alignment of the value chain stream strategies towards a certain performance goal improves the likelihood of success of the implementation task. Moreover, the most commonly applied upgrading typologies do not cover all the strategy choices to value chain streams.

Keywords: Strategy evaluation, global networks, supply chains, policy Delphi, conjoint analysis, economic development, competitiveness, beekeeping, interventions, uncertainty, upgrading.

Chapter 1

General introduction

H. S. de Figueirêdo Junior

1.1 General background

In an increasingly complex world economy, where the exchange of information and goods is accelerating, international trade is growing with multiple stakeholders (Baldwin, 2013). In this riskier business environment, as explained by institutional economics (Ménard, 2012), competition for the end-customer takes place more among networks of firms than among individual firms. The analysis of competing firms, thus, has to go beyond the limits of each firm to incorporate the analysis of the entire chain(s) in which the firms participate (Christopher, 2010). In that regard, value chain analysis provides a way to identify how the economic surplus generated by the chain is shared among participants and what the local impact is (Altenburg, 2007). Simply put, a value chain is defined as the full range of activities which are required to bring a product or service from conception, through the different phases of production, to delivery to final consumers, and final disposal after use (Kaplinsky & Morris, 2001).

Very often, value chains sprawl over several territories, geographically and/or politically defined, each with distinct characteristics and development needs. This situation poses a challenge to development specialists who were used to deal with territories and its well defined borders within which individual firms operate. To set the basis for local development interventions, a value chain can be described by its input suppliers, producers, processors and buyers, and by its supporting markets, all under an enabling environment. The core of the value chain encompasses the firms and their end markets, taking into account individual firm's business processes aspects, supply and demand levels, relations among its horizontal and vertical links and learning mechanisms. The supporting markets include cross-cutting services such as finance, and sector-specific services such as technical assistance. The enabling environment surrounding the value chain is defined as the set of global and national government regulations, operations and legal enforcements that create incentives for investment and private sector growth (USAID, 2007).

This description of a value chain resembles that of a netchain (Lazzarini, Chaddad, & Cook, 2001), simultaneously accounting for inter-firm vertical and horizontal relations. From the point of view of economic development, however, the geographical distribution of those firms is also relevant, as the concentration of firms from the same economic sector in a territory influences local development (Porter, 1998; Coe & Yeung, 2015). In that regard, a value chain stream is the segment of the chain in a territory, and can be viewed as a local netchain.

1.2 Problem statement

Since many global value chains have portions located in impoverished territories, a value chain approach for local development purposes has been adopted by several research and funding institutions such as the United Nations Industrial Development Organisation (UNIDO), the World Bank, the United States Agency for International Development (USAID) and the German Technical Cooperation Agency (GTZ) (Merlin, 2005; Pietrobelli & Staritz, 2013; Ravenhill, 2014). The projects funded by those institutions usually aim at identifying strategies for the chain which contribute most to the development of the territory where the chain is located. Strategies encompass, for instance, product/market choices, technologies deployed, and types of vertical and horizontal linkages among participants (Trienekens, 2011). To identify suitable strategies for segments of value chains in territories, strategy frameworks such as Strengths-Weaknesses-Opportunities-Threats (SWOT), Five-forces (Porter, 1980), and Competitiveness Diamond (Porter, 1998), and tools such as benchmarking and positioning have been combined (Webber & Labaste, 2010; Mitchell, Shepherd, & Keane, 2011; Match Maker Associates Ltd., 2012).

Development practitioners, nonetheless, are still looking for more solid grounds for value chain strategy development (Helmsing & Vellema, 2011; Donovan *et al.*, 2015), especially after expected outcomes of interventions, such as poverty reduction, have not been clearly demonstrated (Humphrey & Navas-Alemán, 2010). Among the frameworks used for value chain strategy conception, SWOT provides no orderly way to identify the constructs of each of its four elements (Hill & Westbrook, 1997). The Five-forces framework focuses on firms and assumes that firm performance is determined mainly at industry level rather than at firm level. The Competitiveness Diamond, in its turn, explores the role of an industry in the competitiveness of territories, but it is not explicit towards performance objectives of the industries in the territory or towards the recognition of dynamic forces that can alter the competitive environment. An approach is lacking to integrate the relations between strategy and structural issues, such as regulations, demand trends and concentration of clients/suppliers, and economic performance in terms of the contribution to local development. The dynamic Structure-Conduct-Performance (SCP) framework (Scherer & Ross, 1990), enhanced from earlier industrial organisation economics studies (Bain, 1951; Bresnahan, 1989), could provide a more comprehensive way to assess value chain strategies. In this

framework, categories are constructs or aspects of analysis for structure, conduct and performance.

1.3 Objectives of the research

The main objective of this research is to make *ex-post* and *ex-ante* assessments of strategies for honey value chains in Brazil. Building upon the dynamic Structure-Conduct-Performance (SCP) framework more recently used to develop strategies for individual firms (Copeland, Koller, & Murrin, 2000; Stuckey, 2008), an extended value chain SCP framework is conceived and applied to selected value chain streams.

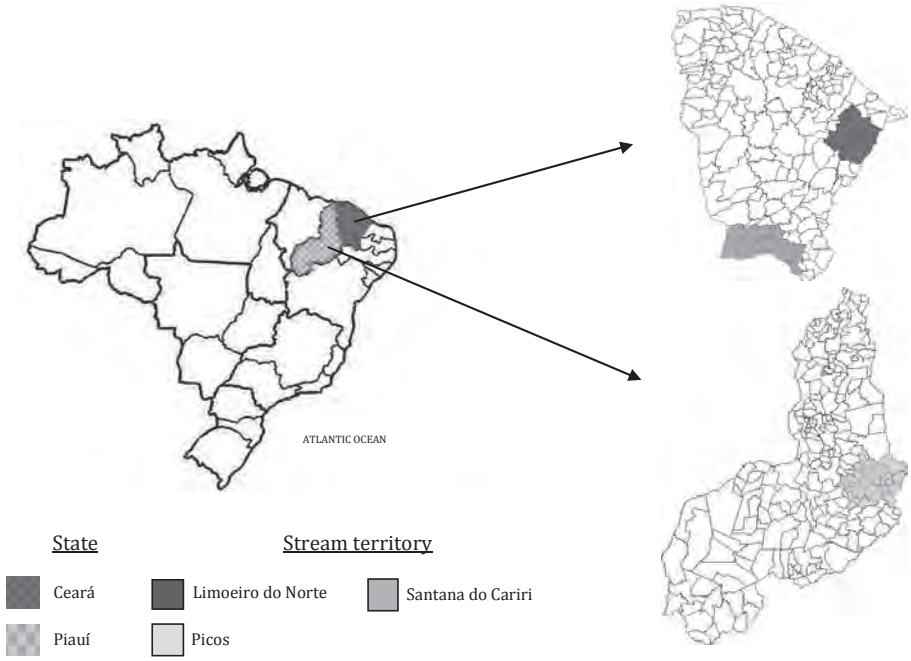
More specifically, this thesis had the following sub-objectives:

a) to conceptually extend the SCP framework to value chains, identifying categories of structure-conduct-performance for value chain streams and exploring interactions among those categories;
b) to identify likely successful strategies of value chain streams to their past performance;
c) to quantitatively assess the contribution of individual strategies of value chain streams to their performance;
d) to identify promising successful strategies to be deployed by value chain streams under different scenarios.

1.4 Description of the study area

Three honey value chain streams in the northeast of Brazil (Figure 1.1) were selected for empirical application of the value chain SCP framework, all in top producing areas: two in Ceará State – Limoeiro do Norte and Santana do Cariri, and one in Piauí State – Picos. Each value chain stream is composed of a set of firms vertically and horizontally linked, with their own group of products, technology levels, supporting market services and other conduct (strategy) options, under an enabling environment. The honey chain was chosen because of the importance of honey production and trade to Brazil, which was among the top ten world honey exporters in terms of volume (FAO, 2013). The honey chain in Brazil involves about 350,000 beekeepers (CBA, 2011) and has grown sharply, with production going from 22,000 in 2001 to almost 42,000 t/year in 2011 (IBGE, 2012). During this

period, the main Brazilian production centres gradually moved from the south to the northeast, where most of the country poverty is located (IBGE, 2008).



Source: IBGE (2012), field interviews, author's analysis.

Figure 1.1. Selected honey value chain streams in Brazil

Each value chain stream encompasses all firms and supporting market service providers located in the geographical limits of the stream territory that participate in the honey business. It includes the local honey producers, the local honey trade intermediaries, the local honey processors, the local honey wholesalers, the local honey retailers, and the local honey consumers. In practice, for the selected streams, local consumption is far below local production, so the large majority of local processed honey is exported or commercialised with other regions of the country through outside dealers. In this configuration, the few local processors play the role of local wholesalers, and the local retailers and consumers have very little influence on the dynamics of the streams. Among the streams, Picos has the largest honey production (almost 2.5 thousand t/year), and Santana do Cariri the largest honey export volume (just above 1.0 thousand t/year). The producers are usually small, owning on average between 60 and 100 hives each, and beekeeping is a

complementary source of income to crops such as corn, cassava, beans, and to a few livestock such as sheep, goats and cattle. The main local processors either sell bulk honey to the United States and Europe, with the help of international traders sitting in these destinations, or fraction honey to sell in the internal market, with the help of dealers in large cities of the country. Supporting market services in the stream include local technical and managerial assistance, and credit providers (Table 1.1). The producers, mostly, sell their honey to the processors that offer the higher prices, in a typical market-based relationship. Special long-term agreements may exist among producers and processors when fair trade and organic certifications are in place.

The region of Picos, in the state of Piauí, houses a stream formed by the pioneers of beekeeping in the Northeast of Brazil, who migrated from the south of the country in the late 1970's. The region of Santana do Cariri was the first in Ceará to attract investment in honey production and processing in a larger scale in the mid 1990's, while the region of Limoeiro do Norte houses producers and processors that initiated their activities in the 2000's (Amaral Filho, 2004; USAID, 2006).

Table 1.1. Summary of figures for the selected value chain streams (2011)

Figure	Value Chain Stream		
	Limoeiro do Norte	Santana do Cariri	Picos
Honey production (t)	1,323	843	2,495
Honey exports (t)	541	1,071	661
Main markets	United States	United States and European Union	United States, European Union, Brazil, outside the stream
Number of producers	1,075	653	1,733
Number of local trade intermediaries*	3	2	20
Number of local processors**	2	2	3
Average size of producers (number of hives)	69	95	60
Average size of processors (processed volume, t)	274	536	300
Number of technical and managerial assistance providers***	2	2	2
Number of credit providers***	2	2	2

Source: IBGE (2012); field interviews.
* No information about their traded volume is available. During the season, there is a fluctuating number of intermediaries commissioned by outside processors.
** Only formal honey processors. Out of the 4 in Picos, only 3 were operating in 2011. Informal honey processors exist, but account for only approximately 1% of total local honey processing in every stream.
*** Number of organisations.

1.5 Outline of the thesis

This thesis consists of four research chapters – each addressing one of the four sub-objectives of the thesis –, a general introduction, and a general discussion. The structure of the thesis is presented in Figure 1.2.

Chapter 2 presents the Structure-Conduct-Performance framework for a value chain, which is used in the remaining empirical chapters of the thesis. The research starts with a literature review about networks of firms, industrial organization and frameworks used to formulate strategies for individual firms. It also shows how value chain strategies have been conceived, in the literature. This contextualises the need to carry out an integrated assessment of structure, conduct and performance and leads to a theoretical framework for value chain strategy formulation. The choice of the SCP categories is also complemented by deductive reasoning.

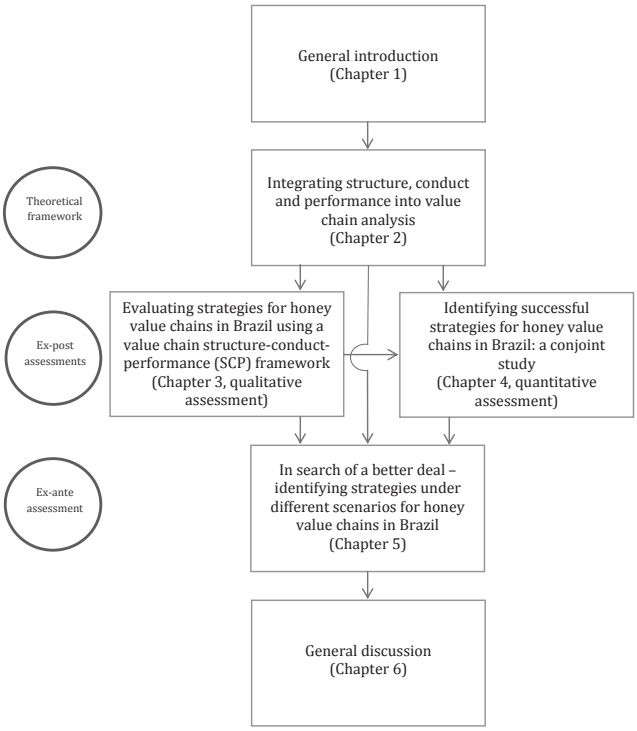


Figure 1.2. Structure of the thesis

Chapter 3 uses the value chain SCP framework to qualitatively evaluate the strategies deployed by honey value chain streams in Brazil between 2007 and 2011. For applying the proposed framework, relating past structure and individual stream conduct to individual stream performance, three competing streams of the honey value chain in Brazil are investigated. Each stream is a case, and the reason to pick different streams of the same value chain is to allow for retrospective comparison. Production and exports by municipality, extracted from Brazilian official government registries, are used upfront for the identification and selection of the streams of the honey value chain. Interviews are carried out with representatives of the streams (e.g., beekeepers, processors and extension services technicians) to identify differences in strategy, performance and local structure indicators.

Chapter 4 quantitatively evaluates the contribution to performance of the strategies deployed by three honey value chain streams in Brazil between 2007 and 2011. Conjoint analysis with experts is used to measure the perceived impact of strategies on the performance. The conjoint study also allows for measuring the effect of the change of a single strategy variable on performance.

Chapter 5 uses a Policy Delphi survey with experts to build three scenarios for the honey industry in Brazil for the period from 2015 to 2020. In the sequence, adaptive conjoint analysis with experts is used to identify the most important strategies to improve the performance of the three honey streams previously investigated. A set of strategies for the value chain streams is suggested for each scenario, according to the performance goals.

Chapter 6 synthesises the previous chapters, and places the outcomes in the literature. It also discusses methodological issues, and presents implications for business, policy and future research. This chapter ends with a summary of the main conclusions of the thesis.

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Chapter 2

Integrating structure, conduct and performance into value chain analysis

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Abstract

Value chain analysis has been adopted by several research and funding institutions for analysing local development opportunities. Development practitioners, however, are still looking for more solid grounds for value chain strategy development, especially after expected outcomes of interventions, such as poverty reduction, have been unclear. This paper aims at extending the Structure-Conduct-Performance (SCP) framework to connect value chain strategies, such as product, market, technology and governance choices, to outcomes with respect to local development. The extended SCP framework is developed through a literature review and an analysis of structure, conduct and performance aspects and their interactions. In this extended value chain SCP framework, the unit of analysis is not a firm, but a portion of a value chain in a territory, a local netchain, competing against another netchain elsewhere. The proposed value chain SCP framework highlights categories of structure, conduct and performance for value chains and provides an integrated approach to explore possible interactions among those categories. The use of the value chain SCP framework will help practitioners to evaluate different policy interventions. Application of this framework to devise strategies for several value chains is expected in future research, as well as the inclusion of social and environmental conduct and performance categories.

Keywords: economic development, supply chains, global networks, strategy

2.1 Introduction

In an increasingly complex world, international trade is growing with multiple stakeholders. In this riskier environment, as institutional economics explains (Ménard, 2005), competition for the end-customer takes place more among firm networks than among isolated firms. Supply chain management (SCM) often presents the notion of supply chain strategy from an individual firm's perspective (Lambert & Cooper, 2000; Wong *et al.*, 2012), where the firm seeks to fit its supply chain strategy to its product and market strategy. From this perspective, scholars have focused on improving supply chain performance through innovations (Archer *et al.*, 2008), green practices (Green *et al.*, 2012), or combinations of operational practices and inter-firm arrangements (Coronado *et al.*, 2010). Overall, SCM concentrates on increasing the surplus of the focal firm's chain and sees surplus distribution among chain participants only as a way to improve coordination and increase surplus. It does not analyse the impact of surplus distribution on the economy of the territories where those participants are located.

Frequently, supply chains sprawl over territories with distinct needs, challenging development specialists used to deal with more homogeneous areas in which individual firms operate. In this economic development context, a value chain is defined as the range of activities required to bring a product or service from conception, through production, to delivery to final consumers, and disposal (Kaplinsky & Morris, 2001). A value chain encompasses firms and their end-markets, business processes, supply and demand levels, horizontal and vertical links, and supporting actors providing cross-cutting and sector-specific services. The enabling environment surrounding a chain is the set of global, national and local government regulations and practices creating incentives for private sector growth (Kula, Downing, & Field, 2006).

The ability of a country to insert itself into global value chains is fundamental for its development (Humphrey & Schmitz, 2002). Under this state of affairs, value chain analysis has become popular in development interventions by government and funding agencies because it depicts business relations and local impact of surplus distribution (Altenburg, 2007), allows leveraging market-driven opportunities to alleviate poverty, and addresses business environment constraints (Roduner, 2007). Scholars (Cattaneo, Gereffi, & Staritz, 2010) and practitioners (Correa & Campbell, 2008) have emphasised the importance of value chain strategies, like product/market choices, technologies deployed, and types of vertical and horizontal linkages

among participants (Trienekens, 2011), to local development. Despite the fact that economic and social upgrading are often intertwined, one does not necessarily lead to the other (Barrientos, Gereffi, & Rossi, 2010). A value chain intervention usually includes participation of donors and insert effects, like poverty reduction, into value chain goals (Ton, Vellema, & de Wildt, 2011), which might otherwise not be explicitly pursued by private firms. In those pro-poor interventions, developmental goals are not expected to be by-products, and strategies mutually beneficial to participants are sought (Stoian *et al.*, 2012).

To identify suitable strategies for segments of value chains in territories, strategy frameworks like Strengths-Weaknesses-Opportunities-Threats (SWOT), Five-forces, and Competitiveness Diamond, and tools like benchmarking and positioning have been combined (Webber & Labaste, 2010; Mitchell, Shepherd, & Keane, 2011; Match Maker Associates Ltd., 2012). However, practitioners are still looking for better methods for value chain strategy conception (Helmsing & Vellema, 2011), especially after outcomes of interventions have been unclear (Humphrey & Navas-Alemán, 2010; Campbell, 2013). Most of the problem with outcomes of interventions may reside in the understanding of what a value chain strategy entails, in the tools used to devise those strategies, and in the missing interactions between strategies and expected outcomes.

Among the strategy frameworks used by practitioners, SWOT is recognizably not very effective and rigorous because it provides no orderly way to identify the constructs of each of its four elements, leaving it up to the user to select the areas of analysis (Hill & Westbrook, 1997). The Five-forces framework (Porter, 1980) assumes that firm performance is determined mainly at industry level rather than at firm level. Teece (2007) is especially critical to the use of the Five-forces framework in dynamic environments with networks for it downplays feedbacks of firm strategies on industry structure. The Competitiveness Diamond, in its turn, explores the role of an industry in the competitiveness of territories (Porter, 1998). The framework itself is not explicit towards performance objectives of the industries in the territory or towards the recognition of dynamic forces that can alter the competitive environment. It also tends to overlook comparisons among competing industries elsewhere.

A promising way of conceptualising strategy design and linking it with structural aspects and performance is the Structure-Conduct-Performance (SCP) framework. SCP was originally proposed to explain market power of firms. However, dissatisfactions mainly with cross-section studies of industries to

predict profits from structural measures originated the New Empirical Industrial Organization approach to market power (Bresnahan, 1989). More recently, in the management literature, a dynamic SCP has been used to conceive strategies for firms by comparing their conducts along their business systems and inferring practices that yield highest performance (Copeland, Koller, & Murrin, 2000). The basic SCP principle is the connection of a firm's performance to its conducts which, in turn, depend on industry structure. In the dynamic SCP, shocks (e.g. significant events caused by technological innovations or social behaviour changes) are the dynamic elements and feedbacks among structure, conduct and performance are acknowledged. SCP is compatible with the resource-based view that a firm's advantage arises from its conduct on acquiring and exploring valuable resources under an industry structure (Barney, 2001). The integrated assessment of variables for strategy conception is the major advantage of SCP (Stuckey, 2008).

In order to use the SCP framework to devise strategies, it is necessary to point out constructs or aspects of analysis for structure, conduct and performance, named herein categories. A characterisation of SCP categories for firm networks was made by Klint and Sjöberg (2003), without linking SCP categories or focusing on local development. To devise strategies for a network of firms and supporting actors that comprise a value chain in a territory, building on SCP interactions (Figueirêdo Junior & Sostowski, 2010), an extended SCP is needed. In such a framework, the unit of analysis is not a firm, but a value chain stream in a certain territory, competing against another stream elsewhere. A value chain is defined from an economic development perspective, in which the effects of the chain activities on the territory where the activities occur are central to the development discussion. The framework aims at devising strategies for value chains, more specifically to a segment of a value chain in a territory, and has the local, territorial development perspective included from its outset. In that regard, a value chain stream is the segment of the chain in a territory and can be viewed as a local netchain (Lazzarini, Chaddad, & Cook, 2001).

In light of the aforementioned, the main objective of this paper is to conceptually extend the SCP framework to value chains by: (i) identifying relevant value chain SCP categories, and (ii) devising an approach to explore possible interactions among those categories, with a focus on strategy conception towards local development.

2.2 Methodology

A literature review to identify value chain strategy studies is carried out within ISI Web of Knowledge and Google Scholar databases using the search criteria: structure-conduct-performance, global value chains, strategy, competitiveness, networks, and development. Next, references and citations are investigated for related contributions. Only value chain strategy studies are selected after the search criteria is deployed and the related references are investigated for relevance. References that do not deal specifically with value chain strategy studies are not included but many of them, for instance Gulati, Nohria and Zaheer (2000) and Klint and Sjöberg (2003), are used along the text to build arguments for the construction and use of the value chain SCP framework. Contributions are then analysed as to aspects of value chain structure, conduct and performance used by scholars and practitioners. The literature review forms the basis for developing a dynamic value chain SCP framework. This extended SCP framework points out structure-conduct-performance categories and mechanisms of interactions among them, deriving from categories of SCP applied to individual firms.

To limit complexity, the focus is on economic conduct and performance, in which only monetary aspects of poverty are considered. Performance categories are selected before conduct categories for conduct categories to be linked to performance categories, just as strategies are linked to goals. The choice of categories and their suggested indicators follows general criteria development institutions use (OECD, 2003): a) relevance to the problem – strategy conception; b) theoretically well-founded; and, c) measurability. Under those circumstances, categories and indicators are not expected to be exhaustive nor final but to cover main aspects of the problem and evolve as new knowledge is incorporated.

2.3 Reviewing structure, conduct and performance in value chain studies

To underpin an extended SCP proposal, scholarly and practitioner literature was investigated as to aspects, in value chain strategy studies, possibly associated with SCP categories. The selected literature list (Tables 2.1 and 2.2) is certainly not exhaustive, it gives preference to influential or overview studies that bring distinct SCP aspects up to discussion. Besides, it was only after the influential publications

by Humphrey and Schmitz (2000) and Kaplinsky and Morris (2001) that the definition of value chain as used in this paper incorporated earlier concepts like global commodity chains and filière (sector in French), solidified and gave birth to a full body of research and applications (Drost, van Wijk, & Vellema, 2010). In fact, there was confusion at the time with the term value chain, as Porter (1980) used it to refer to links between activities inside firms.

Contrary to scholars, practitioners usually produce reports, and few are converted into scientific publications. Considering structural aspects as mostly exogenous and conduct aspects as mostly endogenous to value chains, the most common aspects of structure in literature are market supply and demand, and infrastructure. Regarding conduct aspects, choices of products, market segments, technologies, and horizontal/vertical linkages are commonly cited. Performance aspects relate frequently to poverty reduction and operational chain efficiency.

Table 2.1. SCP aspects in literature produced by scholars*

Authors	Structure	Conduct	Performance	Industry/ Location
Humphrey and Schmitz (2000)	NI	Product/market, process/ functional upgrading, technology, agglomeration, vertical linkages	NI	General
Nadvi (2004)	Supply/demand, infrastructure, regulations	Supporting services, agglomeration	Employment, workers' income, poverty	General, horticulture, garments, textiles; Asia and Africa
Gereffi, Humphrey and Sturgeon (2005)	NI	Vertical linkages	NI	General
Lastres and Cassiolato (2005)	NI	Agglomeration	NI	General
Giuliani, Pietrobelli and Rabellotti (2005)	Global and local supply/demand	Agglomeration, product/ market, vertical/horizontal linkages, technology	NI	General; Latin America
Morrison, Pietrobelli and Rabellotti (2007)	NI	Technology, vertical linkages	NI	General
Coe, Dicken and Hess (2008)	Natural environment, institutions and regulations	Network linkages, vertical linkages, horizontal linkages, production and distribution activities	NI	General

Table 2.1. continued

Authors	Structure	Conduct	Performance	Industry/ Location
Bolwig *et al.* (2010)	NI	Vertical/horizontal linkages, processes, use of resources	Poverty (monetary, non-monetary), sustainability	General
Trienekens (2011)	Supply/demand, regulations, infrastructure, politics	Vertical/horizontal linkages, product/market, technology, marketing activities	Value-added	General, sardines; Asia
van Dijk and Trienekens (2012)	Global, national and local supply/demand, infrastructure, regulations	Vertical/horizontal linkages, agglomeration, product/market, technology	Value-added, poverty	General, horticulture, sorghum beer, bush-to-energy, palm oil, semiconductors, banana; Asia and Africa
Ruben and Zuniga (2012)	Natural conditions, local infrastructure	Product/market, processes, supporting services	Income, yield, price, quality	Coffee; Central America

NI: Not identified

* Aspects underlined are later selected to compose categories/indicators of the extended SCP.

Table 2.2. SCP aspects in literature produced by practitioners*

Authors	Structure	Conduct	Performance	Industry/ Location
FIAS (2007)	Regulations and public policies, infrastructure, entry barriers, demand/supply, geographic location	Product/market diversification, promotion, vertical/horizontal linkages, technology, local regulatory reforms	Jobs created, supply chain operational indicators (cost/time/ value-added), factor productivity (labour, capital, land, others)	Shrimp, tourism, textiles; Asia and Africa
Figueirêdo Junior and Sostowski (2010)	Global and local supply/demand, regulations	Product/market, pricing, technology, vertical/horizontal/ network linkages, supporting services	Sales, volume, yields	Cashew; South America
Webber and Labaste (2010)	Infrastructure, regulations, public policies	Vertical/horizontal linkages, clustering, support services, local regulatory reforms	Value-added, productivity, jobs, business growth	Catfish, floriculture, green beans, avocado, cashew, pineapple, coffee, cotton, meat; Africa
Match Maker Associates Ltd (2012)	Infrastructure	Supporting services (financial, technical assistance), technology, vertical/horizontal linkages, product/market diversification	Farm yields	Banana; Africa

* Aspects underlined are later selected to compose categories/indicators of the extended SCP.

While most of the scholarly literature focuses on specific aspects of value chain development, viewing only parts of the elements required to devise a solid strategy, the practitioners' work is more comprehensive, but no assessment combines all identified SCP aspects. Consequently, several interactions among SCP aspects are not indicated, especially interactions between suggested conduct and expected performance. Even when the aspects are considered, their interactions are not explicit nor feedbacks among aspects recognised. Also, rarely are dynamic aspects of the industry, in the form of structural shocks like regulatory changes, clearly taken into account in strategy conception, as in Nadvi (2004). When mentioned, variations of structural aspects tend not to have their implications fully explored.

2.4 Integrating value chain strategy conception with the SCP framework

Strategy conception starts with definition of goals and concludes with a decision about what strategy to follow. When the unit of analysis is a value chain stream instead of a firm, two questions arise: do the stream firms share common goals and who makes strategic decisions in value chain streams? At the firm level, managers' objective is to maximise the value of the firm to its shareholders, which may come at the expense of its suppliers or buyers in the stream. So, different steps of the stream are likely to have conflicting goals and, simultaneously, need each other to compete with streams elsewhere. Key in this relationship is avoiding short-term exploitation that can dismantle the stream in the long run.

As Gulati, Nohria and Zaheer (2000) argue, coordination and cooperation are paramount tasks in the alignment of network actions and interests, and relationships firms nurture in a network profoundly influence their conduct and performance. Therefore, determining a strategy for a stream requires that firms share some goals. Although strategic decisions are ultimately taken by individual managers inside firms, the degree to which other firms in the stream are involved depends on existing network arrangements. Ritter, Wilkinson and Johnston (2004) acknowledge the influence of the relationships of the network firms on the implementation of network goals, true especially for intentionally developed networks (Möller, Arto, & Svahn, 2005). In value chain interventions, government and funding agencies usually encourage existing network forums (for instance, business associations and boards) or provide new forums for stream coordination

and cooperation to intentionally flourish. Under those circumstances, an integrated strategy conception for a value chain stream points out relevant choices in conduct, and uses the extended SCP framework to investigate interactions among SCP categories. Selection of those categories and how they interact in the extended SCP are presented next.

2.4.1 Performance

For individual firms, financial performance indicators like profits or return on capital employed are preferred. In their absence, or complementarily, operational indicators pointing out measures of productivity are used. Applying the same rationale to value chains, the straightforward indicators of economic performance would be those same for all firms of the stream. Aggregate profitability figures, however, are usually unavailable or different accounting practices among firms complicate their use. Besides, local value chain profitability is not always correlated with local development. Although productivity increase is viewed as the only way a territory can produce high standards of living (Porter, 1990), those goals may be conflicting: productivity increases may come, in the short run, at the expense of jobs, or wage increases may come at the expense of productivity. Therefore, developmental aspects related to poverty alleviation shall comprise an additional dimension of value chain performance.

Combining suggestions from literature, value chain performance categories for the extended SCP framework – and some of their possible indicators – relate to operational (revenue and cost) and developmental (local value-added and employment) dimensions. SCP aspects in literature (Tables 1 and 2) and not listed below were either absorbed in a category (revenue and cost reflect quality, cycle time and factor productivity, avoiding overlap of categories) or not understood as a performance category (pricing):

a) *revenue*: captures the effect of pricing decisions on volume, especially if measured for the stream by product/market segment and compared to total segment sales. The volume of products sold outside the territory is the basis for measuring local surplus and capacity utilization;
b) *cost*: typical indicator of efficiency, total unit cost would ideally be estimated for products per step of the stream and detailed by input, to depict improvement opportunities;
c) *local value-added*: absolute value, per step of the stream and unit of output, and its total growth allow investigating differentiation or cost-efficiency

strategies. From a development standpoint, distribution of surplus among chain participants determines the local contribution of the chain;

d) *local employment*: number and kinds of jobs per step of the stream, their growth during a certain period, plus average individual income, capture who gets employed and serve as monetary indicators of poverty levels (Coudouel *et al.*, 2002).

2.4.2 Conduct

For individual firms, the SCP framework explores differences in behaviour along the main processes within the firm, starting from its product/market selections back to raw materials sourcing, plus internal auxiliary activities when relevant. For value chains, comparisons are required by step because activities are commonly distributed among firms. Besides, a new comparative dimension is required to capture organizational arrangements firms use in competing streams. The decisions on internal organizational arrangements constitute choices of stream participants and, thus, are part of conduct rather than structure. Organizational decisions (e.g. physical location, vertical linkages) are normally taken after a product/market strategy has been chosen, but in practice, especially for value chains, events do not follow an orderly sequence. In any case, like for a focal company supply chain, alignment of choices is desirable.

Drawing from the SCP for individual firms, and expected interactions to the selected performance categories, conduct categories and some indicators for the extended SCP framework are listed. The categories relate to business system processes (Porter, 1980) aggregated to the value chain (product/market, pricing, promotion, distribution channels, production technologies, product development, sourcing), and to aspects of the value chain stream's internal organization (vertical, horizontal and network linkages, agglomeration, use/quality of supporting services). All aspects in value chain literature (Tables 2.1 and 2.2) and in SCP theory are either absorbed in a conduct category or considered as a conduct category itself, with the exception of influence on local regulatory reforms, as explained later:

a) *product/market*: this choice is the fundamental decision of a competitive strategy and moulds the business system. Differentiated versus commodity share of production, and internal market versus exports share for products sold outside the territory depict product/market choices. Usually, full involvement of the chain is required to differentiate (e.g. organics);

b) *pricing*: in the industrial organization application of SCP, price was the essential category of conduct (Scherer & Ross, 1990). With the use of SCP for business strategy conception, price remained an element of strategy, given that only under perfect competition, the firms do not have the choice to determine their prices. In several chain studies, pricing is also key to performance: pricing of products sold outside the territory impacts local value-added and pricing of products traded locally impacts local value-added distribution;

c) *promotion (media and message)*: another classic component of marketing strategy, communication choices associated with value chain products are expected to influence performance;

d) *distribution channels*: placement choices (transportation modes and channels/facilities) for products are essential in marketing and logistics, influencing the chain's operational performance. As a stream is always linked to the same territory, by definition, decisions about location of facilities are only considered inside the stream territory;

e) *production technologies*: as technology plays a key role in strategy, identification of major technologies is required, by step of the chain and selected products. Technology adoption depends on labour costs and educational levels, and affects production scale, products/information flow in the chain, and product quality;

f) *product development*: whether the stream develops its products internally or relies on external agents can influence performance;

g) *sourcing*: types of raw materials and transportation modes used for selected products impact the cost of those products;

h) *vertical linkages*: governance types per step of the stream and on immediate links to firms outside the territory can be different. Governance is classified into market, modular, relational, captive or hierarchy, ranging from high to low levels of explicit coordination and power asymmetry (Gereffi, Humphrey, & Sturgeon, 2005). Governance choices exert influence on local value-added and on operational performance;

i) *horizontal linkages*: cooperation between local competitors range from joint investments to rivalry towards activities like marketing, sourcing and information exchange, and human resources training. While sharing of resources may promote economies of scale and scope in the stream, cooperation effects are not clear: authors like Porter (1990) argue that firm rivalry is necessary to innovation;

j) *network linkages*: network relationships influence the alignment of actions and interests for the achievement of goals (Ritter, Wilkinson, & Johnston, 2004). Those linkages can range from informal local associations to very formal business councils or chambers, with government participation, as suggested by Rodrik (2004). Network linkages go beyond the bi-dimensional interactions explored in vertical and horizontal linkages;

k) *agglomeration*: physical agglomeration of firms promotes economies of scale and scope, influencing stream performance (Porter, 1990). Clustering indices of firms and existence of players per step of stream are agglomeration measures;

l) *use/quality of supporting services*: coverage and quality, per step of stream, of technical and managerial extension services, financial services, research and development services, influence performance.

2.4.3 Structure and shocks

Industry structure categories shape conduct choices, and refer to the business environment, at first exogenous to the stream. They relate not only to demand and supply aspects of the specific market but also to general environmental conditions stemming from regulations, nature and infrastructure availability. Those categories are basically the same as in the firm SCP managers use (Scherer & Ross, 1990; Stuckey, 2008) – with adaptations to consider the stream as unit of analysis – because firms and streams operate under the same business environment. Notice that the value chain SCP structure categories encompass the Five-forces framework (Porter, 1980) as Porter's framework is derived from the structure aspects of the original SCP (Teece, 2007):

a) *demand behaviour*: strategic decisions rely on demand size per product/market segment, in value or units, its growth and trends explained by consumer preferences;

b) *concentration of clients/suppliers*: share of individual clients and suppliers of the stream in revenues and purchases, respectively, depicting the stream's bargaining power towards outside firms;

c) *rivalry intensity*: concentration of competing streams in the market, representing the freedom the stream has to impose its will on outside firms to improve its performance;

d) *entry barriers*: from the stream standpoint, barriers to entry competitors create in some markets – like access to distribution channels, product

differentiation, switching costs, capital requirements, economies of scale, and other cost advantages – are exogenous. Those barriers reduce the threat of new entrants and improve the performance of existing streams;

e) *substitute products*: competition from substitute products tend to force prices down and must be considered by the streams;

f) *natural environment*: local and global natural conditions like rainfall, temperature and vegetation shape strategic decisions, mainly in agribusinesses;

g) *institutional environment*: scholars and practitioners acknowledge the importance of norms and regulations like trade barriers, exchange rates, taxes, labour, quality and environmental rules on strategic decisions;

h) *infrastructure (built environment)*: availability of transportation modes and access to utilities are regarded by practitioners and scholars as factors external to the stream affecting its performance. In fact, local infrastructure availability, as discussed, can be influenced by stream actions.

Structure categories can be influenced by conduct of streams and, therefore, are not completely exogenous, reinforcing the need for feedbacks in the extended SCP. Complementarily, shocks affecting supply and demand structure characteristics – such as new competitors, technological and managerial innovations, changes in consumer preferences, shifting input costs or availability, and new regulations – compose variations of the business environment (Porter, 1998) under which value chain streams operate, and serve as basis for market structure reconfiguration.

2.4.4 An integrated approach to value chain strategy

Combining the SCP categories into a framework that incorporates structural shocks and feedbacks, as seen in Copeland, Koller and Murrin (2000) for individual firms, provides a dynamic and integrated approach to explore possible interactions among those categories (Figure 2.1). Accordingly, for a given structure, performance of a value chain stream in a territory, measured by a set of categorised indicators, can be explained by the conduct of that stream, also described under selected categorised indicators. For instance, streams presenting a high operational performance tend to gain share and alter the market structure. Furthermore, stream representatives, depending on their network linkages, may interact with local government to tilt regulations and infrastructure offer in the favour of the stream. So, the ability of

the stream to influence the local enabling environment is an expression of feedback from conduct to structure, not a conduct category itself.

While it brings more complexity, the integrated SCP assessment helps strategists to perceive factors otherwise forgotten. A value chain stream whose firms employ an imported fully-automated processing technology that yields low-quality products may be tempted to switch back to a semi-manual technology used by firms in competing streams that are gaining market share, but local labour regulations, a structural variable, prevents this. A premium-price segment, however, could absorb part of the production and compensate for increased labour costs in the semi-manual process. Or else, an improved automated process could serve both segments.

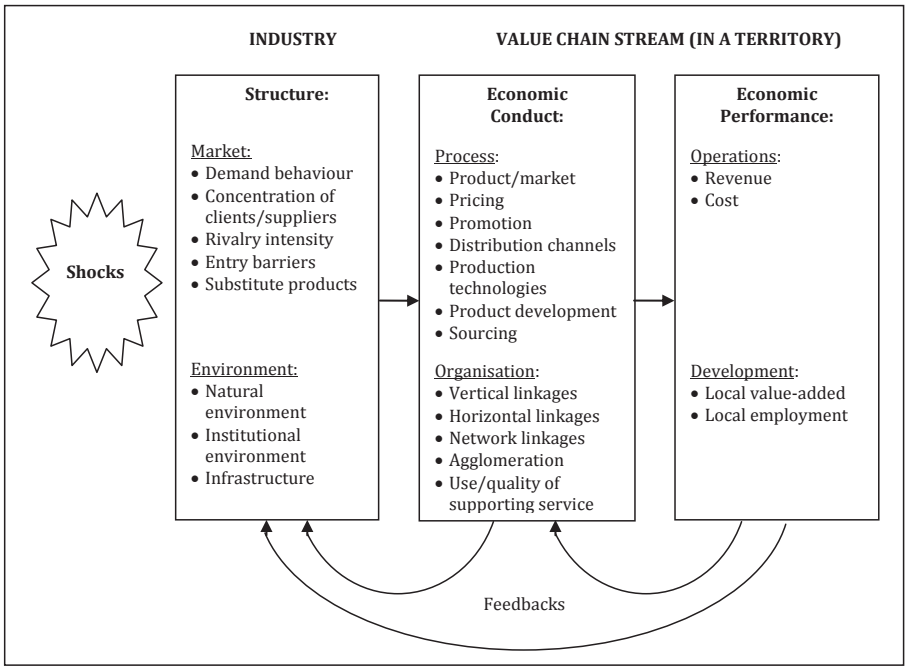

Figure 2.1. Dynamic value chain SCP framework and its categories

2.5 Conclusions and next steps

Existing tools for value chain strategy conception have not clearly pointed out connections of interventions to its outcomes (Humphrey & Navas-Alemán, 2010; Helmsing & Vellema, 2011). Efforts have been put on improving tools to assessing impacts of interventions, but just as important is viewing the value chain as a complex market system with multiple constraints and potential solutions, where changes in one part of the chain affect others parts of the chain (Campbell, 2013). The extended SCP framework, with a value chain stream as the unit of analysis, allows development practitioners to make an integrated assessment of structure, conduct and performance from a value chain perspective, facilitating the follow-up of interventions. The framework instigates value chain theorists to continue advancing the domain of value chain strategy, as explicit categories of strategies are revealed, and conflicting performance categories of the extended SCP highlight the need for better strategy alignment to desired outcomes. Although many value chain studies involve less developed countries and refer to agribusiness products, the extended SCP is generic and can be customised to characteristics of other countries and chains.

Empirical applications of the extended SCP shall address the large number of SCP variables and interactions among them. The challenge is to identify the individual effects on the performance of the value chain. Possible interactions among SCP categories can be analysed by identifying similar indicators of structure and conduct for all comparing competitors. For instance, structure indicators at the global level are the same for all competitors but, at the local level, they may be quite different, like regulatory conditions. A particular characteristic in conduct indicators is that well-managed firms and streams align their indicators in a coherent strategy. Thus, what initially seems a large number of conduct alternatives is reduced to a handful.

Data availability issues for competing stream may arise during the application of the framework, starting with the selection of specific indicators per category. The process of generating feasible strategic alternatives has to identify upfront the steps of the stream and the territory limits where most of the stream activities take place and where development impacts of interventions are expected, for consistent data collection and analysis. In a retrospective analysis, the task is to identify and associate a set of conducts to past stream performance. In a prospective analysis, evaluation of alternatives can be qualitative or involve quantitative investigation

with opinion of experts. A typical application of the extended SCP would be under a multiple case study, with competing streams representing cases for comparison. Applications in different industries are also required to investigate the nature of interactions among SCP categories. For example, which horizontal linkage is the most appropriate to a certain value chain stream in a developing country, if a goal is to reduce monetary poverty? This may evolve to show how important the stream conduct itself is to its performance as compared to the structure of its industry. Additional studies could define specific social and environmental conduct and performance categories, and investigate interactions among them as well as their cross-over effects.

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Chapter 3

Evaluating Strategies for Honey Value Chains in Brazil using a Value Chain Structure-Conduct-Performance (SCP) Framework

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Abstract

Development organizations have used value chain analysis in defining interventions for the honey business in major exporting countries like Brazil. Yet, the impact of interventions has been unclear. This paper aims at evaluating strategies of three honey value chain streams in Brazil, selected for a multiple case study between 2007-2011. Using the value chain Structure-Conduct-Performance (SCP) framework, likely successful strategies are identified by comparing stream performances. Next, the outcomes of this comparison are validated through questionnaires with experts. Understanding current stream strategies and local structural conditions, and fostering well aligned strategies are found to be key for successful donor interventions.

Keywords: economic development; supply chains; interventions; beekeeping

3.1 Introduction

Bees are important pollination agents for many commercial crops. In addition, economic sectors like processed food, food services and pharmaceuticals use apiculture products as input. This intertwined relation became more explicit lately in Europe and in the United States with the puzzle of disappearing bees (Tapparo *et al.*, 2012, Henry *et al.*, 2012). More fundamental problems in apiculture, however, are commonly found in countries that are major producers and exporters of honey: weak market linkages, low pricing transparency, inadequate labour skills, limited access to credit, and inability to perform quality requirement tests (Bradbear, 2009).

In order to address these problems, several development agencies have employed the value chain perspective in defining their interventions (Anand & Sisay, 2011; Reji, 2013). However, often the outcomes of these interventions are not clear in terms of their contributions to competitiveness improvement and poverty reduction. This is because many interventions miss connections among their strategies and expected outcomes, fail to realise limitations in the environment in which they take place, or use evaluation periods shorter than the time required for the results to materialise (Brusky & Monteiro 2008; Horton *et al.*, 2010; Demont & Rizzotto, 2012; Fernandez-Stark & Bamber, 2012). Besides, intervention evaluations do not usually rely on causal relations, on a mix of qualitative and quantitative approaches, and on the inclusion of comparative case studies (Ton, 2012), and are frequently not well documented (Kidoido & Child, 2014). Impact evaluation is also compromised by the introduction of new policies and changes in the management of the government organizations that undertake the intervention, or by the absence of a sound monitoring system for the program (Cuny Garloch, 2012).

The shortcomings of the evaluation of interventions also apply to the honey value chain interventions carried out in the northeast of Brazil. There, national, state governments and non-governmental organizations (NGOs) have been investing in the honey value chain, so far with unclear outcomes. Those interventions are usually made on a segment of the honey value chain located in specific territories. Herein, a segment of a value chain located in a territory is defined as a value chain stream. Against this background, the main objective of this paper is to identify likely successful strategies employed by three honey value chain streams in Brazil, including the ones supported by interventions. The three cases investigated – Limoeiro do Norte, Picos and Santana do Cariri – all received support from government and NGOs. The methodology employed in this paper to

identify successful stream strategies addresses the aforementioned shortcomings of the evaluation of value chain interventions.

The remainder of this paper is organised as follows. Section 3.2 describes the methodology: the choice of the strategy framework to identify and evaluate value chain strategies, the selection of the value chain stream cases, the selection of the framework indicators for inter-case comparison, and the evaluation process. The evaluation of the streams' strategies itself is conducted using the value chain Structure-Conduct-Performance (SCP) framework in Section 3.3, and the discussion of the results and policy conclusions follow in Section 3.4.

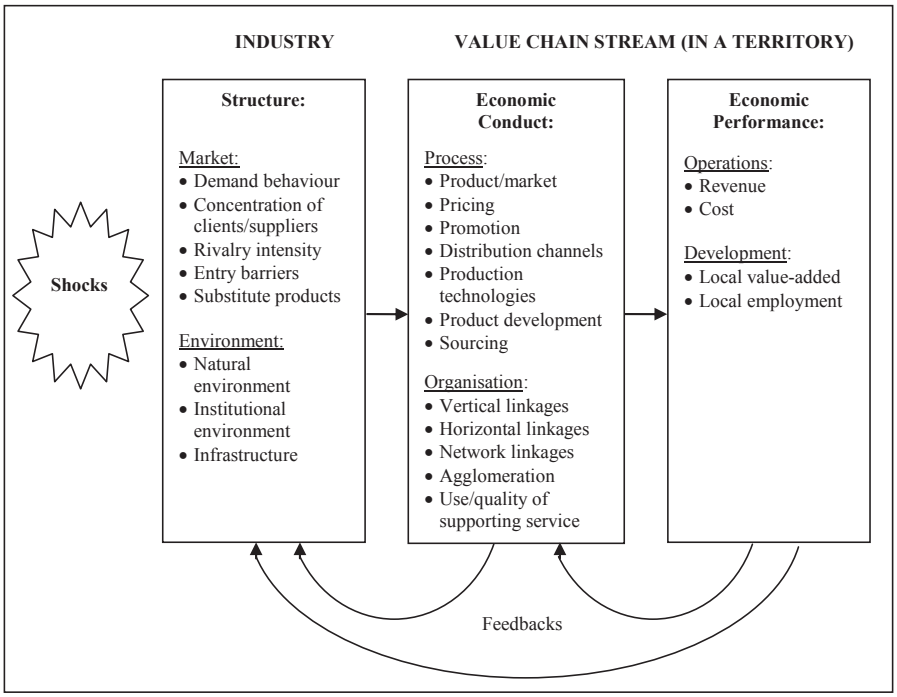
3.2 Methodology

3.2.1 Strategy identification and evaluation framework

Several frameworks like Strengths-Weaknesses-Opportunities-Threats (SWOT), Five-Forces (Porter, 1980) and Competitiveness Diamond (Porter, 1990) have been employed to devise strategies in value chain studies (Webber & Labaste 2010). However, none of these frameworks were originally developed for dealing with value chains. This paper used a framework developed specifically for value chains, which is the value chain SCP framework (Figueirêdo Junior, Meuwissen & Oude Lansink, 2014). The framework identifies and evaluates strategies (conducts) for the value chain streams through an integrated assessment of structure, conduct and performance.

This framework not only recognises direct interactions but also feedbacks among structure, conduct and performance, and acknowledges the existence of shocks, significant events that can alter the way those interactions take place. The value chain stream is the unit of analysis and the categories of the framework are groups of related indicators describing a relevant dimension of structure, conduct and performance. For structure, there are categories related to market forces, and categories related to the enabling environment. For conduct, there are categories related to business process decisions, and categories related to organizational decisions. And for performance, there are categories related to the operations of a stream, and categories related to the contribution of that stream to local development. The performance categories related to the stream operations can be associated to the competitiveness of the stream, while the performance categories related to development can be associated to poverty alleviation (Figure 3.1). The

value chain SCP, therefore, nests the Five-forces framework, and is compatible with the resource-based view of firms (Barney, 2001).



Source: Figueirêdo Junior, Meuwissen and Oude Lansink (2014).
Figure 3.1. Dynamic value chain SCP framework and its categories.

3.2.2 Case selection

A multiple case study was conducted with competing streams of the honey value chain in Brazil with different business characteristics: two in Ceará State – one around the municipality of Limoeiro do Norte and the other around the municipality of Santana do Cariri – and one in Piauí State – around the municipality of Picos. Those three municipalities accounted for 3.3% of the Brazilian production and ranked in the top five among the more than 3,800 honey producing municipalities in the entire country in 2011 (IBGE, 2012). The country itself was among the top ten world honey exporters in 2011 (FAO, 2013). Each case is a value chain stream in a territory, consisting of a set of firms vertically and horizontally linked, with their own group of products, technology levels, supporting market services and other conduct characteristics, under a given business environment. The selected value chain streams also experienced distinct degrees of donor interventions. The reason

to pick different streams of the same value chain is to allow for retrospective inter-case comparison (Yin, 2009). Picking the streams in the same country reduces the complexity of the analysis as the number of relevant structural indicators goes down, and makes the data collection less costly.

Both primary and secondary sources were used according to the type of data required. Production by municipality was extracted from Brazilian official government registries. This information was used to support the identification and selection of the streams of the honey value chain. Information about the chains was also obtained through interviews with 45 stream stakeholders such as beekeepers, processors, traders and supporting services providers (Appendix, Table A1). The interviews took place between November 2012 and October 2013 in the locations of the streams, and were undertaken using a semi-structured general interview schedule with mostly closed questions and some open questions. This schedule, by stream, aimed at obtaining quantitative and qualitative information about the participants of each step of the value chain stream, about the interventions the stream went through, and about the value chain stream SCP categories and their indicators. Each interview focused on parts of the schedule which were more familiar to the interviewee, and lasted between 30 minutes and 2 hours. Sometimes, the interviews were followed up by phone calls or e-mail exchanges, depending on the need for further clarification on the information initially provided by each interviewee. Data were gathered for the period from 2007 to 2011. Five years is considered to be a sufficiently long period to capture the effects of interactions within the value chain SCP framework.

In this research, the borders of the territory where the stream activities take place were defined by the administrative borders of the group of municipalities (Table 3.1) housing the participants of the stream. The selection of the municipalities to compose continuous stream territories (Figure 3.2) started from the main honey producing municipality. Next its immediate neighbours in the same state were included. Furthermore, municipalities within the range covered by local service providers, as identified by the interviewees, were added to the territory. The final configuration of the stream territory was validated by stream representatives. The three resulting streams accounted for 11.2% of Brazilian honey production (IBGE, 2012) and 10.2% of honey volume exports in 2011 (MDIC, 2013).

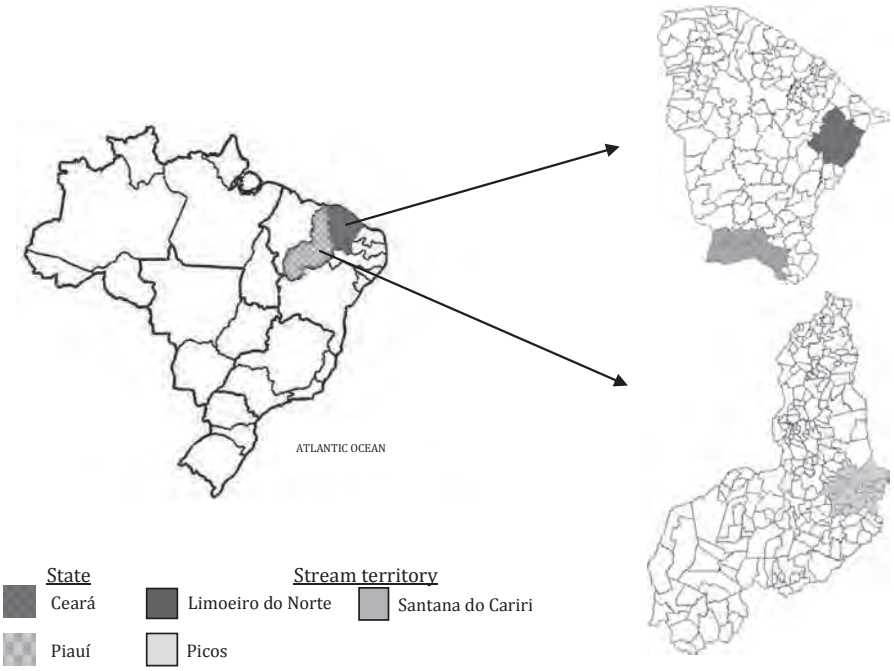
Several government and donor interventions took place during 2007 and 2011 in the selected streams and are described next, based on the information obtained during the interviews. Very often, those interventions did not rely on a

comprehensive development plan for the chain in the region, but just addressed demands of producers. One of the few initiatives that addressed several aspects of the honey business and took a longer range view was the APIS Project carried out by the Brazilian Micro and Small Business Support Service (SEBRAE) between 2003 and 2008 in many regions of Brazil, included the regions around Limoeiro do Norte, Santana do Cariri and Picos. Its goal was to develop a sustainable apiculture in the Brazilian territory, through the diffusion of technical and managerial assistance to smallholders (Souza, 2006).

Table 3.1. Geographical composition of value chain streams

Value Chain Stream		Geographical Composition
Limoeiro do Norte	-	7 municipalities, 8,214 km², 261,037 inhabitants (2010): Alto Santo, Limoeiro do Norte, Morada Nova, Quixeré, Russas, São João do Jaguaribe, Tabuleiro do Norte
Picos	-	34 municipalities, 15.784 km², 294.017 inhabitants (2010): Alagoinha do Piauí, Alegrete do Piauí, Aroeira do Itaim, Belém do Piauí, Bocaina, Caldeirão Grande, Campo Grande do Piauí, D. Expedito Lopes, Francisco Macedo, Francisco Santos, Fronteiras, Geminiano, Itainópolis, Jaicós, Marcolândia, Massapê, Monsenhor Hipólito, Padre Marcos, Paquetá, Patos, Picos, Pio IX, Santa Cruz do Piauí, Santana do Piauí, Santo Antônio de Lisboa, São João da Canabrava, São José do Piauí, São Julião, São Luís do Piauí, Simões, Sussuapara, Vera Mendes, Vila Nova do Piauí, Wall Ferraz
Santana do Cariri	-	14 municipalities, 9,352 km², 640,306 inhabitants (2010): Altaneira, Araripe, Assaré, Barbalha, Campos Sales, Crato, Farias Brito, Jardim, Juazeiro, Missão Velha, Nova Olinda, Potengi, Salitre, Santana do Cariri

Source: IBGE (2013), field interviews, analysis of the authors.



Source: IBGE (2013), field interviews, analysis of the authors.

Figure 3.2. Location of the value chain streams in Brazil.

In Limoeiro do Norte, with the end of the more widespread technical and managerial assistance by the regional development agents of the APIS Project in 2008, only a small group of producers in one village kept receiving some assistance by SEBRAE. From the state government, one intervention was reported between 2007 and 2011: training of groups of producers on beekeeping management, honey house operations and association of farmers, offered by the Secretariat of Agrarian Development of Ceará State (SDA).

In Santana do Cariri, the number of interventions is abundant from 2007 to 2011. The stream was also served by SEBRAE's APIS Project until 2007. In the beginning of that year, the stream was granted by the Ceará State Government and the Ministry of National Integration a new honey processing unit in the municipality of Barbalha, and five new honey houses in other municipalities of the region of the stream. The farmers were expected to extract honey in the houses and process it in the new unit, but that unit never worked. Out of the five honey houses, none has the Hazard Analysis and Critical Control Points (HACCP) certification, and one was not finished. From 2008 on, SDA, with resources from The Food and

Agriculture Organization (FAO), Ministry of National Integration (MNI), Banco do Brasil (Bank of Brazil) Foundation (BBF) and its own, undertook scattered initiatives to small groups of farmers consisting of distribution of queens, and training on beekeeping, honey house operations, and association of farmers. SDA also funded the construction of another honey house with money from the World Bank whose construction has been paralysed for three years. A very local initiative with a group of 75 small producers in five rural agrarian reform communities was under way by BBF from 2007 to 2011 as a sustainable development action (social program). BBF mobilised partners for technical (from the Rural Extension and Technical Assistance Ceará State Company – EMATERCE) and managerial (from SEBRAE) assistance, and provided financing through regular rural credit lines of the local bank branch.

In Picos, government and donor interventions were even stronger in terms of the total amount of subsidies provided. MNI, SEBRAE, BBF, Unisol (a workers' national cooperative), Unitrabalho (network of universities and unions), and ICCO (a Dutch NGO) contributed to the construction, in 2007, of Casa Apis, a processing and fractioning unit in the form of a central producers' cooperative (joint venture of 8 regional honey cooperatives in Piauí State). During this period and with money from those supporters, standard HACCP accredited honey houses were built in the region of the stream to supply Casa Apis. Starting in 2008 and still going on are donations of Casa Apis by SEBRAE and BBF to fund the full salary of regional sustainable development agents and extension officers (inspired in the previous APIS Project). Casa Apis is currently an important player in the Brazilian and in the export market. The national (through the government-owned São Francisco Valley Development Company – CODEVASF) and the Piauí State government (through its Rural Development Secretariat) also implemented programs that involved the donation of hives and training of new producers. In addition, CODEVASF funded a brand new honey technology development centre (CENTAPI) that was built in 2009, and not used so far.

3.2.3 Selection of indicators for stream comparison

Starting from a suggestion of generic indicators by category (Figueirêdo Junior, Meuwissen, & Oude Lansink, 2014) of the value chain SCP framework, specific indicators were chosen for each category according to: a) relevance; b) measurability; c) mutual exclusivity; and, d) data availability. Normalisation of indicators in terms of growth, percentages of total or per unit values was sometimes

required to allow for appropriate inter-stream comparison. Categories for which data on indicators were not available, like cost, were left out. The problems found by Bradbear (2009) in honey value chains were used to point out the relevance of indicators associated to the value chain SCP categories. For instance, in the case of structure categories, labour characteristics are considered in the institutional environment. In the case of conduct categories, commercial and physical market linkages are considered in distribution channels, quality certification is considered in production technologies, and access to credit is considered in use of supporting services. A list of the selected SCP indicators is presented in Table 3.2.

In total, 18 indicators are initially selected for structure, 26 for conduct, and four for performance. Notice that, for structure and conduct categories, both quantitative (for instance, coverage of technical assistance) and qualitative indicators (for instance, technical assistance type) were obtained from the interviews with the chain representatives and from secondary data. For performance, apart from possible conflicting goals, the interpretation of the results is straightforward for each of its quantitative indicators: that is, higher reflects a better performance. Conflicting goals in terms of increased competitiveness and poverty alleviation may be evidenced, for instance, when attempting to increase local value-added by processing commodity honey in the stream territory leads to lower export growth.

3.2.4 Evaluation of strategies

After the quantitative and qualitative indicators were chosen and assessed, the value chain streams were ranked according to each performance indicator. A list of strategies that were most likely to have influenced the relative performance of each stream was initially prepared, based on literature and deductive reasoning in line with the SCP framework. Variations among stream strategies were exploited to explain performance. Next, the importance of each strategy and the effects of those strategies on each stream were further evaluated through a structured questionnaire with two experts per stream, six in total. The experts consisted of honey business consultants and large honey processor associates. The experts were asked to rank the strategies, according to the impact of each strategy on the performance indicator(s) the stream excels. The questionnaires were applied between October and November, 2013. Finally, the top three strategies for each performance indicator were determined by averaging the ranks of the two experts in each stream. Thus, the robustness of the qualitative explanation of each stream performance by its strategies, using the SCP framework, is quantitatively assessed by the experts.

Table 3.2. Initial selection of structure, conduct and performance indicators

Component	Category	Indicator
Structure	· Demand behaviour	- World honey production growth
		- National honey apparent consumption growth
	· Concentration of clients	- World market share of top 4 honey import countries
		- National market share of top 4 food retailers
	· Concentration of suppliers	- Not applicable
	· Rivalry intensity	- World market share of top 4 honey export countries
	· Entry barriers (barriers created by competition)	- Capital and knowledge intensity
	· Substitute products	- Existence of relevant substitute products
	· Local natural environment	- Average temperature[1]
		- Normal rainfall[1]
		- Main bee forage sources
	· Institutional environment	- Taxes and subsidies
		- Business chamber/board/federation
		- Labour
		- Import tariffs
		- Quality requirements
		- Exchange rates
	· Local Infrastructure	- Access to utilities
		- Road distance to export harbour
Conduct	· Product/market	- Honey direct exports as % of production
		- Direct exports to US as % of exports
		- Honey certified organics as % of production
		- Honey certified fair trade as % of production
		- Monofloral honey as % of production
	· Pricing	- Honey bulk export price and % ratio to market price
	· Promotion	- Message/media
	· Distribution channels	- Honey exported directly to packers as % of exports
		- Transportation modes to main clients
	· Production technologies	- Honey production and extraction
		- Number of honey house/HACCP* units, level and per 100 beekeepers
		- Honey bulk processing and packaging
	· Product development	- Internal vs. outsourced
	· Sourcing	- Floral sources distribution as % of production
	· Vertical linkages	- Production by vertically integrated processors as % of total production**
		- Type of governance regarding clients outside stream
		- Honey production sold to local processors as % of total production**
	· Horizontal linkages	- Resources sharing at production step
		- Resources sharing at other steps
	· Network Linkages	- Participation in chamber/board/federation
	· Agglomeration	- Concentration of stream beekeepers per km^2
	· Quality of supporting services	- Technical assistance type
		- Technical assistance practices
	· Use of supporting services	- Technical assistance coverage as % of beekeepers
		- Managerial assistance coverage as % of beekeepers
		- Credit coverage as % of beekeepers
Performance	· Revenue	- Honey production growth***,****
		- Honey exports value growth***
	· Local value-added	- Honey value-added in all stream steps per total production
	· Local employment	- Number of beekeepers growth****

Source: (1) Adjare (1990); field interviews and authors' analysis.
* Hazard Analysis and Critical Control Points accreditation
** Indicators not mutually exclusive but left in final selection to reveal perspectives of vertical integration
*** Indicators not mutually exclusive but left in final selection to reveal components of revenue
**** Indicators not mutually exclusive but left in final selection to represent operations and development categories.

3.3 Results

3.3.1 Structure

The majority of the structure indicators was similar for the three value chain streams, either because they depict world market and environment conditions, or because they depict conditions of similar regions of Brazil where the streams are located. Out of the 18 structure indicators initially selected, 10 were assumed to influence the relative performance of the streams, either directly (as in the case of the favourable conditions shown by the natural environment indicators) or by strengthening the effects of stream strategies (as in the case of the demand behaviour indicators that favour the streams that choose to export). The figures for the remaining, less influential structure indicators are presented in Appendix, Table A2. A summary of the more influential honey business market and environmental structure indicators is presented in Table 3.3, and a more detailed description of those indicators is provided next.

Table 3.3. Relevant structure indicator figures for the selected value chain streams

Category	Indicator	Value Chain Stream		
		Limoeiro do Norte	Santana do Cariri	Picos
Demand behaviour	- World honey consumption growth 2007-2011 (% year)[1]	2.7% (with growing organic and fair trade segments)		
	- National honey apparent consumption growth 2007-2011 (% year)[1]	(3.2%)		
Concentration of clients	- World market share of top 4 honey import countries (% of volume, 2007 and 2010)[1]	64%, 56%		
Entry barriers	- Capital and knowledge intensity[2]	Relatively low in production		
Local natural environment	- Average temperature (°C)[1]	25-29		
	- Normal rainfall (mm/year)[1]	721-973		
Institutional environment	- Taxes*,[2]	Tax incentives to attract processing units offered at state and national levels		
	- Subsidies*,[2]	Limited	Limited	Very strong to small producers
	- Business chamber/board/ federation[2]	Existence of honey chamber and beekeeping federation at state and national levels		
	- Labour[2]	Increasing cost of labour at national level, limited highly skilled labour at local level		
	- Quality requirements[2]	Stricter quality requirements at both national and international levels		

Source: (1) CBI (2011), FAO (2013), IBGE (2012, 2013), INMET (1992), IPECE (2012), MDIC (2013); (2) field interviews.

* Indicator taxes and subsidies divided to account for realised stream differences.

The worldwide honey production reached 1.6 million tons in 2011, growing on average by 2.7% per year since 2007, and is taken as a proxy for global honey demand figures. In the same period, honey consumption in the Brazilian market went down. In 2010, approximately 35% of global honey demand, measured by apparent consumption, came from the European Union (EU), the United States (US) and Japan (FAO, 2013). Organic and fair trade, despite their fragmented market information, are among the fast growing honey segments (CBI, 2011). The biggest importers of honey were Germany and the US, together representing 41% of total 0.5 million tons of honey imported in 2010, followed by Japan and the United Kingdom (FAO, 2013). The share of the top four (CR4) import countries dropped from 64% to 56% in volume from 2007 to 2010.

Capital and knowledge requirements are relatively low for beekeepers. However, capital to acquire hives and equipment for extraction (US$ 50/hive) can still be a significant barrier to low resource beekeepers. Working capital can be a limitation for processors because honey is bought mostly in cash and sold on credit of up to three months. Firms that want to export need to produce at least one container (19,380 kg), and need to have processing units certified by the Brazilian Ministry of Agriculture with the Federal Inspection Service (SIF) seal.

Tax incentives at state and national levels are offered to attract manufacturing facilities like the honey processing units. However, no significant differences exist among the streams because they are all located in the same region of the country and the state governments manage to mimic each other in their tax breaks. Direct subsidies to small honey producers are higher in Picos. Honey chambers and beekeepers federations exist at state and national levels. All streams have faced increasing costs of labour, given that the minimum wage went up from US$ 195 to 325 per month in Brazil during the period of analysis. Also, all firms faced stricter process and product quality requirements, both nationally and internationally.

The EU, according to the interviewed Brazilian exporters, has stricter quality requirements than the US. The EU and the US both require humidity below 18.6%, but the EU maintains maximum values for fructose and glucose ratios, and hydroxymethylfurfural (HMF) content. In addition, the EU requires that the honey houses and processing units follow the HACCP system, while the US only requires HACCP for the latter. Besides, the EU has demanded that the exporting country has a residue monitoring plan approved by the European Commission (European Commission, 2013a). Indeed, regulation regarding residues caused the EU embargo to the Brazilian honey that lasted for almost two years between June 2006 and March 2008.

During the 2007-2011 period, some events (shocks) with the potential to significantly alter the structure of the honey industry, as defined by the value chain SCP framework, are identified. More generally, the financial crisis in the US and the EU that started in 2008 may have affected relationships among some exporting firms and traders but, overall, both international honey prices and consumed volumes kept going up. Other events in the supply side counterbalanced the economic slowdown, like the CCD in Europe and US, and the gradual displacement of traditional bee forage cultures by cattle farms in Argentina (D. Chiachiarini, personal communication, November 14, 2012). More specific to Brazil, the embargo to Brazilian honey by the EU from 2006 to 2008 represented an opportunity for competitors in the EU at the time that it forced Brazil to redirect its exports to the US. The 2011 EU ban on honey ruling out genetically-modified organisms (Court of Justice of the European Union, 2011) from general sale was another relevant event, but its effect may be mostly felt by producers from 2012 on. As a result of industry dynamics, worldwide average honey import prices rose by 8.7% per year between 2007 and 2011 (from US$ 2.18 to 3.04 per kg), which is mainly attributed to a poor harvest in the US, EU and Argentina (USAID, 2012). Alongside, the average price of honey exported from Brazil went up 17.8% per year, from US$ 1.64 to 3.16 per kg (MDIC, 2013) in the period 2007-2011.

3.3.2 Stream conduct

Some of the strategies followed by the value chain streams can be read from the interventions undertaken by government and donors, and more rarely by explicit declarations of leading firms. However, most of the strategies are not known beforehand, they have to be deciphered through registering and comparing conduct indicators. In that sense, from the 26 conduct indicators initially selected, 14 were selected for further analysis. These 14 indicators presented in Table 3.4 were selected because they differed between chains and, thus, were assumed to be important for explaining performance differences between streams. The importance of these conduct indicators was confirmed by the outcomes of the questionnaires with experts. A description of these indicators enriched with qualitative information provided during the interviews with the value chain stream stakeholders is next. Naturally, conduct indicators that are somewhat similar for each stream are not expected to contribute to performance differences. Less influential conduct indicators are reported in Appendix, Table A3.

In terms of product/market choices, the streams present many differences. In Limoeiro do Norte, despite the enormous growth, less than half of the production is being directly exported. In Picos, exports are less than 30% of production and in Santana do Cariri, the processing units export more than the local production, by acquiring honey from other regions. The only region that has been able to offer monofloral honey is Santana do Cariri, due to the high demand for its white *Serjania sp* honey, and to the separate site and season of this plant's blossoming. All but Santana do Cariri have increased the participation of organically certified honey in the production, while only Picos has had part of its production certified as fair trade. When comparing production practices, relevant is the total number of honey houses and the ones with the HACCP accreditation: Limoeiro do Norte has more houses than the other streams but Picos has more houses with HACCP (often built with support of donors).

A clear-cut distinction is observable in the vertical linkages among producers and processors within the stream. In Picos, propelled by cooperative arrangements and family relationships, there is a quasi-vertical integration organisation that currently accounts for roughly 25% of the local production. In Limoeiro do Norte, the processors are vertically integrated towards production, and although their volume represents only around 15% of the stream volume, the processors are local entrepreneurs with a long-standing history of trust-based deals and technical assistance. In Santana do Cariri, the processors are entrepreneurs that moved from other producing areas in the south of Brazil, and managed to pioneer the activity in the region and grow the business through market-based exchanges. As to the flow of the locally produced honey through the streams to the end markets, in Santana do Cariri, the local units acquire almost all local production while in Limoeiro do Norte it is the opposite, with Picos somewhere in between, but growing towards local processing.

In all three streams, it is still common to find groups of producers organised in associations, very often as a result of a requirement of donors to qualify for grants. Nonetheless, horizontal co-operation is usual among producers in the form of labour and material sharing during honey harvest and extraction, especially among the ones located close together. Only in Picos, the associations were turned into active cooperatives, with sales capabilities. In both Ceará and Piauí states, there is one state honey chamber which serves as a forum for problem solving and for channelling demands of the honey chain representatives to government, a form of network level co-ordination. Picos representatives have been very participative

Table 3.4. Relevant conduct indicator figures of the selected value chain streams

Category	Indicator	Value Chain Stream					
		Limoeiro do Norte		Santana do Cariri		Picos	
		2007	2011	2007	2011	2007	2011
Product/ market	Honey direct exports (% of production)[1]	8%	41%	150%	127%	11%	27%
	Honey certified organics (% of production)[2]	0%	22%	89%	75%	7%	14%
	Honey certified fair trade (% of production)[2]	0%	0%	0%	0%	0%	16%
	Monofloral honey (% of production)[2]	0%	0%	45%	37%	0%	0%
Production technologies	Number of honey house units/HACCP units and per 100 beekeepers*[,2]	13/0 (2.6/0)	43/2 (4.0/0.2)	14/0 (3.0/0)	29/3 (4.4/0.5)	20/17 (2.6/2.2)	22/19 (1.2/1.0)
Vertical linkages	Honey production by vertically or quasi-vertically integrated processors (% of production)[2,3]	5%	16%	Insignificant		7%	22%
	Honey production sold to local processors (% of production)[2,3]	10%	42%	95%	85%	19%	31%
Horizontal linkages	Resources sharing at production step[2]	Associations for sharing equipment, labour and facilities for honey extraction		Associations for sharing equipment, labour and facilities for honey extraction		Strong cooperatives for sharing equipment, labour and facilities for honey extraction and sale	
Network linkages	Participation in chamber/board/ federation[2]	Almost no participation in apiculture State Federation or Chamber		Irregular participation in apiculture State Federation or Chamber		Active participation in apiculture State Federation or Chamber	
Quality of supporting services	Technical assistance type	Specialised		Specialised	Not specialised	Specialised	
	Technical assistance practice	No free distribution of hives		No free distribution of hives		Free distribution of hives	
Use of supporting services	Technical assistance coverage (% beekeepers)[2]	63%	6%	NA	43%	59%	30%
	Managerial assistance coverage (% beekeepers)[2]	63%	22%	54%	12%	59%	30%
	Credit coverage (% beekeepers)**[,2]	9%	5%	10%	11%	21%	25%

Source: (1) FAO (2013), IBGE (2006, 2013), MDIC (2013); (2) field interviews; (3) estimated by authors.
* Standard capacity around 1,400 kg/day
** Two government-owned banks, Banco do Nordeste and Banco do Brasil, represent 100% of apiculture credit contracts.

on the state honey chamber, occupying management positions, while Santana do Cariri and Limoeiro do Norte representatives have not. Apart from participation in the honey chamber, co-operation among processors is not existent.

As to supporting services, technical and managerial assistance originally provided by SEBRAE development agents in 2007 through the APIS Project were mostly discontinued, except for Picos, where the local cooperative maintained its specialised assistance to its affiliates and recurs to donor funds to distribute hives for free to beekeepers. In Santana do Cariri, technical assistance was provided by the Ceará State extension services company but the technicians also provided extension to producers of other products such as fruits, sheep and goats. In Limoeiro do Norte, those services were provided only to a small group of beekeepers by SEBRAE. Financial services were provided by two national government-owned banks, Banco do Nordeste and Banco do Brasil, with the former being more active in apiculture than the latter, especially in Ceará state. Picos financial service providers were able to cover a larger percentage of producers than in the other two streams but, in all regions, close to 80% of the producers had no access to credit between 2007 and 2011.

3.3.3 Stream performance

A description of the performance of each value chain stream is presented next, for both the operational and the developmental dimensions (Table 3.5). As for the operational dimension, a comparison between streams also requires understanding aspects of the performance of the honey chain as a whole in the country. In that regard, Brazil's honey production grew 4.6% per year, on average, between 2007 and 2011 (IBGE, 2012), while the value of exports grew, in value, on average, 35.2% per year in the same period (MDIC, 2013). Meanwhile, Limoeiro do Norte's production grew below the country's rate, but its exports grew far above the country's rate due to the start-up of the operations of the local processing and exporting unit during the period. Picos production grew even higher than Limoeiro do Norte's, followed by a rapid increase in its exports, while Santana do Cariri was not able to keep the pace with its exports despite its fast production growth.

As for the development dimension, Santana do Cariri had the highest local value-added for all steps of the stream in 2011 normalised by kilogram of honey produced in the stream, with Picos and Limoeiro do Norte lagging further behind. In terms of employment generation, the growth in the number of beekeepers was also the highest for Picos.

Table 3.5. Performance indicator figures of the selected value chain streams

Category	Indicators	Value Chain Stream		
		Limoeiro do Norte	Santana do Cariri	Picos
Revenue	Honey production growth 2007-2011 (% per year)[1]	2.7%	4.9%	8.0%
	Honey exports value growth 2007-2011 (% per year)[1]	85.4%	10.6%	52.7%
Local value-added*	Honey value-added in all stream steps 2011 per total production (US$/total kg produced)[1,2,3]	2.4	3.5	2.6
Local employment	Number of beekeepers growth 2007-2011 (% per year)[2]	21%	9%	23%

Source: (1) IBGE (2012, 2013), MDIC (2013), (2) field interviews, (3) estimated by authors.
* Proxy calculated by the difference from honey sales and acquisition costs at each step.

The effects of the international trade shocks that occurred around 2008 (EU embargo and world financial crisis) apparently impacted more strongly the export pioneer Santana do Cariri stream, while Limoeiro do Norte and Picos were able to build up their businesses in the new environment. It is not possible to make educated inferences about the impact of the trade shocks on the local value-added behaviour of the streams since the measurement was for only one year.

3.3.4 Evaluation of stream strategies

For each performance indicator, the top performer among the three value chain streams was identified along with the strategies adopted by that stream that can be more closely or directly associated with that outcome (Table 3.6). Notice that some strategies can be more directly connected to the market and the environment structure while others require more investigation to make those connections. Following, the findings about the connections between the SCP indicators in the streams are explained.

Table 3.6. Top value chain stream performers by indicator, likely contributing strategies and supporting structure

Performance Indicator	Top Performer	Likely Contributing Strategies*	Likely Supporting Structure
Honey production growth (% per year)	Picos	- *Increase in honey direct exports as % of production***; - *Offer of technical assistance with free hives;* - *Offer of specialised technical assistance*; - Cooperative-type of horizontal linkage among producers; - Higher coverage of technical and managerial assistance; - Higher coverage of credit.	- High world honey consumption growth as opposite to decrease in local consumption; - Favourable natural conditions; - Low capital and knowledge intensity in production; - Strong subsidies to small producers; - Increasing labour costs; - Stricter quality requirements.
Honey export value growth (% per year)	Limoeiro do Norte	- Increase in honey direct exports as % of production; - *Increase in honey certified as organic as % of production;* - *Increase in % of honey production sold to local processors (the exporters);* - *Increase in number of HACCP accredited honey houses.*	- High world honey consumption growth as opposite to decrease in local consumption; - Low concentration of foreign clients; - Stricter quality requirements.
Honey value-added in all stream steps per total production (US$/total kg produced)	Santana do Cariri	- *High differentiation through organic certification;* - *High differentiation through monofloral production;* - Aggressive acquisition of honey outside territory; - *High % of honey production sold to local processors.*	- High world consumption growth of differentiated honeys; - Tax incentives at state/national levels to attract processing units.
Number of beekeepers growth (% per year)	Picos	- *Offer of specialised technical assistance;* - Higher coverage of technical and managerial assistance; - Increase in coverage of credit; - Active participation in honey chamber; - *Offer of technical assistance with free hives;* - *High % of honey production sold to local processors***.	- High world honey consumption growth; - Low capital and knowledge intensity in production; - Strong subsidies to small producers.

Source: Interviews with experts and authors' analysis.
* Strategies *in italics* were the top three ones selected by experts, out of 14 conduct indicators
** Included by the experts.

Picos opted to offer higher coverage of credit, specialised technical and managerial assistance, along with free distribution of hives. Those strategies can be directly linked to performance not only in terms of growth in production but also in terms of growth in the number of beekeepers. Alignment with the cooperative-type of horizontal relation among producers facilitates the offer of specialised technical

assistance, and alignment with an active participation of stream representatives in the state chamber facilitates fund raising with donors for distribution of hives. Free distribution of hives to overcome the limited investment capacity of the resource-poor entrepreneurs in the territory was only possible because of the low capital intensity of honey production. Other structural conditions like honey world consumption growth and adequate local natural conditions potentiate the effects of the strategies adopted by Picos. Stricter quality requirements also favour Picos, which offered specialised technical assistance to a higher proportion of producers, just like increasing labour costs encourages co-operation of producers for costs savings. For exports, under a growing general demand for honey, a low client concentration and stricter quality requirements, it is expected that the streams that grow their exports faster are the ones like Limoeiro do Norte, which target the export market and increase the number of honey houses certified for exports. In addition, selling more of its honey production for local processing also contributes to the increase in exports, as the local processors are the only exporters. Although no hard figures are available for the organic honey segment growth, the increase in the production fraction certified as organics may explain part of the exports growth as well.

Processing more of the produced volume internally in the stream and selling part of this volume as differentiated, premium-priced products can lead towards a relatively high value-added in the stream. Complementarily, aggressive acquisition of honey outside the stream territory by local processors and packers (notice that the stream exported more than it produced) increases local value-added. This is a successful combination used in Santana do Cariri.

By and large, the experts interviewed confirmed those strategies as the most influential to the individual performance of the streams. Only the effects of horizontal and network linkages were not immediately recognised by the Picos experts, who preferred to associate the superior performance of the stream to market and vertical linkage choices. In all cases, the experts unanimously agreed that reducing the coverage of credit and technical/managerial assistance had a negative impact on the performance of the streams.

Whereas Picos managed to achieve the highest performance among the streams both in honey production and in the number of beekeepers growth, production grew less than the number of beekeepers, meaning that productivity went down, as new producers are likely to lag behind in the learning curve. In a period of growing demand and prices, like the one from 2007 until 2011, this

combination of top operational and developmental performance is more likely to be found in practice. However, in the long run, the stream needs to increase its technical and managerial assistance coverage to recover its productivity.

Notice also that strategies that were identified as not important to some performance indicators under the structural conditions prevailing during the period of analysis (2007-2011) may become relevant when those conditions change. For instance, during a period of drought, the stream whose beekeepers adopt migratory apiculture is likely to have its production less affected by the harshness of the climate.

3.4 Discussion and Conclusions

The value chain SCP framework allows development practitioners to make an integrated assessment of structure, conduct and performance from a value chain perspective. Thereby, it clearly identifies the value chain strategies and points out the main links between strategies and outcomes in a certain business environment. Data collection to proceed with making an integrated assessment is intense. Given the large number of conduct indicators, a qualitative analysis prevails; a quantitative, statistical analysis to identify key success factors is only feasible if data for more value chain streams are available.

The qualitative inference on successful strategies of the studied honey value chain streams, revealed with the multiple case study in this paper, finds ground in the value chain literature. For instance, product and functional upgrades (Humphrey & Schmitz, 2002), like organic certification and additional local processing, were regarded as the main sources of increasing honey value-added. HACCP accreditation of honey houses, a process upgrading strategy, was also regarded as a source of export value growth, a sign of increased competitiveness (Trienekens, 2011). In line with the widespread knowledge that technical, managerial and financial assistance should positively influence production and job creation, the higher the coverage of those supporting services, as observed in Picos, the higher the performance regarding production and beekeepers growth.

In all cases, a market-based type of vertical arrangement among the value chain streams and their outside clients was observed. This arrangement is in line with the expectation following from Gereffi, Humphrey and Sturgeon (2005) for products that require little specification from buyers, like honey. As quality requirements

increase further, movement towards a more modular kind of governance may take place, with local processors codifying the requirements of their foreign buyers. However, determining the effects of vertical, horizontal and network linkages within the stream on stream performance, is not straightforward, as shown by the interviews with experts.

Explicit feedbacks from conduct or performance to structure were not expected at the national or world level due to the small size of the selected streams. At the local level, feedbacks to structure were not identified. Feedbacks from performance to conduct may have taken place, reinforcing or not the behaviour of the streams but they were also not observed because more frequent, intermediary periods of data collection would be required to investigate such events.

As to the interventions by donors observed in the three value chain streams, according to the typology by Humphrey and Navas-Alemán (2010), they were not based on existing lead firms but rather on strengthening chain linkages, especially among small producers. Besides, none of the interventions started off with the understanding of the current stream strategies and of the local structural conditions, or with development plans calling for integrated network strategies. The stream strategic decisions were made by leading processors and supporting service organizations in the streams, and the existing network arrangements did not follow up any stream strategy implementation.

In the studied streams, interventions that considered upgrading strategies without observing the alignment to other categories of strategy, like building processing units, or without observing local structural limitations, like building a technology development centre, were not successful. The bulk processing and packaging unit in the Santana do Cariri territory for a cooperative could not run in the absence of horizontal co-operation and in a situation where almost all local honey was already sold to local processors. An apiculture technology centre in Picos required the existence of local R&D personnel (a structural limitation) or the attraction of outside competence at a high cost. The opposite happened when interventions were aligned with the stream strategies and took advantage of structural conditions. Supporting the construction of a bulk processing and packaging facility in Picos succeeded as it was built on existing cooperative ties, and free distribution of hives (taking advantage of the availability of direct subsidies) worked better when specialised technical assistance was offered. The alignment of strategies recognised as a good management practice in the supply chain literature

(Chopra & Meindl 2010) also seems to hold in general when the unit of analysis is a value chain stream instead of a focal firm.

Specific findings related to the most successful stream strategies in Brazil – for honey production and export value growth (associated to increased competitiveness), and for honey value-added and beekeepers growth (associated to poverty reduction) – can serve as good practices for the honey value chains streams only during the period of analysis in this study. In line with the value chain SCP framework, if structural indicators change in the future, those specific strategies need to be revaluated. Also, applying those successful strategies to streams in other countries depend on the similarity of their structural indicators to Brazil's. Contrary to Brazil, a country with a large and growing domestic market, for example, is likely to host high performance streams that sell their production locally.

Development agencies can use this information to adapt their interventions. For donors, the upfront understanding of the current strategies deployed by the targeted streams and their competitors, along with local structural conditions, are paramount for a successful intervention. Strategies that do not reinforce others tend to fail and jeopardise the stream. Therefore, an intervention should identify the business and organizational strategies it intends to act upon, and foster strategies that are aligned with each other.

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Appendix

Table A1. Number of interviewees per value chain stream and type of stakeholder

Type of stakeholder	Value Chain Stream			
	Limoeiro do Norte	Santana do Cariri	Picos	Total
Beekeeper*	3	4	1	8
Intermediary	1	-	1	2
Processor	2	2	4	8
Service provider (technical/managerial assistance)	5	9	3	17
Service provider (financing)	2	2	2	6
Regulator (sanitary inspection)	1	-	1	2
Trader	-	1	1	2
Total	14	18	13	45

Source: Field interviews.
* Selected beekeepers represented large groups of producers. Besides, 6 out of the 8 processors and the 2 intermediaries were also beekeepers

Table A2. Additional structure indicator figures for the selected value chain streams

		Value Chain Stream		
Category	Indicator	Limoeiro do Norte	Santana do Cariri	Picos
Concentration of clients	National market share of top 4 food retailers (% of sales, 2011)[1]	50%		
Rivalry intensity	World market share of top 4 honey export countries (% of volume, 2007 and 2010)[1]	49%, 44%		
Substitute products[2]	Existence of relevant substitute products	Sugar, glucose syrup and other sweeteners		
Institutional environment	Import tariffs[1]	Lower import tariffs to competitors from North America (by US) and Africa (by US and EU)		
	Exchange rates[1]	Appreciation of Brazilian Real while main competitors Argentina, Turkey, Mexico and Vietnam depreciated their currencies against US dollar		
Local natural environment	Main bee forage sources[2]	*Borreria verticillata, Merremia aegytia, Croton sonderianus Müll. Arg., Hyptis suaveolens*	*Serjania sp, Croton sonderianus Müll. Arg., Borreria verticillata, Hyptis suaveolens*	*Croton sonderianus Müll. Arg., Piptadenia moniliformis, Merremia aegytia, Hyptis suaveolens*
Local Infrastructure	Road distance to export harbour Pecém/CE (km)[1]	253	538	560
	Access to utilities[2]	Partial coverage of cell phone, electricity and water in some areas of the apiaries and honey houses		

Source: (1) ABRAS (2012), European Commission (2013b), FAO (2013), FXTOP (2012), IPECE (2012), USITC (2010); (2) field interviews.

Table A3. Additional conduct indicator figures for the selected value chain streams

Category	Indicator	Value Chain Stream					
		Limoeiro do Norte		Santana do Cariri		Picos	
		2007	2011	2007	2011	2007	2011
Product/market	Direct exports to US (% of exports)[2]	100%	90%	100%	90%	100%	80%
Pricing	Honey bulk exports 2011 (US$/kg) and ratio to market price (%)[1]	1.49 (91%)	3.09 (98%)	2.04 (124%)	2.97 (94%)	1.92 (117%)	3.29 (104%)
Promotion	Message/media[2]	Natural, wild blossom honey through word of mouth					
Distribution channels	Honey exported directly to packers (% of exports)[1,2]	0%	0%	67%	100%	0 %	23%
	Transportation mode to direct export clients	Trucks (inside Brazil) and ships from Pecém harbour in Ceará State					
Production technologies	Honey production and extraction[2]	Stationary apiculture		Some migratory apiculture (less than 5% of producers)		Some migratory apiculture (less than 5% of producers)	
	Honey bulk processing and packaging[2]	Standard					
Product development	Internal vs. outsourced[2]	Outsourced					
Sourcing	Floral sources distribution (% of production)[2]	*Borreria verticillata,* 50%; *Merremia aegytia,* 25%; *Croton sonderianus Müll. Arg.*, 15%; *Hyptis suaveolens* and other bushes, 10%		*Serjania sp,* 30%; *Croton sonderianus Müll. Arg.,* 30%; *Borreria verticillata,* 20%; *Hyptis suaveolens* and other bushes, 20%		*Croton sonderianus Müll. Arg.*, 50%; *Piptadenia moniliformis,* 30%; *Merremia aegytia, Hyptis suaveolens, Croton campestris* and other bushes, 20%	
Vertical linkages	Type of governance regarding clients outside stream[2]	Market-based until 2011					
Horizontal linkages	Resources sharing in other than production steps[2]	No sharing of resources					
Agglomeration	Concentration of stream beekeepers per 100 squared km[1,2]	6.2	13.1	4.1	6.0	3.5	9.5

Source: (1) FAO (2013), IBGE (2006, 2012, 2013), IPECE (2012), MDIC (2013); (2) field interviews.

Chapter 4

Identifying successful strategies for honey value chains in Brazil: a conjoint study

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Abstract

Development studies rarely measure the impact of value chain strategies on performance. This paper aims to quantify the contribution of influential strategies to the performance of three honey value chains in Brazil. The value chain Structure-Conduct-Performance (SCP) framework was used to select strategies and two performance indicators, honey production growth and local value-added. In a conjoint study, experts were asked to judge the contribution to the two performance indicators of several hypothetical combinations of value chain strategies. Adoption of specialised technical assistance, sharing resources at the production step, increase in exports and organic certification were identified as the strategies, which contribute the most to performance. Simulations suggested that some honey value chains could have greatly increased their performance by choosing these higher pay-off strategies. Quantifying the impact of individual strategies contributes to improved planning, implementation and evaluation of development interventions. Outcomes also show that conjoint analysis is a useful method for policy evaluations in data scarce situations.

Keywords: Economics; Supply chains; Strategy evaluation; Conjoint analysis; Beekeeping

4.1 Introduction

Development organisations have adopted a value chain approach in many projects targeted at reducing poverty and increasing local chain competitiveness (Campbell, 2013). In these projects, interventions may occur in many forms because of the systemic nature of the approach, with its view of interconnections among value chain actors (Cuny Garloch, 2012). Two groups of interventions can be identified according to the upgrading possibilities (Mitchell, Keane, & Coles, 2009) they attempt to explore: value chain strategy change-oriented interventions and enabling environment change-oriented interventions. Enabling environment changes usually relate to institutional and infrastructural reforms (Kleinberg & Campbell, 2008) that depend on the ability of chain representatives to influence public organisations not involved in the interventions. Value chain strategy changes depend much more on decisions made by the chain representatives themselves, and are the focus of this paper. Examples of value chain strategies that could be changed by interventions are product/market choices, and types of vertical and horizontal linkages among value chain participants (Ponte & Ewert, 2009; Trienekens, 2011). A value chain intervention often acts on more than one strategy at a time and this makes it difficult to identify the effective strategies (Sebstad & Snodgrass, 2008; Burns & Bogale, 2011). To increase the effectiveness of interventions, it is necessary to identify the relative importance of the different strategies.

This research uses the value chain Structure-Conduct-Performance (SCP) framework, developed specifically to address value chain strategies (Figueirêdo Junior, Meuwissen, & Oude Lansink, 2014). In this framework, the unit of analysis is not a firm, but a value chain stream. A value chain stream is defined as a segment of a value chain in a territory, which competes with similar segments in other territories. Accordingly, for a given structure, the performance of a value chain stream can be explained by the conduct of that stream. This framework allows the identification and evaluation of strategies (realised conducts) for value chain streams through an integrated assessment of structure, conduct and performance. In this paper the term 'realised strategy' is used to refer to a strategy that is actually achieved by a stream. The realised strategy usually differs from the strategy which a stream intended to adopt.

Figueirêdo Junior *et al.* (2014) previously evaluated the realised strategies of three honey value chain streams in the northeast of Brazil: two in Ceará State, one in and around the municipality of Limoeiro do Norte and the other in and around

the municipality of Santana do Cariri, and one in Piauí State, in and around the municipality of Picos. These three streams accounted for 11.2 per cent of Brazilian honey production (IBGE, 2012) and 10.2 per cent of the volume of honey exports in 2011 (MDIC, 2013). Their evaluation relied on qualitative comparisons of the three streams to identify the strategies most likely to contribute to performance, but the study could not quantify the contribution of individual strategies to value chain performance.

The objective of this paper is to quantify the contribution of individual strategies to the value chain performance of the Limoeiro do Norte, Santana do Cariri and Picos honey value chain streams for the period between 2007 and 2011. These are the same three streams as evaluated by Figueirêdo Junior *et al.* (2014). A conjoint study elicited the opinion of experts about the contribution of strategies to performance. Two performance indicators were selected for comparison among the streams: growth of honey production between 2007 and 2011, and local value-added per unit of production of honey in 2011 (in the remainder of this paper, these indicators are simply referred to as production growth and local value-added). Performance indicators related to production growth and value-added are frequently selected in value chain studies (Weber & Labaste, 2010; Van Dijk & Trienekens, 2012). In the value chain SCP framework, production growth represents a stream's operational performance whereas local value-added represents a stream's developmental performance, in particular its contribution to local development. The indicators were chosen to capture the diversity of performance objectives, but the selection of indicators was also influenced by the availability of data for the period of analysis. Data at the household level for targeted beneficiaries in treatment and control groups in the streams was not available. This type of data is recommended to explicitly evaluate the impact on poverty (Humphrey & Navas-Alemán, 2010).

The remainder of this paper is organised as follows. Section 4.2 describes the methodology: the selection of strategies and their levels; the quantitative, conjoint model; the generation of conjoint strategy profiles; the selection of experts; the evaluation of profiles by the experts; the data analysis for the identification of strategies with the largest contribution to performance; and the simulation of the effect on performance of changes in strategy levels. In Section 4.3, the contribution of strategies to performance is assessed using the conjoint model, and the effect of adopting higher pay-off strategies on performance is simulated. Discussion of the results and policy recommendations follow in Section 4.4.

4.2 Methodology

A conjoint analysis (Rao, 2013) was used to elicit the opinion of experts about the contribution of value chain stream strategies to the performance of the selected streams. So-called profiles, each consisting of a combination of value chain strategies (attributes) with their respective levels, were evaluated by experts. The outcomes of the evaluation identify the impact of strategic choices on the performance of the streams. Conjoint analysis is the most frequently used method in consumer studies to analyse preferences for multi-attribute products (Green et al., 2001). More recently, conjoint analysis has found novel applications in pricing (Halme & Somervuori, 2013), and in fields where quantification of relative utilities provides useful information about choices, such as technologies and management techniques (Valeeva *et al.*, 2005; Karniouchina *et al.*, 2009; Tufa *et al.*, 2012).

4.2.1 Selection of strategies

A preliminary list of 14 strategies, which were most likely to have contributed to stream performance, was derived from the qualitative analysis of Figueirêdo Junior *et al.* (2014) using the value chain SCP framework. In their analysis, strategies that did not clearly differentiate between streams, such as choice of export market, were removed because their contributions were expected to be similar and therefore not able to explain performance differences. In November 2013, this list of strategies was presented to a group of four experts (two from Ceará State and two from Piauí State) who were asked to rank the strategies in terms of their contribution to production growth and local value-added.

The responses of the four experts were used to select the strategies for the conjoint task. Two partly overlapping strategies were removed: honey production by vertically or quasi-vertically integrated processors, which overlapped with honey sold to local processor, and managerial assistance coverage, which largely overlapped with technical assistance coverage. The number of strategies was further reduced to keep the conjoint task feasible. The lowest ranked strategies were removed, as long as at least one indicator remained for each conduct category in the value chain SCP framework. For the resulting strategies, up to three levels were derived, which covered the ranges observed in the field. The number of levels was restricted to three to keep the conjoint task feasible for respondents. Table 4.1 shows the final strategies and the corresponding levels, grouped by category of conduct choices (for example, product/market). The resulting conjoint set-up

had twelve strategies in total, two related to production growth only, three related to local value-added only, and seven related to both performance indicators. Each strategy had two or three discrete levels, and no combination of strategy levels was considered to be infeasible.

Table 4.1. Value chain stream strategies and levels, and the relation with performance indicators

Category	Strategy	Level 1	Level 2	Level 3	Production growth	Local value-added
Product/ market	Honey exports (% production)	125%[a]	75%	25%	X	X
	Honey certified as organic (% production)	75%	25%	0%	-	X
	Honey certified as fair trade (% production)	15%	0%	-	-	X
	Honey sold as monofloral (% production)	40%	0%	-	-	X
Production technologies	Number of HACCP[b] honey house units per 100 beekeepers	1.00	0.25	-	X	X
Vertical linkages	Honey sold to local processor (% production)	75%	25%	-	X	X
Horizontal linkages	Resource sharing at production step	no sharing	association[c]	cooperative[d]	X	X
Network linkages	Participation in board/ chamber/ federation	no participation	irregular[e]	active[f]	X	X
Quality of supporting services	Technical assistance type	non-specialised[g]	specialised[h]	-	X	X
	Technical assistance practice	no free distribution of hives	free distribution of hives	-	X	-
Use of supporting services	Technical assistance coverage (% producers)	50%	25%	-	X	X
	Credit coverage (% producers)	25%	10%	-	X	-

(a) The processors have to buy honey from producers outside the stream; (b) Hazard Analysis and Critical Control Points;
(c) Group of producers formally organised for sharing equipment, labour and facilities for honey extraction only;
(d) Group of producers formally organised for sharing equipment, labour and facilities for honey extraction and sales;
(e) With infrequent attendance to the organisations' meetings, *(f)* Occupying management positions in the organisations;
(g) Provided by generalist technicians; *(h)* Provided by technicians trained and experienced in apiculture.

4.2.2 Conjoint model

The strategies implemented by the value chain streams can be summarised in a strategy profile. Each profile is composed of one strategy level for each strategy. The conjoint model assumes that strategy levels have an additive perceived contribution to the stream performance indicators. The perceived total contribution, U_i, associated with profile i containing a set of strategy levels, x_{ij}, can be expressed as:

$$U_i = \Sigma_{j=1,n} u(x_{ij})$$

where x_{ij} is the level that profile i has for strategy j (j = 1, ..., n), and $u(x_{ij})$ is a utility function that expresses the perceived contribution (part-worths) of strategy level x_{ij}. Interaction effects among the selected strategy levels were considered to be negligible.

4.2.3 Generation of profiles

A *full* factorial design with value chain strategies as factors would generate a very large number of profiles, which would be infeasible for respondents. For this reason, an orthogonal fractional factorial design (Addelman, 1972) was used to generate 16 calibration profiles for production growth and 27 calibration profiles for local value-added. These profiles allowed the unconfounded estimation of the main effects of the strategies, that is, the additive contributions of the strategy levels. Furthermore, four hold-out profiles were constructed for each performance indicator. All profiles were presented as paper cards, containing a single level for each of the nine selected strategies for production growth, and for each of the ten selected strategies for local value-added (an example of a profile for production growth is shown in Table 4.2).

Table 4.2. Sample profile for production growth

Strategy	Level
Honey exports (% production)	25%
Number of HACCP honey house units per 100 beekeepers	0.25
Honey sold to local processor (% production)	75%
Resource sharing at production step	no sharing
Participation in board/chamber/federation	irregular
Technical assistance type	non-specialised
Technical assistance practice	free hives
Technical assistance coverage (% producers)	50%
Credit coverage (% producers)	25%

4.2.4 Selection of experts

A set of 15 experts was identified, consisting of consultants, academics, service providers and business people who had been involved in the honey business for at least the past five years in the two Brazilian states (ten from Ceará and five from Piauí). These local experts constituted the majority of the population (15 out of 27) of knowledgeable people who could properly perform the conjoint task (evaluation of profiles), and included the four experts consulted during the selection of strategies for the conjoint task.

4.2.5 Evaluation of profiles

The questionnaire was pre-tested with two respondents to identify the best way of explaining the conjoint task. All experts were interviewed face-to-face using a structured questionnaire between February and April 2014, and were asked to rate the contribution of each profile to the two performance indicators.

In accordance with the value chain SCP framework, the experts were first reminded about the structural aspects of the honey business during the 2007-2011 period (Appendix A, Table A.1). To acquaint the respondents with the strategies and their levels, they were then shown the realised performance of each stream. Prior to the conjoint task, two acquaintance tasks were conducted. In the first acquaintance task, experts were asked to choose for each strategy the level that would have contributed the most to each performance indicator. In the second acquaintance task, the experts were asked to indicate the level that would deserve the rating zero for each strategy, (in the sense that it would have made no contribution to the performance indicator) and the level that would deserve rating ten (in the sense that it would have made the maximum contribution to the performance indicator). In this task, the experts did not have to stick to the pre-determined strategy levels of the profiles (Table 4.1), but were free to indicate any value. The purpose of this second acquaintance task was (i) to help the experts develop their rating criteria using the zero-ten scale before they actually started rating the profiles, and (ii) to generate extreme strategy ratings later used for simulations of strategy changes. During this task, the respondents were reminded to check their previous choices about the strategy levels that contributed the most to performance, to ensure consistency. For instance, if they previously answered that, for a given strategy, a certain level had most contributed to production growth, that level should be closer to the rating ten level than the other levels. Some experts changed their initial preferred level after this consistency check.

The responses collected during the second acquaintance task were used for simulating the effects of strategy changes. The averages of the extreme ratings for the strategies for the production growth indicator are shown in Table 4.3. For example, the maximum contribution to production growth would have been to export 102 per cent of honey production and to have two honey houses per 100 beekeepers (Table 4.3). For technical assistance type, all experts chose the level 'specialised' as the level with the maximum contribution to production growth. For resource sharing at the production step, the majority of experts chose the level 'cooperative' (73%) as the level with the maximum contribution to production growth, and 27 per cent of experts chose the level 'association' as the maximum contribution. The average minimum contribution to production growth was to export 11 per cent of production and have 0.1 honey houses per 100 beekeepers. The majority (80%) chose 'no free distribution of hives' as the level with the minimum contribution to production growth.

Table 4.3. Averages of extreme ratings (minimum and maximum) for the strategies contributing to production growth 2007-2011

Strategy	Level Rate 0 (Minimum)	Level Rate 10 (Maximum)
Honey exports (% production)	11%	102%
Number of HACCP honey house units per 100 beekeepers	0.1	2.0
Honey sold to local processor (% production)	19%	69%
Resource sharing at production step	100% no sharing	27% association, 73% cooperative
Participation in board/chamber/ federation	100% no participation	100% active
Technical assistance type	100% non-specialised	100% specialised
Technical assistance practice	80% no free distribution of hives	80% free distribution of hives
Technical assistance coverage (% producers)	5%	86%
Credit coverage (% producers)	6%	75%

Source: Field interviews.

The averages of the extreme ratings for the strategies contributing to the local value-added indicator are shown in Table 4.4. The maximum contribution to local value-added was to export 98 per cent of honey production and to have 1.9 honey houses per 100 beekeepers. For technical assistance type, experts unanimously chose the level 'specialised' as the level with the maximum contribution. For resource sharing at the production step, the majority chose the level 'cooperative'

(80%) as the level with the maximum contribution, and 20 per cent of experts chose the level 'association' as the maximum contribution. The minimum contribution to local value-added was to export 18 per cent of production and have 0.1 honey houses per 100 beekeepers (Table 4.4).

Table 4.4. Averages of extreme ratings (minimum and maximum) for the strategies contributing to local value-added 2011

Strategy	Level Rate 0 (Minimum)	Level Rate 10 (Maximum)
Honey exports (% production)	18%	98%
Honey certified as organic (% production)	1%	73%
Honey certified as fair trade (% production)	0%	33%
Honey sold as monofloral (% production)	8%	48%
Number of HACCP honey house units per 100 beekeepers	0.1	1.9
Honey sold to local processor (% production)	11%	74%
Resource sharing at production step	100% no resource sharing	20% association, 80% cooperative
Participation in board/chamber/federation	100% no participation	93% active, 7% irregular
Technical assistance type	100% non-specialised	100% specialised
Technical assistance coverage (% producers)	6%	73%

Source: Field interviews.

For the conjoint task itself, the experts were given the profiles and asked to rate the contribution of each one to the relevant performance indicator, using a scale from zero to ten. Prior to this task, they were asked to sort the profiles into groups with similar numbers of cards, according to their contribution to the relevant performance indicator: two groups for production growth (high and low) and three groups for value-added (high, medium and low). This initial selection (Acito & Jain, 1980; Green *et al.*, 1993) allowed the respondents to become familiar with all the profiles and improved the consistency of the rating process that followed.

4.2.6 Analysis of conjoint data

Ratings for the calibration profiles were mean-centred for each respondent to account for different usage of the scale by respondents (Endrizzi *et al.*, 2011). A factorial Analysis of Variance (ANOVA) was used, with the strategies included as factors, to determine the significance of the main effects of the strategies on production growth and on local value-added. To assess the individual-level predictive validity of the model, individual utilities of each strategy level were also estimated for production growth and local value-added. Predictive validity of the

model was assessed at the individual level using the hold-out profiles, by estimating Pearson correlation coefficients between predicted and observed ratings for each performance indicator.

4.2.7 Simulation of the effect of strategy changes on stream performance

The link between the rating of a stream profile and this stream's performance can be utilised to simulate the effects on the performance indicators of changes in strategy levels. Two methods were used to simulate these effects: (1) the extreme (zero-ten) ratings from the experts, and (2) the estimated conjoint model. In each case, ratings of the realised strategies of the streams were predicted through linear interpolation and extrapolation. In the extreme ratings case, the ratings of the stream profiles were predicted in two steps. First, ratings for each realised strategy level were obtained through interpolation from the minimum and maximum ratings shown in Tables 4.3 and 4.4. Second, the resulting ratings for each strategy level of the profile were averaged out to arrive at the stream profile rating. Because ratings below zero and above ten were not allowed, realised levels below the minimum level had their ratings truncated to zero, and realised levels above the maximum level had their ratings truncated to ten. For strategies with three qualitative levels, the second-best realised level received a rating equal to five, the midpoint between zero (assigned to the worst level) and ten (assigned to the best level). In the conjoint model case, interpolation or extrapolation of the quantitative levels was used to predict the utilities of the realised strategies of the streams. From these utilities, the conjoint model was used to obtain the ratings. When there were three levels for a strategy, only the two levels closest to the realised stream level were used for the interpolation or extrapolation. For both methods, the predicted ratings of the three streams were then linked to the realised performance values to simulate the effects of strategy changes. This simulation took place in two steps. First, a new stream rating was obtained for the assumed change (from the original realised strategy level). Second, this new rating was associated with a new value for the performance indicator, through interpolation or extrapolation from the predicted ratings of the three streams.

4.3 Results

4.3.1. Main strategies that contributed to performance

The results of the conjoint model for production growth (Table 4.5) show that the largest effect (utility) of exports on performance is for the level where exports account for up to 75 per cent of the production. There is no additional expected effect from higher export levels. The majority of the effect of resource sharing is due to moving from 'no sharing' to 'association', with only a modest, and decreasing, effect due to moving from 'association' to 'cooperative'. Overall, the main effects of the strategies on production growth were significant at the 5 per cent significance level, except for honey sold to local processors (as % of production) and credit coverage (as % of production). The model explained 45.1 per cent (η^2) of the total variation in the ratings of the contribution of strategies to production growth. Honey exports (as % of production), resource sharing at production step, and technical assistance type, together, accounted for approximately 70 per cent (% η^2) of the variation that was explained by the model.

The results of the conjoint model for local value-added (Table 4.6) show that the largest effect (utility) of exports on local value-added is for the level where exports account for 75 per cent of production, similar to the results for production growth. The effect of increasing the share of organic production is largest if the share is up to 25 per cent of production. In contrast to the results for production growth, 'cooperative' had a higher utility than 'association' for resource sharing at the production step. Overall, the main effects of the strategies on local value-added were significant at the 5 per cent significance level, except for honey sold to local processors (as % of production), number of HACCP honey house units per 100 beekeepers and technical assistance coverage (as % of production). The model explained 42.4 per cent (η2) of the total variation in the ratings of the contribution of strategies to local value-added. Honey exports (as % of production) and honey certified as organic (as % of production), together, accounted for almost 60 per cent (% η2) of the variation explained by the model.

Table 4.5. Main effects of strategies on production growth

Source of effect	Levels	Utilities	Df	F[(a)]	η^2	% η^2
Model			12	14.56	0.451	100.00
Honey exports (% production)	125%	0.500	2	24.45	0.126	27.98
	75%	0.500				
	25%	-1.000				
Number of HACCP honey house units per 100 beekeepers	1.00	0.375	1	16.32	0.042	9.33
	0.25	-0.375				
Honey sold to local processor (% production)*	75%	0.117	1	1.58	0.004	0.90
	25%	-0.117				
Resource sharing at production step	no sharing	-0.733	2	17.60	0.091	20.14
	association	0.408				
	cooperative	0.325				
Participation in board/chamber/ federation	no participation	-0.356	2	4.57	0.024	5.23
	irregular	0.053				
	active	0.303				
Technical assistance type	non-specialised	-0.575	1	38.36	0.099	21.95
	specialised	0.575				
Technical assistance coverage (% producers)	50%	0.333	1	12.98	0.033	7.38
	25%	-0.333				
Technical assistance practice	no free hives	-0.308	1	11.04	0.028	6.32
	free hives	0.308				
Credit coverage (% producers)*	25%	0.108	1	1.36	0.004	0.78
	10%	-0.108				
(Constant)	-	5.256	-	-	-	-

* Not significant at the 5 per cent significance level.
(a) Corrected by subtracting the number of respondents minus one from the error's degrees of freedom, to take into account estimation of one mean per respondent.
Source: Field interviews.

Table 4.6. Main effects of strategies on value-added

Source of effect	Levels	Utilities	Df	F[(a)]	η^2	% η^2
Model			14	19.75	0.424	100.00
Honey exports (% production)	125%	0.504	1	38.53	0.118	27.86
	75%	0.407				
	25%	-0.911				
Honey certified as organic (% production)	75%	0.674	2	46.32	0.142	33.50
	25%	0.304				
	0%	-0.978				
Honey certified as fair trade (% production)	15%	0.406	2	27.04	0.041	9.78
	0%	-0.406				
Honey sold as monofloral (% production)	40%	0.406	1	27.04	0.041	9.78
	0%	-0.406				
Number of HACCP honey house units per 100 beekeepers*	1.00	0.089	1	1.30	0.002	0.47
	0.25	-0.089				
Honey sold to local processor (% production)*	75%	0.106	1	1.83	0.003	0.66
	25%	-0.106				
Resource sharing at production step	no sharing	-0.378	2	7.13	0.022	5.15
	association	0.096				
	cooperative	0.281				
Participation in board/chamber/ federation	no participation	-0.111	2	4.83	0.015	3.50
	irregular	-0.207				
	active	0.319				
Technical assistance type	non-specialised	-0.372	1	22.78	0.035	8.24
	specialised	0.372				
Technical assistance coverage (% producers)*	50%	0.133	1	2.92	0.004	1.06
	25%	-0.133				
(Constant)	-	5.152	-	-	-	-

* Not significant at 5 per cent significance level.
(a) Corrected by subtracting the number of respondents minus one from the error's degrees of freedom, to take into account estimation of one mean per respondent.
Source: Field interviews.

To assess the internal predictive validity of the conjoint model, ratings were predicted for the hold-out profiles based on the estimated utilities for the two performance indicators. The individual-level Pearson correlation coefficients between the predicted and the actual ratings for the hold-out profiles showed that

the validity of the model was high for both indicators, but more so for production growth. For production growth, the mean Pearson correlation coefficient was 0.90 and the standard deviation was 0.08. For local value-added, the mean Pearson correlation coefficient was 0.73 and the standard deviation was 0.22. These statistics imply that the experts were consistent in their responses.

4.3.2 Simulated effects of changes in strategies on stream performance

The realised strategies of the streams can be viewed as profiles, with the difference that their quantitative levels do not coincide with the discrete levels of the conjoint model (Appendix A, Tables A.2 and A.3). The ratings of the realised stream profiles were obtained using the conjoint model by means of interpolation and extrapolation. For example, for production growth, the Limoeiro do Norte stream profile required extrapolation of the utility levels for number of HACCP honey house units (realised level was 0.10 and minimum profile level was 0.25 per 100 beekeepers) and for credit coverage (realised level was 7% and minimum profile level was 10% of producers). When the relative difference between the realised strategy level and the minimum or maximum profile strategy level is large, extrapolations of utilities can lead to distortions. However, in this evaluation, the highest relative differences occurred in strategies that had relatively small main effects (number of HACCP honey house units per 100 beekeepers and credit coverage, both for Limoeiro do Norte). The two methods (conjoint model and extreme strategy ratings) for predicting the ratings of the realised stream profiles were compared by estimating correlation coefficients between the predicted ratings of each method. Both methods were consistent, with all the correlation coefficients greater than or equal to 0.98 for both performance indicators.

The simulation was conducted for the strategies that contributed the most to the performance indicators, based on the estimated main effects shown in Tables 4.5 and 4.6. The simulated quantitative changes in the levels of the strategies were based on attainable values for the streams, derived from comparisons among the streams. These strategy changes and the simulated effects on stream performance are shown in Table 4.7. For example, if the Limoeiro do Norte stream had moved from non-specialised to specialised technical assistance, then according to the extreme strategy ratings, it could have increased its production growth by 0.9 percentage point (from 2.7% to 3.6%) and its local-value-added by US$ 0.1/kg (from US$ 2.4/kg to US$ 2.5/kg). According to the conjoint model, it could have increased its production growth by 1.0 percentage point (from 2.7% to 3.7%) and

its local-value-added by the same US$ 0.1/kg (from US$ 2.4/kg to US$ 2.5/kg). According to the conjoint model, the increase in production growth in any one stream could have been as high as 67 per cent. If the Santana do Cariri stream had moved from non-specialised to specialised technical assistance, its production growth could have increased 3.3 percentage points, from 4.9 per cent to 8.2 per cent. According to the conjoint model, the increase in local value-added in any one stream could have been as high as 23 per cent. If the Picos stream had increased the share of organics to 30 per cent of production, its local value-added could have increased by US$ 0.6/kg, from US$ 2.6/kg to US$ 3.2/kg (Table 4.7).

Table 4.7. Estimated impact of strategy changes on the performance indicators for the three streams(a)

	Stream					
	Limoeiro do Norte		Picos		Santana do Cariri	
Strategy change[b]	Production growth (% per year)	Local value-added[c] (US$/kg)	Production growth (% per year)	Local value-added (US$/kg)	Production growth (% per year)	Local value-added (US$/kg)
No change (performance baseline[d])	2.7%	2.4	8.0%	2.6	4.9%	3.5
Increase exports to 40% of production	+0.1%, +0.4%	NA	+0.4%, +1.8%	+0.2, +0.3	NA	NA
Move from non-specialised to specialised technical assistance	+0.9%, +1.0%	+0.1, +0.1	NA	NA	+1.7%, +3.3%	+1.2, +0.7
Move resource sharing from association to cooperative	+0.4%, 0.0%	0.0, 0.0	NA	NA	+0.8%, -0.2%	+0.6, +0.2
Increase organics to 30% of production	NA	0.0, 0.0	NA	+0.3, +0.6	NA	NA
Increase to 1.00 HACCP honey house units per 100 beekeepers	+0.4%, +0.8%	0.0, 0.0	NA	NA	+0.7%, +2.2%	+0.4, +0.1

(a) Underlined values from conjoint model, not underlined from extreme ratings interpolation;
(b) Changes are from average 2007-2011 values for production growth and from 2011 values for local value-added;
(c) Local value-added is approximated by the difference between honey sales and acquisition prices at each of the stream;
(d) The realised strategy levels for each stream corresponding with the baseline performance are shown in Table A.2 and A.3 in the Appendix.
NA: Not applicable, either because the strategy was not considered to affect the performance indicator or because the stream
already achieved the simulated strategy level.
Source: Field interviews; Figueirêdo Junior et al. (2014).

A stream is only likely to adopt a strategy if its effect on performance is expected to be positive. However, there are strategies that influence both production growth and local value-added, such as technical assistance type, whereas others influence only one performance indicator, such as percentage of honey production certified as organics. In case of simultaneous and opposing effects, there might be a performance trade-off. For the strategies that influenced both performance indicators, the simulated effects were not opposing, except for the change from 'association' to 'cooperative' as a form of resource sharing at the production step of the chain. For this strategy change, a trade-off among performance indicators was also observed in the conjoint model simulations for the Santana do Cariri stream; production growth was expected to decrease 0.2 percentage points, whereas local value-added would increase by US$ 0.2/kg.

4.4 Discussion and Conclusions

Because of the systemic approach, value chain interventions usually promote changes in more than one value chain strategy. Evaluations of interventions, even when thoroughly performed, tend to evaluate the overall impact of the interventions (Humphrey & Navas-Alemán, 2010; Creevey *et al.*, 2011). In addition to interventions from development projects, stakeholders in the value chain streams may need to adopt new strategies in response to structural market movements (Maertens & Swinnen, 2009; Gebreeyesus & Sonobe, 2012). In this context, it is desirable to identify the contribution of strategies to performance in order to effectively use resources. Conjoint analysis proves a useful method in a data scarce situation, such as in this study, and provides a reliable indication of the effects of the realised strategies of value chain streams.

The conjoint model in this study had a high validity in forecasting the hold-out profiles for both production growth and local value-added, which suggests that the model was accurate enough to estimate the main effects of the strategies. The higher validity for production growth may be explained by the previous familiarity of the experts with this concept, even though the calculation of both indicators was explained in detail during the interviews. The conjoint analysis not only allowed a quantitative assessment of the contribution of individual strategies to the performance of the value chain streams, but also enabled the effects of strategy changes on performance to be simulated.

The overall importance of the strategies was generally consistent with previous qualitative results for both production growth and local value-added (Figueirêdo Junior *et al.*, 2014). The focus on the export market, for instance, was confirmed as one of the most important strategies for production growth, as the world honey market was growing and the national market declining between 2007 and 2011. The importance of specialised technical assistance, mainly for production growth, was also confirmed. However the relative effects of cooperative as a mode of sharing resources, free distribution of hives, and technical assistance and credit coverage were smaller than expected from the previous study of Figueirêdo Junior *et al.* (2014). The experts all agreed that producers should not attempt to operate on their own; the mixed preferences about the form of resource sharing at the production step (association or cooperative) can be explained by different perceptions about the degree of network maturity (Miric, 2011) required for producers to engage in cooperative arrangements. Related to local value-added, product differentiating strategies were perceived to have a relatively large effect on performance, as suggested by Figueirêdo Junior *et al.* (2014). In contrast to this previous study, however, the effect of the amount of honey sold to local processor was not significant. This implies that the experts perceived that the opportunities to sell and buy honey outside the streams were the same for local producers and local processors. The experts also perceived that relationships among local producers and local processors were purely market-based, without any influence on local value-added.

The experts' perception, given spontaneously during the interviews, that the adoption of specialised technical assistance should actually precede other strategies is likely to have influenced their ratings. For instance, they perceived credit coverage or free distribution of hives as important, but only if specialised technical assistance was provided first or provided simultaneously. This sequence is even more important for new producers, who lack experience in the activity and may misuse credit. For the conjoint model, this time-dependency implies interactions among the strategies that were not considered in this study. Nonetheless, the conjoint model revealed that credit coverage alone had a low effect on performance and this, together with the experts' additional comments, confirms the importance of policy sequencing in value chain interventions (Demont & Rizzotto, 2012).

To simulate the effect of a change in strategies on the selected performance indicators, the conjoint model is preferred to the extreme strategy interpolation. This is because conjoint analysis measures the utility of all strategy levels on one scale and therefore the relative contributions of all levels are obtained. In the

extreme strategy interpolation, assumptions about the relative contributions of strategy levels are required if there are three or more strategy levels, and this may distort the evaluation. Despite this potential distortion, the two methods yielded, in general, similar results for the three streams studied in this paper (see Table 4.7).

Value chains operate in an environment where multiple stakeholders and multiple factors influence chain performance. In these circumstances, identifying the impact of strategies on performance is complex. The quantitative assessment of the realised value chain strategies in this study provides information to decision makers about the relative contribution of strategies to performance. This type of information is important to evaluate interventions, as it enables the resources invested in the strategies to be associated with their pay-offs. This quantitative assessment can also be used to set priorities in planning and implementing value chain development programmes.

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Appendix A

Table A.1 Structural indicators and their values for the period 2007-2011, for the selected value chain streams.

Category	Indicator	Value Chain Stream		
		Limoeiro do Norte (LN)	Santana do Cariri (SC)	Picos (P)
Demand behaviour	Growth of world honey consumption 2007-2011 (% per year)[a]	2.7% (with growing organic and fair trade segments)		
	Growth of national honey apparent consumption 2007-2011 (% per year)[a]	-3.2%		
Concentration of clients	World market share of top 4 honey importing countries (% of volume, 2007 and 2010)[a]	64%, 56%		
	National market share of top 4 food retailers (% of sales, 2011)[a]	50%		
Rivalry intensity	World market share of top 4 honey exporting countries (% of volume, 2007 and 2010)[a]	49%, 44%		
Entry barriers	Capital and knowledge intensity[b]	Relatively low in production		
Substitute products[2]	Existence of relevant substitute products	Sugar, glucose syrup and other sweeteners		
Institutional environment	Taxes[b]	Tax incentives to attract processing units offered at state and national levels		
	Subsidies[b]	Almost no direct subsidies to producers	Almost no direct subsidies to producers	Strong direct subsidies to groups of small producers
	Business chamber/board/federation[b]	Existence of honey chamber and beekeeping federation at state and national levels		
	Labour costs[b]	Increasing cost of labour at national level, limited highly skilled labour at local level		
	Quality requirements[b]	Stricter quality requirements at both national and international levels		
	Import tariffs[a]	Lower import tariffs to competitors from North America (by US) and Africa (by US and EU)		
	Exchange rates[a]	Appreciation of Brazilian Real while main competitors Argentina, Turkey, Mexico and Vietnam depreciated their currencies against US dollar		
Local natural environment	Average temperature (°C)[a]	25-29		
	Normal rainfall (mm/year)[a]	721-973		
	Main bee forage sources[b]	*Borreria verticillata, Merremia aegytia, Croton sonderianus Müll. Arg., Hyptis suaveolens*	*Serjania sp, Croton sonderianus Müll. Arg., Borreria verticillata, Hyptis suaveolens*	*Croton sonderianus Müll. Arg., Piptadenia moniliformis, Merremia aegytia, Hyptis suaveolens*
Local infrastructure	Road distance to export harbour Pecém/CE (km)[a]	253	538	560
	Access to utilities[b]	Partial coverage of cell phone, electricity and water in some areas of the apiaries and honey houses		

Source: (a) CBI (2011), FAOSTAT (2013), IBGE (2012, 2013), INMET (1992), IPECE (2012), ABRAS (2012), European Commission (2013), FXTOP (2012), IPECE (2012), MDIC (2013), USITC (2010); (b) Figueirêdo Junior *et al.* (2014).

Table A.2. Realised strategy levels for each stream for the strategies contributing to production growth (average 2007-2011)(a).

Strategy	Stream		
	Limoeiro do Norte	Picos	Santana do Cariri
Honey exports (% production)	25%	19%	139%
Number of HACCP honey house units per 100 beekeepers	0.10	1.15	0.25
Honey sold to local processor (% production)	26%	25%	90%
Resource sharing at production step	association	cooperative	association
Participation in board/chamber/federation	no participation	active	irregular
Technical assistance type	non-specialised	specialised	non-specialised
Technical assistance practice	no free hives	free hives	no free hives
Technical assistance coverage (% producers)	35%	45%	43%(b)
Credit coverage (% producers)	7%	23%	11%

(a) Strategy levels are different for each performance indicator to ensure consistency with the time period of each performance indicator: average 2007-2011 for production growth and 2011 for local value-added;
(b) Value not available for 2007 but assumed to be identical to 2011.
Source: Figueirêdo Junior *et al.* (2014).

Table A.3. Realised strategy levels for each stream for the strategies contributing to local value-added (2011) (a).

Strategy	Stream		
	Limoeiro do Norte	Picos	Santana do Cariri
Honey exports (% production)	41%	27%	127%
Honey certified as organic (% production)	22%	14%	75%
Honey certified as fair trade (% production)	0%	16%	0%
Honey sold as monofloral (% production)	0%	0%	37%
Number of HACCP honey house units per 100 beekeepers	0.20	1.00	0.50
Honey sold to local processor (% production)	42%	31%	85%
Resource sharing at production step	association	cooperative	association
Participation in board/chamber/federation	no participation	active	irregular
Technical assistance type	non-specialised	specialised	non-specialised
Technical assistance coverage (% producers)	6%	30%	43%

(a) Strategy levels are different for each performance indicator to ensure consistency with the time period of each performance
indicator: average 2007-2011 for production growth and 2011 for local value-added.
Source: Figueirêdo Junior *et al.* (2014).

Chapter 5

In search of a better deal – Identifying strategies under different scenarios for honey value chains in Brazil

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Abstract

Value chain (VC) participants often need to revise their strategies in response to new structural events or to encouragement from development organisations. Aimed at improving chain competitiveness and reducing local poverty, the selection of value chain strategies has nonetheless been restricted to the portfolio of upgrading. This paper aims to identify successful strategies for honey value chains in Brazil for the period 2015 to 2020. Strategies and performance indicators were selected using the value chain Structure-Conduct-Performance (SCP) framework. The opinion of experts was elicited in a Delphi setting to build business scenarios, and Adaptive Conjoint Analysis was used to identify promising strategies for increasing production growth and local value-added under these scenarios. This study finds that the most important strategies differ by performance indicator and business scenario. The results confirm the relevance of process (e.g. complementary colony feeding) and product (e.g. organic certification) upgrading strategies, some of which are robust across scenarios. Important strategies beyond the typologies of upgrading were also identified, such as offering specialised technical assistance. As the importance of strategies differs for each performance goal, streams should prioritise a performance goal, and adopt the most important strategies in the order of importance for the most likely, realistic scenario. The use of the value chains SCP framework offers the opportunity to search for promising strategies towards a performance goal – the "better deal" – in an integrated way.

Keywords: economic development, supply chains, uncertainty, beekeeping, adaptive conjoint analysis, policy Delphi

5.1 Introduction

Participants of a value chain may frequently need to change their joint strategies in response to new structural events (Neilson, 2008; Maertens & Swinnen, 2009). New structural events may relate to changes in industry structure outside of the control of chain participants. In addition, development organisations have supported value chain interventions to reduce poverty and increase local chain competitiveness. A crucial task in any value-chain-oriented development project is to identify the value chain strategies that are most effective in achieving its desired goals (Folke *et al.*, 2010; Pietrobelli & Staritz, 2013). The scope of an intervention includes adoption of new value chain strategies (Riisgaard *et al.*, 2010) and attempts to change the enabling environment (Figueirêdo Jr. & Millis, 2010), or both at the same time (FIAS, 2007).

In this context, the strategic notion of upgrading has been influential: looking for rent-rich opportunities that allow firms to add value to their products through shifts in their capabilities, technologies, and targeted markets. Four types of upgrading were originally identified: product, process, functional, and inter-chain (Humphrey & Schmitz, 2002)[1]. In response to empirical evidence from a variety of chains and locations, new upgrading typologies have been suggested that account for vertical and horizontal linkages, and network organizational forms among chain members (Trienekens, 2011). A variant of the original typology replaces inter-chain with channel upgrading, which involves diversifying into new buyers or moving into new markets (Pietrobelli & Staritz, 2013). Another variant adds end-market upgrading, which also relates to the idea of market diversification, and linkages/supply chain upgrading, which relates to strengthening vertical linkages (Frederick, 2014). In addition, as recognition of the importance of the institutional and infrastructural aspects of the environment in which a value chain operates, the upgrading concept was extended to accommodate enabling environment changes that can impact on the outcomes of interventions (Mitchell, Keane, & Coles, 2009). Although all value-chain development interventions take place in a certain territory, the upgrading discussion has given little attention to the entire segment of the value chain bounded within a territory (Fold, 2008), and to the local dynamics

1 *product*: moving into more sophisticated products with increased unit value; *process*: achieving a more efficient transformation of inputs into outputs through reorganization of activities or introduction of new technologies; *functional*: acquiring new functions (or abandoning old ones) that increase the skill content of activities; *inter-chain (or inter-sectoral)*: applying competences acquired in one function of a chain into a different sector/chain.

that shape the chain (McCarthy, Gillepsie, & Zen, 2012). This is because upgrading originated from the classic global value chain theory (Gereffi *et al.*, 2001), which initially focused on bilateral, firm level linkages, and is now evolving to consider relations in larger portions of the chain (Ponte & Sturgeon, 2014). The challenge to value chain strategy setting has been to select alternatives from the portfolio of the widening concept of upgrading. In some situations, for instance where volume and economies of scale are relevant, some upgrading paths may not even be the most appropriate to promote local development (Ponte & Ewert, 2009). The existing literature currently lacks a more general approach, beyond widening the concept of upgrading, to identify the range of strategy options that value chains can choose in different situations.

To avoid limiting the range of strategic value chain alternatives to upgrading typologies only, this paper uses the value chain Structure-Conduct-Performance (SCP) framework, developed specifically to address value chain strategies (Figueirêdo Junior, Meuwissen, & Oude Lansink, 2014). This framework is an extension of the relatively recent dynamic SCP framework used by managers to conceive strategies for firms (Copeland, Koller, & Murrin, 2000; Stuckey, 2008), and builds on the ideas from industrial organisation economics (Bain, 1951; Bresnahan, 1989). In this framework, the unit of analysis is not a firm, but a value chain stream – a segment of a value chain in a territory – competing against streams elsewhere. Accordingly, for a given structure, the performance of a value chain stream can be explained by the conduct of the stream. This framework is expected to provide a way to identify and evaluate strategies (conducts) for value chain streams through an integrated assessment of structure, conduct, and performance.

In light of the foregoing discussion, the main objective of this paper is to devise likely successful strategies for improving the performance of value chain streams. The empirical application focuses on three honey value chain streams in the Northeast of Brazil. Brazil is among the top 10 honey exporters in the world in volume (FAO, 2013). Two of the streams are located in Ceará State, one in and around the municipality of Limoeiro do Norte and the other in and around the municipality of Santana do Cariri, and the third stream is located in Piauí State, in and around the municipality of Picos. In 2011, the three streams accounted for 11.2% of Brazilian honey production (IBGE, 2012) and 10.2% of the country's honey exports in volume (MDIC, 2013). These streams have been receiving support from governmental and donor agencies since 2007, with the intent to promote local development and provide guidance to improve competitiveness.

The strategies in this paper were designed to be deployed between 2015 and 2020, aiming at promoting chain competitiveness and local development. Two economic performance indicators were chosen as targets for the streams: production growth of apiculture products and local value-added per unit of production of apiculture products (in the remainder of this paper, these indicators are simply referred to as production growth and local value-added, respectively). Production growth represents the stream's operational performance, its contribution to the stream's own competitiveness, whereas local value-added represents the stream's developmental performance, its contribution to local development. The choice of these indicators was based not only on the diversity of goals that the value chain streams have, but also on the familiarity of the experts with the indicators from a previous analysis (Figueirêdo Junior *et al.*, 2015).

The remainder of this paper is organised as follows. Section 5.2 describes the methodology: the construction of scenarios using a Policy Delphi survey and the conception of strategies using Adaptive Conjoint Analysis with experts. The identification of the most important strategies for each scenario is reported in Section 5.3, and the discussion of the results and policy conclusions follows in Section 5.4.

5.2 Methodology

5.2.1 The Delphi survey

A Policy Delphi survey was applied to identify scenarios for the honey business between 2015 and 2020. The use of scenarios is a powerful tool for strategy development (Lindgren & Bandhold, 2003), and the Delphi technique is widely applied for the construction of scenarios (Nowack, Endrikat, & Guenther, 2011). The usefulness of Delphi as a means of eliciting group-based judgments is well acknowledged for establishing exogenous variables – or mostly exogenous variables, such as structural aspects of a business – for other future models (Rowe & Wright, 2011). In this study, each scenario was described by a set of relevant events that could occur simultaneously, with each event belonging to only one scenario. Given that total agreement among experts about the inclusion of a certain event in a certain scenario was not required, the less time consuming Policy Delphi was used. Policy Delphi is a variant of the Delphi technique, which explores the diversity of opinions and in which consensus among experts is not necessary (Turoff, 2002).

5.2.1.1 Selection of experts

A set of six local experts (two per stream) was identified, which consisted of consultants (two), academics (one), service providers (one), and business people (two) who had been involved with the honey business for at least 10 years. They were informed about the purpose of the study: to lay the foundation for the development of successful strategies for their streams in the next years. All the experts were interviewed between November 2013 and January 2014 by phone, email, or in person, using a structured questionnaire.

5.2.1.2 Construction of scenarios

The experts were first reminded about the structural aspects of the honey business during the 2007-2011 period (Table A1, Appendix). Then, they were presented with a preliminary list of events, both national and international, which could significantly influence the structure of the business during the period from 2015 to 2020. This list was derived from specialised publications and contained seven events, such as rainfall reduction in the Northeast of Brazil as a consequence of global climate change and continuation of the European Union (EU) ban on genetically-modified contaminated honey from general sale. Next, they were asked to add any other events they envisioned as being significant to the list. Finally, they were asked to group the events according to their likelihood and their impact on the streams in one of three scenarios: pessimistic, realistic, or optimistic (Table 5.1).

Table 5.1. Classification of events in scenarios according to likelihood and stream impact

		Impact of events on streams	
		Negative	Positive
Likelihood of events	High	Realistic	Realistic
	Low	Pessimistic	Optimistic

The significant events were distributed as follows:

a) Realistic scenario: events that are most likely to happen, regardless of their positive or negative impact on the streams;
b) Optimistic scenario: events that are less likely to happen, but if they occur, would have a positive impact on the streams;
c) Pessimistic scenario: events that are less likely to happen, but if they occur, would have a negative impact on the streams.

After the first round, the initial and newly suggested events were consolidated in a complete list, containing the frequency each event appeared in the scenarios. After each round, the frequencies were updated, and the results were informed to the experts in the next round. The Delphi was considered finished when the majority of the experts agreed, for all events, on their positioning in a certain scenario.

5.2.2 The adaptive conjoint analysis

An adaptive conjoint analysis (ACA) (Johnson, 1987) was used to elicit the opinion of experts on the relative contribution of selected value chain strategies to the future performance of the streams in the period 2015-2020, for each of the three scenarios as defined in the Policy Delphi survey. ACA with experts was preferred to an extension of the Delphi survey in a self-explicated setting because ACA is better suited to exploring the actual trade-offs that experts make among different strategies (Hair *et al.*, 2008). ACA was used instead of traditional conjoint analysis because the full profiles used in traditional conjoint analysis would put too much of a cognitive burden on the experts, due to the large number of possible strategies (Orme, 2010).

5.2.2.1 Selection of experts

A set of 15 experts was identified, consisting of consultants (three), academics (four), service providers (five), and business people (three), who had been involved with the honey business for at least five years in the two Brazilian states (ten from Ceará and five from Piauí) where the value chain streams are located. The experts constituted the majority of the population (15 out of 27) of knowledgeable people with diverse professional origins who were available to face the conjoint task (evaluation of profiles). The same experts were consulted during a previous conjoint task about the contribution of strategies to past performance (Figueirêdo Junior *et al.*, 2015).

5.2.2.2 Selection of strategies

A preliminary list (Table A2, Appendix) of 22 strategies (original strategies) that could be adopted by the selected value chain streams to increase production growth or value-added was derived from a qualitative analysis using the value chain SCP framework (Figueirêdo Junior *et al.*, 2014). The group of 15 experts was offered this list in face-to-face interviews and was asked to add any other strategies

they thought necessary (additional strategies), given the scenarios. The interviews took place between February and April 2014. Furthermore, the experts were asked to indicate the strategies they believed would be applicable to each stream for each scenario (Table C, Appendix). The strategies were solicited separately for production growth and for local value-added.

The additional strategies suggested by the experts for each performance indicator, when not mutually exclusive with the original strategies or with each other, were consolidated into a complete list containing mutually exclusive strategies only. For each scenario, the 10 most frequently voted original strategies and the additional strategies receiving more than three votes were selected. There was a considerable similarity of the strategies across the streams, so the final list of selected strategies was the same for all streams. This is mainly because the experts believed the streams shared most of the structural characteristics and would be influenced much the same way by the expected scenarios.

Levels were derived for the selected strategies for each scenario, to make the stream choices more specific and allow the application of a conjoint model. The levels were based on past choices actually observed in the field (Figueirêdo Junior *et al.*, 2015) and on strategies suggested by experts, which were elicited through open questions. The levels captured ranges sufficiently wide to cover feasible choices in any scenario. They were restricted to a maximum of four, to make the conjoint task feasible for respondents. The number of strategies was also restricted for the same reason. The final strategies and corresponding levels were categorized according to the value chain SCP framework. The resulting conjoint set-up contained 19 different strategies for production growth, 15 in the pessimistic scenario, 14 in the realistic scenario, and 13 in the optimistic scenario. For local value-added, there were 17 different strategies, 16 in the pessimistic scenario, 14 in the realistic scenario, and 14 in the optimistic scenario. Of the final strategies, 14 were common to both indicators (Table 5.2).

5.2.2.3 Conjoint model

The conjoint model assumes that the levels of the strategies (referred to as attributes in the conjoint literature) have an additive perceived contribution to the stream performance indicators. So, the perceived total contribution, U_i, associated with the combination of strategy levels (profile) can be expressed as:

$$U_i = \Sigma_{j=1,n} u(x_{ij})$$

where x_{ij} is the level that profile i has for strategy j (j = 1, ..., n) and $u(x_{ij})$ is the contribution (utility or part-worth) of strategy level x_{ij}. Interaction effects among the selected strategy levels were assumed to be negligible. This is a necessary assumption because ACA accounts only for main effects.

In ACA, two types of data inputs (see Section 5.2.2.4) are used to estimate the $u(x_{ij})$'s for each expert separately, using Ordinary Least Squares (OLS) regression. The first type is data generated by the experts' ratings of attributes and their levels – the so-called self-explicated phase. The second type is data generated by the experts' graded paired comparisons of partial profiles: profiles specified in terms of their levels for a limited number of attributes. With this ACA set-up, more information about utilities can be obtained from fewer questions (Sawtooth Software, 2007). The resulting utilities are later calibrated for use in likelihood simulations using logit transforms of the expert's likelihood estimates (Johnson, 1987; Green, Krieger, & Agarwal, 1991).

Table 5.2. Strategies and strategy levels by performance indicator for each scenario

SCP Category	Strategies	Level 1	Level 2	Level 3	Level 4	Production Growth	Local Value-added
Product/ market	Honey exports (% processed volume)	100%	75%	50%	-	P, R, O	R, O
	Exports to markets other than US and EU (% exported volume)	10%	5%	-	-	P	P
	Honey certified as organic (% production)	75%	25%	0%	-	P, R, O	P, R, O
	Honey certified as fair trade (% production)	40%	20%	0%	-	R	P, R, O
	Honey sold as monofloral (% production)	50%	25%	0%	-	None	P, R, O
	Exploitation of new bee product: propolis	no	yes	-	-	P, R, O	P, R, O
	Exploitation of new bee product: pollen	no	yes	-	-	P, R, O	P, R, O
	Exploitation of new bee product: wax	no	yes	-	-	P, R, O	P, R, O
	Indication of stream origin (% honey production)	50%	25%	0%	-	None	P, R, O
Sourcing	Additional sources of bee forages	none	recovery of original forages	cultivation of new forages	both	P	None
Production technologies	Number of HACCP honey house units per 100 beekeepers	2.00	1.00	0.25	-	P, R, O	P, R, O
	Migratory apiculture (distance from base in km)	800	200	0	-	P	None
	Complementary colony feeding	none	natural feed (pollen and honey)	artificial feed (protein and syrup)	-	P, R, O	None
	Use of alternative vehicles (ex. motorised quad bikes) for collection/ transportation of hives	no	yes	-	-	R	None
	Artificial replacement of queen bees	none	induced division of colonies	introduction of genetically improved queen bee	both	P, R, O	P, R, O

Table 5.2. continued

SCP Category	Strategies	Level 1	Level 2	Level 3	Level 4	Production Growth	Local Value-added
Vertical linkages	Honey sold to local processor (% production)	75%	25%	-	-	O	P, R, O
Horizontal linkages	Resource sharing at production step	no sharing	association(1)	cooperative(2)	-	P	P
Network linkages	Number of chain information exchange events per year in the state	6	4	2	-	None	P, R, O
Agglomeration	Number of hives per beekeeper	200	100	60	-	R, O	None
Quality of supporting services	Technical assistance type	non specialised(3)	specialised(4)	-	-	P, R, O	P, R, O
Use of supporting services	Technical and managerial assistance coverage (% producers)	90%	50%	25%	-	P, R, O	P, R, O
	Credit coverage (% producers)	75%	25%	10%	-	P, R, O	P

P = Pessimistic scenario; R = Realistic scenario; O = Optimistic scenario

(1) Group of producers formally organised for sharing equipment, labour, and facilities for honey extraction only; *(2)* Group of producers formally organised for sharing equipment, labour, and facilities for honey extraction and sales; *(3)* Provided by generalist technicians; *(4)* Provided by technicians trained and experienced in apiculture.

Source: Field interviews, prepared by the authors.

5.2.2.4 ACA questionnaire

The experts were first informed about the structural aspects of the honey business for the period 2007-2011 and about the strategies that most influenced performance during this period. The experts were also informed about the performance indicators. Particular attention was given to local value-added because the experts were less familiar with its calculation. Scenario orientation followed, in which the experts received a detailed explanation about the scenarios and their use, as recommended by O'Brien and Meadows (2013).

Data collection took place during individual face-to-face interviews with the experts between September and December 2014, using a structured standard procedure built in a computer software (ACA Sawtooth Software version 5.1.0). For each scenario, the experts were asked to rate the contribution of the ACA-generated profiles to each performance indicator. The list of simultaneous events in each scenario was kept in front of the expert during the ACA process as a reminder. The procedure was pre-tested with five of the experts to find the best way of acquainting the experts with the conjoint task. The individual characteristics of the respondents were not expected to influence their opinion and were therefore not investigated. The size of the sample was also too small to relate the experts' characteristics to differences in utility estimates.

The ACA questionnaire contained four sections of questions and statements for each performance indicator. In the self-explicated phase of the interview, composed of Sections I and II, the experts were first asked to rate their preference for each strategy level on a scale from 1 (least preferred) to 7 (most preferred) (Section I statement: please evaluate the following strategy levels as to their contribution to the performance indicator). In the second section, they were asked to rate the importance of the strategies (or more precisely, the importance of the differences between the most-preferred and the least-preferred levels) on a scale from 1 (not important) to 7 (extremely important) (Section II question: if two strategy sets were acceptable in all other aspects, how important would this difference in strategy levels be to the performance indicator?). Dependent on an expert's ratings in the first two sections, the software selected pairs of partial profiles, each of which contained two or three strategies. Pairs of partial profiles were generated using a random mechanism for the selection of strategies and levels and a heuristic for the assignment of those levels to the profiles in the pair, which maximises the information that can be obtained from the question. In this graded paired comparison (Section III), each respondent saw a different set of pairs of

partial profiles and rated them on a scale from 1 (strong preference for left-hand profile) to 9 (strong preference for right-hand profile) (Section III question: if these two sets of strategies were equal in all other aspects, which one would contribute most to the performance indicator?).

In ACA's Section IV, respondents are typically asked to express their likelihood of buying a number of hypothetical products. In this study, buying likelihoods are replaced by contributing likelihoods, the likelihood of contributing to maximum performance. The questionnaire therefore deviated from the standard ACA task after Section III, in that the experts were presented with an intermediate question: what is the maximum indicator value that is reasonably for the period from 2015 to 2020, as a percentage of the past value (2007-2011 production growth or 2011 local value-added) of the performance indicator for all streams, on average? Percentages of past indicators were used because it was expected to be more difficult, even for the experts, to provide answers about future performance in absolute values. The reference to a maximum possible indicator was included to maintain the original set-up of ACA's Section IV, in which a scale with more objective anchors is typically used.

Section IV was implemented to be able to check the internal predictive validity (consistency) of the Section I/II/III utilities. In this section, five profiles, with six strategy levels each, were generated by the software and experts were asked to rate the likelihood that they would contribute to attain the maximum estimated indicator value (see intermediate question after Section III), on a scale from 0 (definitely would not contribute) to 100 (definitely would contribute) (Section IV question: how likely is it that this strategy set contributes to the maximum indicator value you just estimated?). Section IV ratings are typically used for re-scaling (by means of OLS regression) the more or less arbitrarily scaled Section I/II/III utilities towards contributions to logit transforms of the buying likelihoods (Johnson, 1987).

The consistency of the experts' utilities was measured in terms of the squared multiple correlations (R^2) from the OLS regressions (Huber *et al.*, 1991). Subsequently, the consistency and the absolute agreement among experts were measured by the two-way random intraclass correlation coefficient of the utilities (Shrout & Fleiss, 1979).

5.2.2.5 Further analysis of ACA utilities

The relative importance of each strategy was derived from the ACA-estimated individual utilities for each strategy level. The relative importance was derived for each performance indicator in each of the three scenarios. For each strategy, the difference between the utility of the most preferred and the least preferred strategy level was obtained and expressed in terms of percentages (Churchill, 1999; Reutterer & Kotzab, 2000). These relative importances in percentages, as well as the utilities of each strategy level obtained from the experts, were averaged for each indicator in each scenario. This procedure allowed the identification of the most important strategies and the most preferred strategy level for each strategy, for each indicator in each scenario. Comparing the magnitude of the utility changes across scenarios is not appropriate because strategies differ across scenarios and utility values are influenced by the strategies considered.

5.3 Results

5.3.1 Scenarios for the honey business

No experts dropped out during the Delphi study, which was concluded with a total of 16 relevant events distributed in three non-overlapping 2015-2020 scenarios for the honey business. Each event was placed in only one of the scenarios. The Delphi was concluded after two rounds, with an agreement of at least two thirds of the experts about the placing of an event in a scenario (Table 5.3). This level of agreement does not reflect the likelihood of the scenarios. By definition, the most likely events are all grouped in the realistic scenario (thus the most likely scenario).

All disagreements among the experts referred to the likelihoods of the events, not to the signs of the impacts. According to van Notten *et al.* (2003), the resulting scenarios can be classified as normative (describing probable futures), forecasting (built from the present), institution-based (focused on the honey chain), short term (3-10 years), and spatially multiple-scaled (with global and local inputs).

Table 5.3. Placement of events in the 2015-2020 honey business scenarios and the level of agreement amongst experts about the placement

Scenario	Event	Agreement (%)
Pessimistic	1) Rainfall reduction in the Northeast of Brazil as a consequence of global climate change;	100%
	2) Spread of Colony Collapse Disorder (CCD) to Northeast of Brazil;	100%
	3) Return of Chinese honey to the United States (US) market (lift of antidumping import duty, expected to continue until at least 2017), which is the main destination of stream exports (above 80% of volume);	67%
	4) Withdraw of donors' support to the Picos value chain stream;	83%
	5) New ban of Brazilian honey from European Union (EU) market.	100%
Realistic	1) Continuation of EU ban on genetically-modified contaminated honey from general sale (not identified as Genetically Modified Organisms – GMOs) starting 2012;	100%
	2) Growth of honey demand in the external market;	100%
	3) Continuation of the advance of agriculture over bee forages in Argentina;	83%
	4) Continuation of bee deaths in the US (by CCD);	100%
	5) Growth of honey exports from African countries (e.g. Ethiopia);	83%
	6) Prohibition of exporting, by the Brazilian Ministry of Agriculture or the Brazilian Sanitary Inspection Service, of honey extracted in honey houses without the accreditations Good Manufacturing Practices (GMP) and Hazard Analysis and Critical Control Points (HACCP).	67%
Optimistic	1) Continuous growth of national honey consumption (in contrast to 2007-2011 period);	67%
	2) Equity partnerships among local honey processors and global traders (e.g., as occurred with two major processors in Santana do Cariri at the end of 2011);	67%
	3) Devaluation of Brazilian Real in relation to the American dollar, favouring Brazilian exports;	83%
	4) Growth of direct state government subsidies to honey producers in Ceará;	83%
	5) Advance of bee forages over areas previously occupied by traditional and diminishing rural activities like extensive cattle raising and non-irrigated agriculture in the Northeast of Brazil.	83%

Source: Delphi questionnaire with experts; Court of Justice of the European Union (2011); European Commission (2013a); PBMC (2013); USITC (2010).

5.3.2 Effects of strategies

Overall, the mean R^2 from the OLS regressions of the Section IV likelihood ratings on the Section I/II/III combined utilities was around 0.80, showing the high internal validity of the individual-level utilities in all scenarios. The intraclass correlation coefficient of utilities was also high, above 90% in all scenarios, expressing a strong agreement across experts in all scenarios.

For the production growth indicator, the strategy level mean utilities and the relative importances of the strategies were calculated for each scenario (Table 5.4). For each strategy in a certain scenario, the level with the highest utility is the strategy

Table 5.4. Mean utilities and relative importance of strategies (%) for production growth by scenario*

Strategy	Level	Scenario					
		Pessimistic		Realistic		Optimistic	
		Utilities	%	Utilities	%	Utilities	%
Honey exports (% processed volume)	100%	-0.185	4.9%	-0.014	5.6%	-0.071	5.7%
	75%	*0.201*		*0.187*		*0.142*	
	50%	0.041		-0.119		0.003	
Exports to markets other than US and EU (% exported volume)	10%	*0.291*	5.4%	NA	NA	NA	NA
	5%	-0.252		NA		NA	
Honey certified as organic (% production)	75%	*0.196*	6.3%	*0.302*	7.9%	*0.316*	7.8%
	25%	0.111		0.057		0.075	
	0%	-0.249		-0.306		-0.316	
Honey certified as fair trade (% production)	40%	NA	NA	0.231	6.7%	NA	NA
	20%	NA		0.041		NA	
	0%	NA		-0.219		NA	
Exploitation of new bee product: propolis	no	-0.132	4.5%	-0.177	5.0%	-0.223	5.3%
	yes	*0.171*		*0.212*		*0.273*	
Exploitation of new bee product: pollen	no	-0.086	4.7%	-0.167	4.6%	-0.184	5.2%
	yes	*0.124*		*0.203*		*0.234*	
Exploitation of new bee product: wax	no	-0.161	4.6%	-0.195	5.2%	-0.248	5.9%
	yes	*0.199*		*0.231*		*0.297*	
Additional sources of bee forages	none	-0.508	9.8%	NA	NA	NA	NA
	recovery of original forages	0.242		NA		NA	
	cultivation of new forages	0.099		NA		NA	
	both	*0.245*		NA		NA	
Number of HACCP honey house units per 100 beekeepers	2.00	0.097	5.2%	*0.289*	8.4%	*0.299*	8.7%
	1.00	*0.177*		0.163		0.174	
	0.25	-0.217		-0.398		-0.399	
Migratory apiculture (distance from base, km)	800	0.100	7.6%	NA	NA	NA	NA
	200	*0.211*		NA		NA	
	0	-0.253		NA		NA	
Complementary colony feeding	none	-0.426	9.5%	-0.383	9.9%	-0.470	11.5%
	natural feed (pollen/honey)	*0.267*		*0.258*		*0.350*	

Table 5.4. continued

Strategy	Level	Scenario					
		Pessimistic		Realistic		Optimistic	
		Utilities	%	Utilities	%	Utilities	%
	artificial feed (protein/syrup)	0.217		0.179		0.194	
Use of alternative vehicles for collection/ transportation of hives	no	NA	NA	-0.115	4.0%	NA	NA
	yes	NA		*0.150*		NA	
Artificial replacement of queen bees	none	-0.471	9.1%	-0.510	10.2%	-0.502	10.5%
	induced division of colonies	0.126		0.096		0.033	
	introduction of genetically improved queen bee	0.175		0.214		0.178	
	both	*0.247*		*0.273*		*0.390*	
Honey sold to local processor (% production)	75%	NA	NA	NA	NA	0.338	6.2%
	25%	NA		NA		-0.289	
Resource sharing at production step	no sharing	-0.467	9.4%	NA	NA	NA	NA
	association	0.168		NA		NA	
	cooperative	*0.356*		NA		NA	
Number of hives per beekeeper	200	NA	NA	0.132	7.4%	0.230	10.0%
	100	NA		0.129		0.173	
	60	NA		-0.207		-0.328	
Technical assistance type	non specialised	-0.359	7.6%	-0.385	8.9%	-0.370	8.3%
	specialised	*0.397*		*0.420*		*0.420*	
Technical and managerial assistance coverage (% producers)	90%	*0.307*	6.1%	*0.405*	8.6%	*0.381*	7.8%
	50%	-0.043		-0.028		0.064	
	25%	-0.206		-0.323		-0.370	
Credit coverage (% producers)	75%	*0.257*	5.4%	*0.309*	7.7%	*0.317*	7.2%
	25%	-0.006		0.011		0.060	
	10%	-0.193		-0.266		-0.302	
Total			100%		100%		100%
Consistency of experts, mean of ACA model R^2			0.811		0.853		0.881
Intraclass correlation coefficient, α			0.953		0.953		0.939

* The relative importances of the three strategies with the highest relative importances per scenario are shown in bold, and the most preferred levels per strategy in each scenario are shown in italics.
NA: Not applicable because the strategy was not included in this scenario.
Source: Field interviews, prepared by the authors.

level preferred by the experts. In the pessimistic scenario, defensive strategies such as 'additional sources of bee forages' and 'resource sharing at production step' were among the top three strategies in importance (%). In the optimistic scenario, 'number of hives per beekeeper' was among the top three. 'Complimentary colony feeding', a productivity improvement strategy, rated among the top three strategies in all scenarios. The three most important strategies accounted for approximately 30% of the total importance in each scenario. The preferences for the strategy levels changed across the scenarios for production growth, however the most preferred level was generally stable across the scenarios. The only exception was the number of HACCP honey houses per 100 beekeepers. Having one HACCP honey house unit per 100 beekeepers was the preferred level in the pessimistic scenario but became less preferred than two HACCP honey house units per 100 beekeepers in the realistic and optimistic scenarios. The differences in the utilities of the levels for this strategy in each of the scenarios was large, meaning that the experts had similar views about the effects of the strategy levels: in scenarios with growing demand and qualified competition, having more certified capacity would contribute more to production growth. In eight of the remaining strategies, the utility of the preferred level increased as the scenario shifted from pessimistic to optimistic.

For the local value-added indicator, the strategy level mean utilities and the relative importances of the strategies were also calculated for each scenario (Table 5.5). For each strategy in a certain scenario, the level with the highest utility is again the preferred level by the experts. In the pessimistic scenario, 'resource sharing at production step' was among the top three strategies whereas in the realistic scenario, 'honey sold to local processor' was the most important strategy. In the optimistic scenario, a less traditional product-differentiating strategy, 'indication of stream origin', was among the top three. Well-known product-differentiating strategies such as 'honey certified as organic' and 'honey certified as fair trade' rated among the top three in all scenarios. The utilities of the three most important strategies together accounted for 25% to 32% of the total utility in each scenario.

Changes in the preferences for strategy levels were also observed across the scenarios for local value-added. For four strategies these changes were such that a strategy level was no longer preferred ('honey exports', 'number of HACCP house units per 100 beekeepers', 'artificial replacement of queen bees', and 'number of information exchange events per year in the state'). The difference in the utilities of the second-most preferred and the most preferred strategy level was small for each scenario. For example, exporting 50% of the processed volume was the preferred

strategy level in the realistic scenario (with utility 0.107), compared to the 75% strategy level (with utility 0.091) and the 100% strategy level (with utility -0.119). The difference in utilities of the 50% and 75% levels was small in the realistic scenario. This means that the experts were not completely sure about the difference in the effects of the two most-preferred strategy levels in the realistic scenario In the optimistic scenario, the 50% strategy level was clearly preferred, with utility 0.218 versus utility -0.031 for the 50% level and utility -0.098 for the 100% strategy level. This pattern of perceptions among experts contributed to none of these four strategies being among the most important in any of the scenarios.

Comparing the results of the two performance indicators, it is noteworthy that none of the top three strategies for production growth were among the top three for local value-added. As long as performance goals are not the same, it is expected that the strategies to reach them may also be different. Furthermore, consistency among experts was lower for local value-added than for production growth in all scenarios, as the experts were less familiar with the local value-added indicator.

5.4 Discussion and Conclusions

Application of the value chain SCP framework entails substantial data gathering and processing, construction of business environment scenarios, and cause and effect analysis to link strategies to performance indicators. The support of experts in an ACA setting allows the quantification of perceived utility differences among strategy levels and perceived strategy importances by performance indicator. This information can be used to allocate resources under different goals and scenarios.

The results of this study showed that strategy choices vary according to the goal of the value chain stream in a given industry structure. Common upgrading strategies, such as those relying on product differentiation, are not the most recommended to all performance goals. Promising strategies are also frequently influenced by business scenarios. The influence of the dynamics of the business environment on promising strategies is revealed not only by changes in their importances across scenarios but also by comparison with past successful strategies. Figueirêdo Junior *et al.* (2015) showed, for instance, that adoption of technical assistance was among the top contributing strategies to production growth between 2007 and 2011, for the same honey streams. This strategy was not among the top two in any of the 2015-2020 period scenarios; it was displaced by strategies not previously pursued.

Table 5.5. Mean utilities and relative importance of strategies (%) for local value-added by scenario*

Strategy	Level	Scenario					
		Pessimistic		Realistic		Optimistic	
		Utilities	%	Utilities	%	Utilities	%
Honey exports (% processed volume)	100%	NA	NA	-0.119	5.9%	-0.098	6.6%
	75%	NA		0.091		*0.218*	
	50%	NA		*0.107*		-0.031	
Exports to markets other than US and EU (% exported volume)	10%	*0.257*	5.2%	NA	NA	NA	NA
	5%	-0.223		NA		NA	
Honey certified as organic (% production)	75%	*0.397*	9.6%	*0.426*	9.6%	*0.513*	12.4%
	25%	0.089		0.025		0.080	
	0%	-0.435		-0.372		-0.504	
Honey certified as fair trade (% production)	40%	*0.302*	8.1%	*0.323*	8.8%	*0.423*	10.3%
	20%	0.134		0.101		0.129	
	0%	-0.385		-0.344		-0.463	
Honey sold as monofloral (% production)	50%	*0.246*	6.6%	*0.207*	7.5%	*0.262*	7.7%
	25%	0.127		0.154		0.134	
	0%	-0.322		-0.282		-0.308	
Exploitation of new bee product: propolis	no	-0.210	5.1%	-0.238	6.0%	-0.188	5.3%
	yes	*0.244*		*0.291*		*0.247*	
Exploitation of new bee product: pollen	no	-0.101	3.7%	-0.201	6.3%	-0.182	5.2%
	yes	*0.135*		*0.253*		*0.241*	
Exploitation of new bee product: wax	no	-0.200	4.9%	-0.186	5.1%	-0.162	4.7%
	yes	*0.234*		*0.238*		*0.221*	
Indication of stream origin (% honey production)	50%	*0.348*	6.7%	*0.273*	7.2%	*0.335*	9.0%
	25%	-0.012		0.086		0.118	
	0%	-0.286		-0.281		-0.364	
Number of HACCP honey house units per 100 beekeepers	2.00	*0.185*	5.1%	*0.262*	7.1%	0.120	5.8%
	1.00	0.072		0.110		*0.162*	
	0.25	-0.206		-0.293		-0.194	
Artificial replacement of queen bees	none	-0.266	6.2%	-0.196	5.8%	-0.205	6.8%
	induced division of colonies	0.068		0.039		0.077	
	introduction of genetically improved queen bee	*0.176*		*0.142*		0.106	
	both	0.090		0.121		*0.140*	

Table 5.5. continued

Strategy	Level	Scenario					
		Pessimistic		Realistic		Optimistic	
		Utilities	%	Utilities	%	Utilities	%
Honey sold to local processor (% production)	75%	*0.289*	6.2%	*0.400*	10.5%	*0.343*	7.7%
	25%	-0.255		-0.347		-0.283	
Resources sharing at production step	no sharing	-0.351	8.0%	NA	NA	NA	NA
	association	0.115		NA		NA	
	cooperative	*0.287*		NA		NA	
Number of information exchange events per year in the state	6	0.064	6.0%	*0.072*	4.6%	0.032	5.1%
	4	*0.072*		0.056		*0.114*	
	2	-0.085		-0.048		-0.058	
Technical assistance type	non specialised	-0.276	6.4%	-0.336	8.4%	-0.227	6.4%
	specialised	*0.310*		*0.389*		*0.286*	
Technical and managerial assistance coverage (% producers)	90%	*0.305*	6.8%	*0.325*	7.3%	*0.313*	6.9%
	50%	0.038		0.054		-0.008	
	25%	-0.293		-0.299		-0.216	
Credit coverage (% producers)	75%	*0.200*	5.6%	NA	NA	NA	NA
	25%	0.024		NA		NA	
	10%	-0.173		NA		NA	
Total	-		100%		100%		100%
Consistency of experts, mean of ACA model R^2	-		0.800		0.809		0.820
Intraclass correlation coefficient, α	-		0.943		0.950		0.953

* The relative importances of the three strategies with the highest relative importances per scenario are shown in bold, and the most preferred levels per strategy in each scenario are shown in italics.
NA: Not applicable because the strategy was not included in this scenario.
Source: Field interviews, prepared by the authors.

There are also strategies that rate among the top three in terms of their perceived contribution to performance in all three scenarios. These strategies are the so-called robust strategies, for which usefulness does not depend on the scenario. This is the case for 'complimentary colony feeding' for production growth, and 'certification of honey as organic' and 'certification of honey as fair trade' for local value-added. The common characteristic of these strategies is that they fit the traditional patterns of process (productivity improvements) and product (product differentiation) upgrading (Humphrey & Schmitz, 2002). This reinforces the relevance of the process and product upgrading types because these strategies are robust across different scenarios.

The use of upgrading typologies for value chain strategies, however, should be further discussed. The two types of upgrading, product and process, for which examples of robust strategies were found in this study both relate to established upgrading forms studied in the economics of innovation (Kaplinsky, 2013). These types can still be easily observed when the upgrading perspective is aggregated for networks of firms, as in a value chain stream. The other two upgrading types that were added by global value chain theory in the initial debate of economic upgrading (Kaplinsky & Morris, 2001) – functional and inter-chain – are intrinsically related to moves by individual firms. Therefore, they deserve a closer look when the unit of analysis is a value chain stream, and not an individual firm. Functional upgrading of a firm in a certain territory is captured by decisions of the network to have participants more active in additional steps of the chain. In this study, an example of a functional upgrading strategy for a stream is 'honey sold to local processor'. Inter-chain upgrading, a type of diversification of a firm, is not captured in the assessment of a given stream because this move impacts a different value chain. In the extreme, diversification of a stream (all the segments of a value chain in a territory entering another value chain) would not be a very likely alternative. In addition, among the most important strategies for both performance goals, a few are related to the widened concept of linkage upgrading ('resource sharing at production step' and 'number of hives per beekeeper'), whereas others are not yet classified as upgrading ('technical assistance type' and 'technical and managerial assistance coverage').

It is clear, then, that the definition of upgrading would have to be expanded to include strategies that could possibly contribute to specific value chain stream goals in any business scenario. This supports the argument of Ponte and Ewert (2009) that upgrading should be viewed as searching for a "better deal", to be properly defined in each situation. Instead of expanding the upgrading concept every time a newly identified strategy does not fit the most current definition of upgrading, the application of the value chain SCP framework offers an opportunity to search for promising strategies towards a performance goal – the "better deal" – in an integrated way.

The results of the analysis can be used for the practical implementation of the strategies. Value chain streams are advised to first to prioritise a performance goal. Then, for the prioritised performance goal, implement the strategies in the order of importance for the realistic scenario, which is the most likely scenario by definition. If the situation changes, for example from realistic to pessimistic

during the implementation process, the order of importance of the strategies in the pessimistic scenario should then be followed. However, before the situation changes, it is likely that the robust strategies have already been implemented, as they are among the most important regardless of the scenario.

In practice, the scenarios may not be mutually exclusive, and an event that was expected to be less likely to occur, may happen. The strategies that are more influenced by this particular event could then be pursued. For instance, 'rainfall reduction as a consequence of global climate change' was considered less likely to occur and some strategies associated with this event (for instance, 'additional sources of bee forages' and 'migratory apiculture') were considered relevant in the pessimistic scenario only. However, should this less likely event occur, these strategies should be considered. This shows how the results can be used to find appropriate strategies if an unlikely event occurs. A new conjoint study involving new scenarios may therefore not always be necessary in order to identify the importance of a specific strategy should an unlikely event occur.

Although the three honey streams in this study are located relatively close to each other and the group of strategies is the same across the streams, there may be relevant differences in their strategy levels in practice. For instance, it is much easier for the Santana do Cariri stream to sell a higher percentage of its production as monofloral honey then its counterparts (Figueirêdo Junior *et al.*, 2014) due to the existence of a well-defined blossoming season for a clear honey-source flower.

Once the most important strategies have been identified, it is still necessary to check for the alignment of those strategies with each other towards the prioritised performance goal (Figueirêdo Junior *et al.*, 2014). Alignment means the value chain stream strategies should converge to a performance goal. This implies that the streams may find it difficult to pursue strategies that aim at both production growth and local value-added at the same time. If they do pursue strategies that do not converge, suboptimal performance regarding a certain goal may be reached. For instance, the complementary feed (a production growth strategy) available at a large scale for bees may not be compatible with organic certification (a local value-added strategy). Even for the strategies that should contribute to the same performance goal, alignment should be sought. For instance, increasing the percentage of honey sold to local processor (a local value-added strategy) requires that processor to be certified as fair trade (also a local value-added strategy).

Value chain strategy design in development interventions is a frequent task with a variety of perspectives and frequently overlooked alternatives (Donovan

et al., 2015). The use of the value chain SCP framework to design value chain strategies, as shown in this study, allows development practitioners and value chain participants to make an integrated assessment of structure, conduct, and performance from a value chain perspective, linking the behaviour of value chains in a certain business scenario to their results.

This study focused on the strategies that can be pursued by the value chains to improve their competitiveness and promote local development. The value chain SCP framework is expected to be valuable for future research in the following areas: application of the value chain SCP framework to identify strategies for other value chain streams, identification of strategies for value chain streams to achieve socio-environmental goals in addition to economic goals, and the identification of structural limitations that deserve to be targeted by value chain development interventions.

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Appendix

Table A.1. Structural indicators and their values for the period 2007-2011, for the selected value chain streams

Category	Indicator	Value Chain Stream		
		Limoeiro do Norte (LN)	Santana do Cariri (SC)	Picos (P)
Demand behaviour	World honey consumption growth 2007-2011 (% year)[1]	2.7% (with growing organic and fair trade segments)		
	National honey apparent consumption growth 2007-2011 (% year)[1]	-3.2%		
Concentration of clients	World market share of top 4 honey import countries (% of volume, 2007 and 2010)[1]	64%, 56%		
	National market share of top 4 food retailers (% of sales, 2011)[1]	50%		
Rivalry intensity	World market share of top 4 honey export countries (% of volume, 2007 and 2010)[1]	49%, 44%		
Entry barriers	Capital and knowledge intensity[2]	Relatively low in production		
Substitute products	Existence of relevant substitute products[2]	Sugar, glucose syrup, and other sweeteners		
Institutional environment	Taxes[2]	Tax incentives to attract processing units offered at state and national levels		
	Subsidies[2]	Almost no direct subsidies to producers	Almost no direct subsidies to producers	Strong direct subsidies to groups of small producers
	Business chamber/board/federation[2]	Existence of honey chamber and beekeeping federation at state and national levels		
	Labour costs[2]	Increasing cost of labour at national level		
	Quality requirements[2]	Stricter quality requirements at both national and international levels		
	Import tariffs[1]	Lower import tariffs to competitors from North America (by US) and Africa (by US and EU)		
	Exchange rates[1]	Appreciation of Brazilian Real while main competitors Argentina, Turkey, Mexico, and Vietnam depreciated their currencies against US dollar		
Local natural environment	Average temperature (°C)[1]	25-29		
	Normal rainfall (mm/year)[1]	721-973		
	Main bee forage sources[2]	*Borreria verticillata, Merremia aegytia, Croton sonderianus Müll. Arg., Hyptis suaveolens*	*Serjania sp, Croton sonderianus Müll. Arg., Borreria verticillata, Hyptis suaveolens*	*Croton sonderianus Müll. Arg., Piptadenia moniliformis, Merremia aegytia, Hyptis suaveolens*
Local infrastructure	Road distance to export harbour Pecém/CE (km)[1]	253	538	560
	Access to utilities[2]	Partial coverage of cell phone, electricity and water in some areas of the apiaries and honey houses		

Source: (1) CBI (2011), FAO (2013), IBGE (2012, 2013), INMET (1992), IPECE (2012), ABRAS (2012), European Commission (2013b), FXTOP (2012), IPECE (2012), MDIC (2013), USITC (2010); (2) field interviews.

Table A.2. Preliminary list of strategies by value chain SCP category with number of votes per scenario and performance indicator

Category	Strategy	Votes per scenario and performance indicator*					
		Pessimistic		Realistic		Optimistic	
		Production Growth	Local Value-added	Production Growth	Local Value-added	Production Growth	Local Value-added
Product/market	- Increase in honey certified as organic as % of production	24	39	30	42	30	45
	- Increase in honey certified as fair trade as % of production	16	40	22	40	22	43
	- Increase of monofloral production as % of production	9	31	12	34	21	33
	- Increase in honey exports as % of production	18	24	31	30	30	36
	- Exploitation of new bee products (e.g. propolis)	25	36	23	29	33	39
Pricing	- Processed honey price reduction as compared to competing streams	6	14	8	12	12	6
Promotion	- Indication of stream origin for honey products	21	33	16	30	24	30
Distribution channels	- (no suggestion)	0	0	0	0	0	0
Production	- Increase in the number of HACCP accredited honey house units per 100 beekeepers	30	33	39	36	42	33
	- Increase in the practice of migratory apiculture	30	18	16	11	21	14
	- Increase in the practice of bee feeding during dry season (using natural honey or complimentary feeds like soy flour)	40	25	33	26	32	23
	- Use of alternative vehicles to collect and transport honey to honey houses and processors	12	3	22	9	18	6
Product development	- Movement from outside the stream to local development of honey products	15	20	8	23	17	23
Sourcing	- Identification and exploitation of new sources of bee forages	24	15	15	18	18	15
Vertical linkages	- Increase in % of local honey production sold to local processors[(1)]	18	27	20	27	30	36
	- Increase in % of production from vertical or quasi-vertical integration among producers and processors[(1)]	9	27	17	20	15	24
Horizontal linkages	- Movement from associative to cooperative-type of horizontal linkage among producers	25	28	15	26	21	22

Table A.2. continued

Category	Strategy	Votes per scenario and performance indicator*					
		Pessimistic		Realistic		Optimistic	
		Production Growth	Local Value-added	Production Growth	Local Value-added	Production Growth	Local Value-added
Network linkages	- Increase in participation of stream representatives in board/chamber/federation	21	15	21	17	24	15
Agglomeration	- Increase the number of hives per beekeeper	12	15	24	20	36	24
Use/quality of supporting services	- Offer of specialized technical assistance	36	33	41	32	33	33
	- Offer of technical assistance with free distribution of hives	13	16	18	16	19	19
	- Increase in coverage of technical and managerial assistance	36	33	34	32	36	33
	- Increase in coverage of credit	33	27	31	23	33	18

* Number of votes added for all streams. Strategies for which the number of votes is underlined were selected as belonging to the top 10.
(1) Overlapping with each other.
Source: Interview with experts and research analysis.

Table A.3. Additional list of strategies by value chain SCP category with number of votes per scenario and performance indicator

Category	Strategy	Votes per scenario and performance indicator*					
		Pessimistic		Realistic		Optimistic	
		Production Growth	Local Value-added	Production Growth	Local Value-added	Production Growth	Local Value-added
Product/market	- Promotion of honey in the domestic market(1)	9	3	6	0	6	0
	- Export to new markets other than US and EU (e.g., Japan and Middle East)	6	6	0	0	0	0
Production	- Recovery of original bee forage from semi-arid region (*Myracrodruon urundeuva*, *Anadenanthera colubrina*, *Mimosa caesalpiniifolia, Anacardium occidentale L.*); Growing of bee forage species that blossom in the dry season (*Spondias mombi, Spondias tuberosa, Prosopis juliflora, Anacardium occidentale L.*); Consociate beekeeping with seed oil (peanuts, castor, sunflower) and fruit growing (citrus, cashew, melon etc.)(2)	8	2	5	2	5	2
	- Selection of more productive bees (genetic improvement); Systematic replacement of queen bees	6	6	6	6	6	6
	- Increase quality of honey extraction equipment (vertical spin extractor, automated uncapping table)	0	3	0	3	0	3
Use/quality of supporting services	- Increase in laboratory capacity to conduct quality control analysis	0	0	3	0	3	0
Network linkages	- Increase in the exchange of information among stream participants (e.g., fair, magazine etc.)	3	6	3	6	3	6
Agglomeration	- Attract more material and equipment suppliers (e.g., hive manufacturers, wax honeycomb manufacturers) to the streams	0	3	0	3	0	3

* Number of votes added for all streams. Strategies for which the number of votes is underlined were selected because they received more than three votes per scenario.
(1) Partly overlapped with 'increase in honey exports as % of production' in Table A.2, thus new resulting strategy became 'increase in honey exports as % of processed volume'; (2) Overlapped with 'identification and exploitation of new sources of bee forages' in Table A.2.
Source: Interview with experts and research analysis.

Chapter 6

General discussion

H. S. de Figueirêdo Junior

6.1 Introduction

The general objective of this research was to make *ex-post* and *ex-ante* assessments of strategies for honey value chains in Brazil. This general objective was broken down in four specific objectives, which were addressed in separate chapters. Chapter 2 extended the SCP framework to value chains, identifying categories of structure, conduct and performance for value chain streams and providing an integrated approach to explore possible interactions among those categories. Chapter 3 identified likely successful strategies of value chain streams to their past performance. Chapter 4 quantitatively assessed the contribution of individual strategies of value chain streams to their performance. Chapter 5 identified promising strategies at contributing to chain competitiveness and local development, to be deployed by value chain streams, under different scenarios. The empirical part of this research, presented in Chapters 3 to 5, focused on three honey value chain streams in Brazil, located in the Northeast of the country, two in Ceará State (Limoeiro do Norte and Santana do Cariri) and one in Piauí State (Picos).

This final chapter synthesises the results of the different chapters of this thesis, points out the contribution of the value chain SCP framework to the literature on value chains, discusses methodological issues, presents business and policy implications, suggests areas for future research, and summarises the main conclusions of this thesis.

6.2 Synthesis of results

This thesis assessed the strategies for the honey value chain streams in Brazil using the value chain SCP framework. The first assessment (Chapter 3) was performed in qualitative terms and *ex-post*, whereas the second assessment (Chapter 4) was also *ex-post* but in quantitative terms. In both *ex-post* assessments, the period of analysis was 2007-2011, and the strategies were evaluated with respect to their contribution to honey production growth (% per year) and to honey value-added in all stream steps per total production (US$/kg) (in the remainder of this chapter, these performance goals are referred to as 'production growth' and 'local value-added'). In the third assessment (Chapter 5), i.e. an *ex-ante* assessment for the period 2015-2020, similar performance goals were used.

In the first assessment (Chapter 3), the strategies were also evaluated in terms of their contribution to 'honey exports value growth' (a competitiveness category

goal, just as production growth) and 'growth of the number of beekeepers' (a local development category goal, just as local value-added). In the qualitative evaluation in Chapter 3, the strategies that were perceived successful varied according to performance goals, even when the goals were in the same performance category (for example, 'local value-added' and 'growth of the number of beekeepers'). In the quantitative assessments (Chapters 4 and 5), because of requirements of the evaluation methods, the number of performance goals was reduced from four to two (one related to competitiveness, and the other to local development). A summary of the strategies that rated among the top three for 'production growth' and 'local value-added' in each of the assessments of this thesis is presented in Table 6.1. The results in this table confirm what was expected: different strategies for periods with structural differences – 2007-2011 and 2015-2020 (Chapters 3 and 4, and Chapter 5), and for distinct performance goals. In Chapters 3 and 4, the strategy assessment methods differed (multi-case and conjoint analysis), but the industry structure was kept the same; in Chapter 5, the industry structure differed between scenarios, but the strategy assessment method was the same for all scenarios, i.e. adaptive conjoint analysis.

As to the consistency of the results between Chapters 3 and 4, the focus on the export market and the importance of specialised technical assistance were perceived the most important strategies for 'production growth'. However the relative effect of 'technical assistance with free distribution of hives' in Chapter 4 was smaller than expected, based on the findings in Chapter 3. A plausible explanation is that free distribution of hives alone is not effective, and complementary strategies, such as 'specialised technical assistance' and 'credit coverage', are needed. The quantitative assessment with conjoint analysis in Chapter 4 measured the effects of each strategy separately, and did not consider interactions among strategies.

When it comes to 'local value-added', product differentiating strategies, such as 'organic certification' and 'monofloral production', were among the most important strategies in Chapters 3 and 4. In contrast to Chapter 3, however, the effect of the amount of 'honey sold to local processor' was not significantly contributing to local value-added in Chapter 4. The experts perceived that the opportunities to sell and buy honey outside the streams were the same for local producers and local processors, so value could still be added by just trading with producers and processors that are not in the stream territory. Furthermore, in Chapter 4, another differentiating strategy, 'fair trade certification', was identified as a promising strategy for 'local value-added'.

Table 6.1. Top three value chain stream strategies by performance indicator and assessment type

Performance Indicator*	Strategy (upgrading type)	Assessment type				
		Chapter 3	Chapter 4	Chapter 5		
		Ex-post (2007-2011)	*Ex-post* (2007-2011)	*Ex-ante* (2015-2020)		
		Qualitative	Quantitative	Quantitative, pessimistic scenario	Quantitative, realistic scenario	Quantitative, optimistic scenario
Production growth	- *Increase in honey direct exports** (end market or channel)*	x	x			
	- *Offer of technical assistance with free hives (not classified)*	x				
	- *Offer of specialised technical assistance (not classified)*	x	x		x	
	- *Additional sources of bee forages*** (process)*			x		
	- *Complementary colony feeding*** (process)*			x	x	x
	- *Artificial replacement of queen bees*** (process)*				x	x
	- *Resource sharing at production step (horizontal)*		x(1)	x(2)		
	- *Increase in number of hives per beekeeper*** (not classified)*					x
Local value-added	- *Increase in honey direct exports** (end market or channel)*		x			
	- *High differentiation through organic certification (product)*	x	x	x	x	x
	- *High differentiation through fair trade certification (product)*		x	x	x	x
	- *High differentiation through monofloral production (product)*	x	x			
	- *High differentiation through indication of stream origin*** (product)*					x
	- *High % of honey production sold to local processors (functional)*	x			x	
	- *Resource sharing at production step (horizontal)*			x(2)		

* In the *ex-ante* assessment, other apiculture products were included (although the prevalence of honey remained).
** As % of production in the *ex-post* assessments, and as % of processed volume in the *ex-ante* assessment
*** Strategies not executed in the period 2007-2011.
(1) as association; (2) as cooperative.
Source: Authors' analysis.

The influence of the dynamics of the industry structure on promising strategies is revealed not only by changes in their perceived importances by scenario in Chapter 5, but also by comparison with past successful strategies (Chapters 3 and 4). The assessments executed in Chapters 3 and 4 showed that adoption of 'specialised technical assistance' was among the most important strategies to enhance 'production growth' between 2007 and 2011. This strategy, however, was among the two most important strategies in only one of the period 2015-2020 scenarios (Chapter 5). It was replaced by strategies not previously pursued, i.e. in the pessimistic scenario, by 'additional sources of bee forages' and by 'complementary colony feeding'.

The assessments carried out in Chapters 3, 4 and 5 also revealed that the traditional upgrading strategies serve different performance goals: process upgrading strategies were more important to 'production growth', whereas product upgrading strategies were more important to 'local value-added'. Extended upgrading types (Trienekens, 2011) (e.g. 'resource sharing at production step') were important to one performance goal or to both, according to the industry structure. In that regard, this confirms the suggestion by Ponte and Ewert (2009) that the concept of upgrading should be viewed as searching for a "better deal", to be properly defined in each situation. Instead of widening the upgrading concept every time a newly identified strategy does not fit the most current definition of upgrading, the application of the value chain SCP framework naturally offers the opportunity to search for this "better deal" in an integrated way. Furthermore, the fact that one strategy may be important to only one performance goal reinforces the need to extend the concept of strategy alignment (Chopra & Meindl, 2010) to value chains, brought up in both Chapters 3 and 5.

6.3 Contribution of the Value Chain SCP framework

The original SCP framework was applied in industrial organisation studies to determine market power of firms (Bain, 1951; Bresnahan, 1989; Church & Ware, 2000). This thesis extended to value chains the updated, dynamic Structure-Conduct-Performance (SCP) framework (Scherer & Ross, 1990; Lee, 2007), which has more recently been used to devise strategies for individual firms (Copeland, Koller, & Murrin, 2000; Stuckey, 2008). Like the dynamic SCP framework, the value chain SCP framework accounts not only for direct links but also for feedbacks

among structure-conduct-performance, and for shocks, significant events which make the effects of those relations vary over time.

Extending the SCP framework to value chains brought three innovations to the value chain strategy literature: the integrated assessment of value chains provided by the relations between structure, conduct and performance; the explicit embeddedness in the territory where the segment of the value chain (the stream) is located; and the value chain stream (a network of firms composing a segment of a value chain in a territory) itself as the unit of analysis.

The value chain SCP framework takes into account the concepts of governance and value distribution from global value chain (GVC) theory (Gereffi & Korzeniewicz, 1994; Humphrey & Schmitz, 2002) in its conduct categories. Moreover, the framework incorporates, from Global Production Network (GPN) theory (Coe, Dicken, & Hess, 2008; Coe & Hess, 2011), the concept of territorial embeddedness in its unit of analysis and in its structural categories, and the notion of competing geographies in its unit of analysis. By doing so, the value chain SCP framework also combines the strengths (Parrilli, Nadvi, & Yeung, 2013) of two leading approaches, GVC and GPN, towards local and regional development. With its economic development perspective, the framework departs from the Supply Chain Management (SCM) literature, concentrated on performance of a focal firm's supply chain (Lambert & Cooper, 2000; Drost, van Wijk, & Vellema, 2008), but maintains SCM's orientation to performance.

Three other frameworks have been more frequently used to devise strategies for value chains, either applied individually, or combined to compensate for their shortcomings in a specific application (Webber & Labaste, 2010; USAID, 2015): Strengths-Weaknesses-Threats-Opportunities (SWOT), Porter's five forces (Porter, 1980), and Porter's Competitive Diamond (Porter, 1998). SWOT is derived from military strategy, simple, but not rigorous regarding the constructs for analysis, so interactions among relevant variables can be easily overpassed. Porter's models are built for individual firms and regions, respectively, and focus on the structure of the industries. The value chain SCP framework combines the structural constructs of both Porter's models with the territorial view of Porter's Competitive Diamond, and explicitly adds interactions among choices of strategies and results. In this endeavour, it misses the simplicity of SWOT in exchange for an orderly, more complete set of constructs for analysis.

By combining the strengths of leading network approaches for economic development, GVC and GPN, and bringing a theoretical entry point, SCP, to address

the competition among value chains, the value chain SCP framework contributes to re-shaping the conceptual and heuristic discussion on upgrading strategies of value chains (Ponte & Ewert, 2009; Barrientos *et al.*, 2011; Taglioni & Winkler, 2014).

The application of the value chain SCP framework in distinct configurations of structure, conduct and performance also reveals that some strategy upgrading types may be more adequate towards certain performance goals. If the goal, for instance, is to increase local value-added, product upgrading strategies are naturally more appropriate. *A priori*, the implementation sequence of the strategies, nonetheless, depends on the degree of the contribution of the strategies to performance, rather than on the types of the strategies. This is in contrast to the global value chain (GVC) theory, which expects a regular trajectory of strategy adoption, starting from process upgrading, to product, then to functional, and finally, to inter-chain upgrading (Kaplinsky, 2013). However, this standard trajectory described by GVC theory is expected from individual firms (Bair, 2005), and not from value chain streams.

In that regard, the value chain SCP framework assumes the adoption of a certain set of strategies by a stream, to be expressed as a combination of the strategies adopted by all firms in that stream. In practice, it is possible that firms in the same step of the stream follow very different, conflicting sets of strategies. Depending on the characteristics of the stream (size of territory, number of firms in each step of the stream), those differences in the firms' strategy sets may not be sustainable, because the stream capabilities and resources would be stretched too thin. In any case, the value chain SCP framework allows for those differences within the streams, as stream strategies can be expressed in percentages of adoption of a certain strategy (for example, percentage of production certified as organic). In practice, it is also possible that firms in different steps of the same stream engage in strategies that are beneficial to one, and at the expenses of the others. Adopting conflicting, divergent strategies (Muradian *et al.*, 2013) may not be sustainable in the long run, and may cause the stream to collapse. For example, to compensate for their high cost, outdated processing technologies, leading honey processors in a stream may decide to pay low prices to honey producers, who may end up out of business. The SCP framework addresses this concern by considering vertical relations not only among firms inside and outside the stream (Gereffi *et al.*, 2005), but also relations among stream members.

6.4 Methodological issues

Data availability is usually a challenge in value chain studies (Frederick, 2014; Donovan *et al.*, 2015). In this thesis, primary data had to be collected for the three streams, given that informative secondary data was not fully available. In the value chain SCP framework, the unit of analysis is a stream, so each stream represents an observation, with its own strategies and performance indicators. The choice of methods to support the application of the framework, then, has to take into account the available data. The value chain SCP framework offers the possibility to investigate an ample set of cause and effect relations, and to choose qualitative and quantitative methods that are deemed most adequate in each situation. In this thesis, for example, multi-case study and conjoint analysis were used. Conjoint analysis proved a useful evaluation method in data scarce, *ex-post* situations, to assess the effects of the realised strategies of value chain streams. If an econometric model were to be constructed, it would require the estimation of a large number of parameters, and thus would require an even larger number of observations (in this case, streams). Collecting data for more honey value chain streams was out of the time and budget limits of this study.

Although in smaller magnitude, this challenge is actually the same faced by decision makers applying the dynamic SCP framework to individual firms: to find the conducts (or strategies) that yield the highest performance, given a certain industry structure. In practice, only few competitors are chosen for comparison, as gathering data about competitors is costly. Then, the problem is solved by, first, separating the *ex-post* explanation from the *ex-ante* investigation. The *ex-post* analysis explains what conducts worked well during the past, when all the structure variables were known, and can also unravel path dependences of the chains. The *ex-ante* analysis, in turn, is more difficult because it also requires assumptions on possible structural changes in addition to pinpointing the relations among all the framework variables. At the same time that it brings more complexity, the integrated assessment of structure-conduct and performance also allows the decision makers to perceive issues that could otherwise be forgotten (for instance, a new strategy, or alignment and sequencing of strategies) (Chapters 3, 4 and 5). Forms of dealing with this framework complexity, compatible with the complexity of the problem at hand, have been applied throughout this thesis.

As to the sources of data, collection did not take place at the firm level of each step of the chain, but at an aggregated level from primary and secondary sources.

Collecting data at the firm level (or household level, for producers) would have allowed for analysing poverty reduction, for instance. However, this was not an option in the case of the *ex-post* evaluations (Chapters 3 and 4) because data at firm or household level before the implementation of the strategies were not available. Connection of adopted strategies with performance pay-offs (as done in Chapter 4) is a type of information that can be used in investment decisions. However, extrapolations of those benefits to the future only hold if the structural conditions of the industry remain the same. This was not the case in the *ex-ante* assessments carried out in Chapter 5.

Ratings-based conjoint value analysis (CVA) instead of choice-based conjoint (CBC) analysis for the strategy profiles of the *ex-post* assessment (Chapter 3) was used because the resulting strategy profiles had, at least, nine attributes (strategy levels), to be evaluated by 15 respondents. The recommendation for CBC is that the profiles have, at most, three attributes, and sample sizes are above 100 respondents (Orme, 2009). With an even larger number of attributes in the *ex-ante* assessment, the computer-based adaptive conjoint analysis (ACA) was a natural choice over the paper-based CVA (Chapter 4).

Another aspect that deserves attention is the sampling of the experts in the conjoint studies, which made possible to quantify the importance of the stream strategies to performance in both *ex-post* (Chapter 3) and *ex-ante* (Chapter 4) assessments. By definition, experts in any field of knowledge are not numerous so the size of a sample of experts tends to be small, in absolute figures, but has to be large when compared to its population. This was the case in this thesis, with the sample being diverse among the experts, and containing more than half of the population of experts. The limitation from the use of experts is that the results derived from their opinions may not be statistically testable when dealing with a large number of variables.

Along this thesis, the importance of the successful strategies being identified by stream was stressed. This was clearly presented in Chapters 3 and 4, with *ex-post* and comparative assessments by stream showing the effects of different adopted strategies on the streams' performance goals. In Chapter 5, however, the experts were asked to rank strategies per stream and the rankings were very similar. Moreover, to take into account differences in streams' strategies would have been too demanding for the experts in the adaptive conjoint task. It is still possible, though, that the results in some situations, which represent the average of the three investigated streams, do not express the best choices for the individual streams. For instance,

'resourcing sharing at production step as cooperative' was rated as a top strategy in the pessimistic scenario, but a stream that has not had successful experiences with cooperatives yet (such as Limoeiro do Norte or Santana do Cariri) will find it more difficult to follow that strategy than a stream that has had experience with cooperatives (such as Picos). A deeper understanding about such connections was only possible due to the qualitative, *ex-post* analysis presented in Chapter 3.

6.5 Business and policy implications

The empirical application of the value chain SCP framework has revealed that it can support strategic decisions on value chains, to both value chain participants and development practitioners.

For the individual firms participating in a segment of a value chain in a territory (a stream), the framework conveys, from the beginning, the message about the growing importance of collaborating as a network of firms to compete with other streams in the pursuit of common goals. In that regard, win-win strategies among firms in the different steps of a value chain stream should be sought (Chapter 2). In addition, value chain participants should be aware that strategy choices vary according to the goal of the value chain stream in a given industry structure, be it in response to structural shocks or be it in response to development interventions (Chapters 3, 4 and 5).

The results of this thesis suggest that for the period 2015-2020, the three studied streams in Brazil should prioritise a performance goal, and implement the strategies in the order of perceived importance for the realistic scenario. This is because the realistic scenario, by construction, is the one most likely to happen according to the experts. For the realistic scenario, the most promising strategies are 'artificial replacement of queen bees through both division of colonies and artificial replacement of queen bees' for 'production growth', and 'honey sold to local processor at the 75% level of production' for 'local value-added'. If any stream is already at the level of those strategies, it should go on to implement the strategies that are next in perceived importance. If, during the implementation process, the state of nature switches from realistic to pessimistic, for example, then the streams should switch to implementing the strategies in the order of perceived importance for the pessimistic scenario. For 'production growth', this would mean starting to implement 'both recovery of original forages and cultivation of new forages as

additional sources of bee forages' and 'resource sharing at production step as a cooperative'. For 'local value-added', this would also mean starting to implement 'resource sharing at production step as a cooperative'. In any case, before the state of nature changes, it is likely that robust strategies, the ones among the most promising regardless of the scenarios, have already been implemented (Chapter 5).

For development institutions, the upfront understanding of the current strategies deployed by the targeted streams and their competitors, along with local structural conditions, are paramount for a successful intervention (Chapter 3). Interventions that considered traditional upgrading strategies without observing the alignment to other categories of strategy, such as building processing units, or without observing local structural limitations, such as building a technology development centre, were not successful. In this study, the two levels of the robust strategies to 'local value-added', i.e. 'organic certification at the level of 75% of production', and 'fair trade certification at the level of 40% of production', are also preferred for 'production growth', although not as important. Thus, those two strategies are aligned with each other towards 'production growth' and 'local value-added' increase, and may coexist to meet these two different performance goals (Chapter 5). Development agents and value chain participants should identify the business process and organisation strategy categories they intend to act upon, and foster strategies that are aligned with each other and reinforced by the business environment (Chapter 3). Furthermore, practitioners should be aware that the effect of value chain stream strategies on performance may be influenced by interactions occurring among the strategies, which is possibly the case between 'credit coverage' and 'technical assistance' (Chapter 4).

When devising value chain strategies, practitioners should not restrict their choices to upgrading typologies but investigate all the choices that can yield better results, according to the goals of the value chain stream and to the chain industry structure (Chapter 5). Common upgrading strategies, such as those relying on product differentiation, may not be the most recommended in every situation.

6.6 Future research

Applications in different industries are usually required to investigate the nature of interactions among SCP categories. For example, is there a pattern among value chain streams in different industries regarding the most appropriate type of

horizontal linkages for producers (no cooperation, association or cooperative), if the goal is production growth? Future studies could also define specific social and environmental conduct and performance categories, and investigate their interactions as well as their cross-over effects. Conflicting and reinforcing strategies towards economic, social and environmental goals could become evident, and their interactions could be measured.

Another topic for future investigation is the use of the framework in the context of collaboration among competing streams. In a state composed of municipalities, the value chain streams in territories formed by groups of municipalities (as in this thesis) can compete for their local development and, at the same time, cooperate for regional, state development.

The value chain SCP framework can also be used in future research to devise strategies *ex-ante* and confirm the validity of the devised strategies *ex*-post. This full-cycle study, including the devising of stream's strategies, their implementation, and the evaluation of the stream's performance afterwards, could use firm level data and compare results with streams that followed different strategies. In addition, as more economic input-output standardised datasets (for example, International Standard Industrial Classification of All Economic Activities – ISIC) are disaggregated from the industry to the activity (business function) level to measure the flow of goods and services through value chains (Frederick, 2014), those datasets could also be used to assess the stream's strategies.

Although most of the work in this thesis involved evaluations of the effects of the strategies on performance, the effect of the structure (scenarios) on performance, through strategy, was assessed in Chapter 5. In this context, the effect of changes in structural categories due to the influence of value chain participants or development institutions (for instance, tax or license reforms) could be further investigated.

Finally, future research could compare the SCP approach used in this thesis with value chain strategy studies that use other frameworks and methods for strategy conception (SWOT, Porter's five forces, and Porter's Competitive Diamond, for instance).

6.7 Main conclusions

The main conclusions of this thesis are:

- The value chain SCP framework allows for *ex-ante* and *ex-post* integrated assessments of strategies for a segment of a value chain in a territory (Chapters 2, 3, 4 and 5).
- The relative importance of strategies to enhance performance of the studied honey value chain streams in Brazil depends on industry structure and varies among performance goals (Chapters 3, 4 and 5).
- Focus on the export market and providing specialised technical assistance were the most important strategies for production growth in the honey value chain streams in Brazil during 2007-2011 (Chapters 3 and 4).
- Organic certification and monofloral honey production, both product-differentiating strategies, were the most important strategies for improving local value-added in the honey value chain streams in Brazil during 2007-2011 (Chapters 3 and 4).
- Complementary colony feeding with natural feed was perceived to be among the most promising strategies to increase production growth, across the three 2015-2020 scenarios, for the honey value chain streams in Brazil (Chapter 5).
- Organic certification at the level of 75% of production and fair trade certification at the level of 40% of production were perceived to be among the most promising strategies to increase local value-added, across the three 2015-2020 scenarios, for the honey value chain streams in Brazil (Chapter 5).
- The alignment of the value chain stream strategies towards a certain performance goal improves the likelihood of success of the implementation task (Chapters 3 and 5).
- The most commonly applied upgrading typologies do not cover all the strategy choices to value chain streams (Chapter 5).

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Summary

In an increasingly complex world economy, where the exchange of information and goods is accelerating, international trade is growing with multiple stakeholders. In this riskier business environment, as explained by institutional economics, competition for the end-customer takes place more among networks of firms rather than among individual firms. The analysis of competing firms, thus, has to go beyond the limits of each firm to incorporate the analysis of the entire chain(s) in which the firms participate. Since many global value chains have portions located in impoverished territories, a value chain approach for local development purposes has been adopted by several research and funding institutions. The projects funded by those institutions usually aim at identifying strategies for the chain which contribute most to the development of the territory where the chain is located. Development practitioners, nonetheless, are still looking for more solid grounds for value chain strategy development, especially after expected outcomes of interventions, such as poverty reduction, have not been clearly demonstrated. An approach is lacking to integrate the relations between strategy and structural issues, such as regulations, demand trends and concentration of clients/suppliers, and economic performance in terms of the contribution to local development.

The main objective of this research was to make *ex-post* and *ex-ante* assessments of strategies for honey value chains in Brazil. This general objective was broken down in four specific objectives, which were addressed in chapters 2 to 5. Building upon the dynamic Structure-Conduct-Performance (SCP) framework more recently used to develop strategies for individual firms, an extended value chain SCP framework was conceived and applied to selected value chain streams (segment of a chain in a territory). Three honey value chain streams in the northeast of Brazil were selected for the empirical application of the value chain SCP framework, all in top producing areas: two in Ceará State – Limoeiro do Norte and Santana do Cariri, and one in Piauí State – Picos. The honey chain was chosen because of the importance of honey production and trade to Brazil, which was among the top ten world honey exporters in terms of volume.

Chapter 2 presented the Structure-Conduct-Performance framework for a value chain, which is used in the remaining empirical chapters of the thesis. The research started with a literature review about networks of firms, industrial organization and frameworks used to formulate strategies for individual firms. It also showed how value chain strategies have been conceived, in the literature. This contextualised the need to carry out an integrated assessment of structure,

conduct and performance and led to a theoretical framework for value chain strategy formulation. The choice of the SCP categories was also complemented by deductive reasoning.

Chapter 3 used the value chain SCP framework to qualitatively evaluate the strategies deployed by honey value chain streams in Brazil between 2007 and 2011. For applying the proposed framework, relating past structure and individual stream conduct to individual stream performance, the three competing streams of the honey value chain in Brazil mentioned above were investigated. Each stream was a case, and the reason to pick different streams of the same value chain was to allow for *ex-post* evaluation and comparison. Production and exports by municipality, extracted from Brazilian official government registries, were used upfront for the identification and selection of the streams of the honey value chain. Interviews were carried out with representatives of the streams (e.g., beekeepers, processors and extension services technicians) to identify differences in strategy, performance and local structure indicators.

Chapter 4 quantitatively evaluated the contribution to performance of the strategies deployed by three honey value chain streams in Brazil between 2007 and 2011. Conjoint analysis with experts was used to measure the perceived impact of strategies on the performance. The conjoint study also allowed for measuring the effect of the change of a single strategy variable on performance.

Chapter 5 used a Policy Delphi survey with experts to build three scenarios for the honey industry in Brazil for the period from 2015 to 2020. In the sequence, adaptive conjoint analysis with experts was used to identify the most important strategies to improve the performance of the three honey streams previously investigated. A set of strategies for the value chain streams was suggested for each scenario, according to the performance goals.

Chapter 6 synthesised the previous chapters, and placed the outcomes in the literature. It also discussed methodological issues, and presented implications for business, policy and future research. Based on the results of this thesis, the main conclusions are:

- The value chain SCP framework allows for *ex-ante* and *ex-post* integrated assessments of strategies for a segment of a value chain in a territory (Chapters 2, 3, 4 and 5).
- The relative importance of strategies to enhance performance of the studied honey value chain streams in Brazil depends on industry

structure and varies among performance goals (Chapters 3, 4 and 5).

- Focus on the export market and providing specialised technical assistance were the most important strategies for production growth in the honey value chain streams in Brazil during 2007-2011 (Chapters 3 and 4).
- Organic certification and monofloral honey production, both product-differentiating strategies, were the most important strategies for improving local value-added in the honey value chain streams in Brazil during 2007-2011 (Chapters 3 and 4).
- Complementary colony feeding with natural feed was perceived to be among the most promising strategies to increase production growth, across the three 2015-2020 scenarios, for the honey value chain streams in Brazil (Chapter 5).
- Organic certification at the level of 75% of production and fair trade certification at the level of 40% of production were perceived to be among the most promising strategies to increase local value-added, across the three 2015-2020 scenarios, for the honey value chain streams in Brazil (Chapter 5).
- The alignment of the value chain stream strategies towards a certain performance goal improves the likelihood of success of the implementation task (Chapters 3 and 5).
- The most commonly applied upgrading typologies do not cover all the strategy choices to value chain streams (Chapter 5).

Acknowledgements

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The idea of pursuing a PhD degree in Wageningen University was hatched in the end of 2009, when I submitted an application to the Mansholt Graduate School of Social Sciences, now Wageningen School of Social Sciences (WASS). The application took longer than normal to be processed, until it reached the hands of a professor in the Business Economics Group in 2010. The name of this professor was Alfons Oude Lansink. He quickly evaluated the application and returned it with a letter of acceptance. It was the beginning of a journey to the kingdom of the Netherlands.

So my first personal word of gratitude goes to Alfons, my promotor and supervisor, whose sense of organisation, fast replies from all over the world, and sharp comments enriched the investigations of this thesis. And I am also thankful for his appointing Miranda Meuwissen as my daily supervisor.

During my first visit to Wageningen in January 2011, to decide whether I was really going to face the challenge of the PhD abroad, Alfons introduced me to Miranda. She would become much more than a co-promotor, with her outstanding communication skills and expert knowledge. Miranda, thanks for your confidence in my work, for the freedom to explore my initiatives, and for your full-time encouragement, even in the difficult periods. And, of course, thanks for sharing with me part of your time with Stef, Thomas and Manon.

When I was considering writing a PhD project for submission to Wageningen University, I was favoured by the opportunity to discuss my preliminary ideas with professor Jair do Amaral, a colleague of mine at the Federal University of Ceará (UFC) and a friend. This interaction led to him becoming my local supervisor at UFC for the Netherlands Cooperation for Higher Education (NUFFIC) scholarship, and also to him collaborating during this thesis.

In the middle of the thesis, I was faced with the challenge of learning a new quantitative method to deal with some technical problems at hand. At the time, I was lucky to be introduced to Ivo van der Lans, from the Marketing and Consumer

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Back to UFC, where I still hold my professorship position, I had the continuous support of my long-time colleague Vicente, during all those years on leave of absence. Besides, I must remember the encouragement from my colleagues Monica and Naiula in 2009. Thank you for this.

I dedicate this thesis to my parents, Hugo and Mariêta, who taught me by example the importance of hard work and continuous learning, and the value of a loving family.

The completion of this journey could not have been possible without the love and strength of my wife Cléa, and of our children Victor, Lara and Hugo. Cléa, you know I would not have succeeded without you, and I am afraid I will never

be able to find enough words to express your importance to this effort. I had to subtract time I could have spent with you all to prepare this thesis. You agreed to leave behind a stable life in Brazil to adventure in the experience of a life in the Netherlands. We all know now we've made the right decision.

I'll return to Brazil carrying a piece of the Netherlands with me.

Hugo Santana de Figueirêdo Junior
Wageningen, 9 November 2015

About the author

Hugo Santana de Figueirêdo Junior was born on June 25, 1967 in Fortaleza, capital of the Brazilian state Ceará, and grew up in Juazeiro do Norte, located in the Cariri region, countryside of Ceará. He returned to Fortaleza in 1981 to pursue secondary school, and was admitted in 1984 to Instituto Tecnológico de Aeronáutica (ITA), in São José do Campos, São Paulo, Brazil, where he graduated with a Bachelor degree in Aeronautical Engineering in 1988. During this period, he developed his B.Sc. research as a trainee in the aircraft manufacturer EMBRAER. After his graduation, he worked for one year and a half as an engineer with Ceará State Meteorology Foundation in a project to retrofit a small aircraft for climate research purposes. In 1990, he moved to Troy, NY, to pursue an MBA at Rensselaer Polytechnic Institute. After graduating in 1992, he was recruited by the consulting firm McKinsey for its São Paulo office. As an associate consultant, he participated in several assignments in Brazil and in the United States, on organizational restructuring, strategy conception and operational improvements for clients in segments like consumer goods, financial services and basic materials. Back to Fortaleza in 1996, he ran a management consulting firm acting mainly in the areas of investment structuring for the private sector and of planning for the public sector, leading several projects funded by multilateral institutions like The World Bank, The Inter-American Development Bank and USAID. He also served as lecturer on management at Ceará State University (UECE), and started publishing in peer-reviewed journals findings from some of his consulting engagements. In 2007, he was admitted through public examination as Assistant Professor to the Department of Accounting at the School of Economics, Administration, Actuarial Sciences and Accounting of the Federal University of Ceará (UFC). There, he was responsible for teaching managerial accounting, budgeting, costs analysis and financial mathematics, and conducting research on strategy and control, economic development, competitiveness and technological innovation. In 2011, he was granted a scholarship by the Netherlands Cooperation for Higher Education (NUFFIC) to pursue a PhD in Business Economics at Wageningen University. During his PhD, he developed and applied a framework to devise and evaluate strategies for value chains. Since January 2015, he joined the cabinet of the Governor of the State of Ceará as the Secretary of Planning and Management.

Hugo Santana de Figueirêdo Junior

Wageningen School of Social Sciences (WASS)

Completed Training and Supervision Plan

Name of the learning activity	Department/Institute	Year	ECTS*
A) Project related competences			
Advanced Microeconomics	ECH 32306	2011	6.0
Advanced Macroeconomics	ENR 30806	2011	6.0
Research Methodology: from Topic to Proposal	WASS	2011	4.0
Econometrics I	Tinbergen Institute TI1105-I/Erasmus University	2012	4.0
The Empirics of Economic Organization & Transaction Cost	NOVA Network/ Swedish University of Agricultural Sciences	2012	5.0
Advanced Econometrics	AEP-60306	2013	6.0
B) General research related competences			
Introduction Course	WASS	2011	1.0
Writing Research Proposal	BEC, WASS	2011/ 2012	6.0
BEC PhD Meetings	BEC	2011/ 2015	3.0
WASS Multidisciplinary Seminar (PhD day 2013), presentation entitled 'Integrating structure, conduct and performance into value chain analysis'	WASS	2013	1.0
Teaching: BEC-50306, Advanced Financial and Business Management	WUR	2014	1.0
11th Wageningen International Conference on Chain and Network Management, presentation entitled 'Performance of honey value chains in Brazil'	Capri, Italy	2014	1.0
Ceará State Honey Chamber Presentation, entitled 'Identifying successful strategies for honey value chains in Brazil: a conjoint study'	Fortaleza, Brasil	2014	1.0
C) Career related competences/personal development			
Techniques for Writing and Presenting a Scientific Paper	WGS	2012	1.2
Voice Matters – Voice and Presentation Skills Training	WASS	2012	0.3
D) Other courses			
Organisation of the Agribusiness	BEC 31306	2011	-
Advanced Supply Chain Management	ORL 31306	2012	-
Total			**46.5**

*One credit according to ECTS is on average equivalent to 28 hours of study load.

Colophon
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