UNIVERSIDAD COMPLUTENSE DE MADRID
FACULTAD DE CIENCIAS ECONÓMICAS Y EMPRESARIALES

TESIS DOCTORAL

Implementation of voluntary environmental: effects for Costa Rican companies

Implementación de enfoques ambientales voluntarios: efectos para las empresas costarricenses

MEMORIA PARA OPTAR AL GRADO DE DOCTOR

PRESENTADA POR

Jorge Andrey Valenciano Salazar

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Complutense Institute of Economic Analysis ICAE

Doctoral Thesis

Implementation of voluntary environmental approaches: Effects for Costa Rican companies

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Madrid, 2020

A Karina e Iván, compañeros inseparables en este viaje.

Acknowledgements

My heartfelt gratitude to Professor Francisco J. André. I am quite fortunate to have the advice of a prestigious professional, but above all, a great, respectful, and hard-working person.

Many other qualified professionals have contributed their ideas to improve this thesis. I want to show my gratitude to Professors Gregorio Martín-de-Castro and Javier Amores-Salvadó for their valuable and theoretical advice in chapters two and three, and their recommendations about companies' motivations for the adoption of environmental approaches. My thankfulness to Professor Carlos Rivero for his advice to improve the statistical approaches in chapter four. I would also like to thank Professors Rafael Díaz, Elena Huergo, and Tania Osejo for their valuable comments on chapter seven.

I am especially grateful to Professor Mario Soliño for his advice during the preparation of chapters five and six. Professor Soliño's advices have been essential to carry out adequate valuation of coffee ecolabels in Costa Rica.

My thanks also to Francinie Jiménez, Hillary Brenes, Jeison Rodríguez, Karina López, Kristel Cid, Nathy Álvarez, Yanci Vargas and Yendry Sánchez for their support during the consumers survey process. In addition, I would like to thank all the managers and executives of the companies that participated in the different stages of this thesis.

I acknowledge support from the Scholarship Department of the National University of Costa Rica, (grant JB-C-1106-2016). This doctoral thesis would not have been made possible without the monetary contribution provided by the National University of Costa Rica.

Agradecimientos

Mi más sincero agradecimiento al profesor Francisco J. André. Soy bastante afortunado de contar con el asesoramiento de un profesional prestigioso, pero sobre todo una gran persona, respetuosa y trabajadora.

Muchos otros profesionales calificados han aportado sus ideas para mejorar este trabajo, quiero mostrar mi gratitud a los profesores Gregorio Martín-de-Castro y Javier Amores-Salavadó por sus valiosos consejos teóricos en los capítulos 2 y 3; además de sus recomendaciones para elegir las motivaciones de las empresas para la adopción de enfoques ambientales. Agradezco al profesor Carlos Rivero por sus consejos para mejorar las metodologías estadísticas en el capítulo 4. También me gustaría agradecer a los profesores Rafael Díaz, Elena Huergo y Tania Osejo por sus valiosos comentarios sobre el capítulo 7.

Estoy especialmente agradecido al profesor Mario Soliño por sus recomendaciones durante la preparación de los capítulos 5 y 6. Los consejos del profesor Soliño han sido esenciales para llevar a cabo una valoración adecuada de las etiquetas ecológicas del café en Costa Rica.

También agradezco a Francinie Jiménez, Hillary Brenes, Jeison Rodríguez, Karina López, Kristel Cid, Nathy Álvarez, Yanci Vargas y Yendry Sánchez por su trabajo durante el proceso de aplicación de las encuestas a los consumidores. Además, me gustaría agradecer a todos los gerentes y ejecutivos de las empresas que participaron en las diferentes etapas de esta tesis.

Reconozco el inmenso apoyo del Departamento de Becas de la Universidad Nacional de Costa Rica (subvención JB-C-1106-2016). Esta tesis doctoral no hubiera sido posible sin la ayuda monetaria provista por la Universidad Nacional de Costa Rica.

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Acronyms and abbreviations

AHP: Analytical Hierarchy Process

CN: Carbon Neutral

CNP: Carbon Neutrality Program

CSRC: Corporate Social Responsibility Coordinator

CST: The Costa Rican Certification for Sustainable Tourism

CVM: Contingent valuation method

DCE: Discrete choice experiment

EBF: Ecological Blue Flag.

EM: Environmental Manager

EMAS: Eco-management and audit scheme

EMS: Environmental Management Systems

EVAs: Environmental voluntary approaches

FT: Fairtrade

FTSE: Financial Times Stock Exchange

GM: General Manager

GHG: Greenhouse Gas

INTECO: The Institute of Technical Standards of Costa Rica

ISO: International Organization for Standardization

MES: Material Efficiency Strategy

MM: Management Manager

MSCC: Marine Stewardship Council Certification

NGOs: Non-governmental organizations

NRBV: Natural Resource-Based View

OE: Open-ended

OECD: The Organization for Economic Co-operation and Development

OHAS: Occupational Health and Safety Management

PPP: Purchasing power parity

SD: Sustainable Development

SDGs: Sustainable Development Goals

U.S: The United States of America

UK: The United Kingdom of Great Britain

UN: The United Nations

USDA: The United States Department of Agriculture.

VAs: Voluntary approaches

VCE: Voluntary environmental certification

VEAs: Voluntary environmental approaches

VEP: Voluntary environmental program

VESCPs: Voluntary environmental and social certifications and programs

WTP: Willingness to pay

Summary

This thesis is entitled "***Implementation of voluntary environmental approaches: Effects for Costa Rican companies***" and consists of eight chapters. The first one is an introductory chapter that describes the general conceptual framework of voluntary environmental approaches (VEAs) and their possible effects for companies, and the last one states the general conclusions.

The rest of the chapters (from the second to the seventh) are divided into three parts that correspond to different dimensions of VEAs. The first part studies VEAs from the point of view of companies. Specifically, it focuses on Costa Rican companies' criteria, motivations, and obstacles to implement an VEA, and it includes chapters two and three. The second part, which includes chapters four and five, focuses on consumers' knowledge. Specifically, it explores the consumers' recognition of the voluntary environmental certifications and programs that are available for companies in Costa Rica and also the role of the media to boost such knowledge and recognition. The third part focuses on prices and, more specifically, on environmental certifications as a price differentiation mechanism for companies. This part includes chapters six and seven.

In the first part, dealing with firms, chapter two explores the motivations and obstacles that a sample of Costa Rican companies face when adopting the Carbon Neutral (CN) or the Fairtrade (FT) certification. The former is a domestic certification aimed at reducing or offsetting carbon emissions and fighting climate change, while Fairtrade (FT) is a well-known international label that guarantees compliance with environmental and social standards in developing countries. Using qualitative and quantitative approaches, our research concludes that firms' motivations include commitment to environmental quality and to the sustainable development goals established by Costa Rica, along with more traditional economic and strategic incentives of companies, such as improving the image and the relationship with stakeholders. Regarding obstacles, high investment and certification costs are ranked as the most difficult to overcome.

In the third chapter, the Analytical Hierarchy Process (AHP) is applied to determine the priorities given by firms to environmental sustainability criteria and economic-strategic criteria when choosing an environmental certification. A sample of 24 company managers was used to assess different criteria and sub-criteria to choose between two possible alternative certifications: CN and ISO 14001. As a general conclusion, CN turns out to be preferred to ISO

14001 among the interviewed Costa Rican firms. This result is due to the fact that CN was considerably better rated under environmental sustainability criteria, although the ISO 14001 certification received better ratings under the economic and strategic criteria.

Moving on to the second part, the purpose of chapter four is to investigate the media coverage and consumer recognition of the CN organizations. A search in Costa Rican online newspapers was performed between 2013 and 2016 to look for articles addressing the main actions undertaken and the main benefits obtained by CN firms. In total, 141 articles were reviewed. The three main actions highlighted in the articles include offsetting carbon emissions, replacement of polluting inputs by cleaner ones and employees' training. The main benefits are reducing production costs, improving the organizations' image, and achieving market differentiation due to the CN certification. In addition, using non-parametric statistic procedures, the research shows that "highly cited organizations" tend to be CN-certified earlier and have a larger number of environmental certifications than "scarcely cited organizations". In 2017, a survey about the consumers' recognition of CN organizations was applied, the results show that "recognized organizations" tend to be the oldest, the largest and those that have been cited more often in the press. In addition, "recognized entities" also tend to be those that obtained the CN certification sooner than unrecognized entities, which probably means that there is a reward in terms of public recognition for companies that took the risk of being innovative.

Chapters five and six use information from a survey applied to 1,191 consumers in Costa Rica. In chapter five, we investigate the socioeconomic profile of consumers with knowledge of environmental certifications (what we label as "general knowledge") and certified companies ("specific knowledge"). Using probabilistic models, our research shows that consumers with higher household incomes, who have a technical or university degree and who participate in environmental or community groups are more likely to have a better general and specific knowledge. In addition, age is slightly and negatively related to the probability of having such knowledge. Finally, the consumers are more prone to name companies certified as ISO 14001 and Carbon Neutral than companies certified as Fairtrade.

The price impact of environmental certifications is studied in the third part of the thesis. Specifically, chapter six determines the willingness to pay (WTP) of Costa Rican consumers for two marketed coffee eco labels (Fairtrade and CN) and a company certification (ISO 14001). First, an open-ended (OE) contingent valuation method (CVM) was conducted. Secondly, a discrete choice experiment (DCE) was applied. The results from the OE-CVM show that Costa Rican consumers are willing to pay price premiums around 30% for all the considered

environmental certifications. Income and education show a positive influence on consumers' WTP, while married individuals present a lower WTP than unmarried ones. In the DCE, the WTP tends to be higher than OE-CVM, specifically, price premiums were between 141% for ISO14001 and 178% for FT coffee compared to a regular coffee, which is in line with the price gaps between some certified coffee brands vs. non-certified brands in the final coffee consumption market in Costa Rica.

The purpose of chapter seven is to study the determinants of coffee berry prices in Costa Rica, paying attention to whether environmental aspects (such as environmental certifications) generate any price difference or not. Using a panel data set of coffee berries purchases between 2008 to 2016, our research shows that the international coffee price is the main reference of domestic prices. Likewise, there are some intrinsic characteristics of berries that are positively related to the domestic prices: mainly, the use of an organic coffee production system, the altitude of the region where the coffee is harvested, and the yield of the berries. Our estimations also show that multinational coffee companies tend to pay lower average prices than other firms. Finally, the coffee mills certified as FT mills do not necessarily pay higher prices to the growers. Actually, certified mills tend to pay, on average, a lower price than non-certified ones.

Resumen

Esta tesis se titula ***"Implementación de enfoques ambientales voluntarios: efectos para las empresas costarricenses"*** y consta de ocho capítulos. El primero es un capítulo introductorio que describe el marco conceptual general de los enfoques ambientales voluntarios y sus posibles efectos para las empresas, y el último expone las conclusiones generales.

El resto de los capítulos (del segundo al séptimo) se dividen en tres partes que corresponden a diferentes dimensiones de los enfoques ambientales adoptados de manera voluntaria. La primera parte estudia dichos enfoques desde el punto de vista de las empresas. Específicamente, se enfoca en los criterios, motivaciones y obstáculos de las compañías costarricenses para implementar un enfoque ambiental de manera voluntaria, e incluye los capítulos dos y tres. La segunda parte incluye los capítulos cuatro y cinco centrados en el análisis de los consumidores. Explora el reconocimiento de los consumidores de las certificaciones y programas ambientales voluntarios que están disponibles para las empresas en Costa Rica y también el papel de los medios de comunicación para impulsar dicho conocimiento y reconocimiento. La tercera parte se centra en los precios y, más específicamente, en las certificaciones ambientales como mecanismo de diferenciación de precios para las empresas. Esta última parte incluye los capítulos seis y siete.

La primera parte, que aborda el punto de las empresas, comienza con el capítulo dos, que explora las motivaciones y obstáculos que enfrenta una muestra de empresas costarricenses al adoptar la certificación Carbono Neutral (CN) o la certificación de Comercio Justo (CJ). La primera es una certificación nacional destinada para reducir o compensar las emisiones de carbono y combatir el cambio climático, mientras que CJ es una etiqueta internacional bien conocida que garantiza el cumplimiento de las normas ambientales y sociales en los países en desarrollo. Utilizando enfoques cualitativos y cuantitativos, nuestra investigación concluye que las motivaciones de las empresas incluyen el compromiso con la calidad ambiental y los objetivos de desarrollo sostenible establecidos por el gobierno de Costa Rica junto con incentivos económicos y estratégicos de las empresas, como mejorar la imagen y la relación con las partes interesadas. En cuanto a los obstáculos, los altos costos de inversión y certificación se clasifican como los más difíciles de superar.

En el tercer capítulo, se aplica el Proceso de Jerarquía Analítica (AHP) para priorizar entre criterios de sostenibilidad ambiental y criterios económico-estratégicos generalmente utilizados para elegir una certificación ambiental. Utilizando los criterios y subcriterios priorizados por 24 gerentes, la investigación se centró en la elección de dos posibles

alternativas: las certificaciones CN e ISO 14001. La conclusión principal es que, en promedio, las empresas analizadas prefieren CN a ISO 14001. Este resultado se debe al hecho de que la certificación CN ha sido considerablemente mejor calificada bajo criterios de sostenibilidad ambiental, aunque la certificación ISO 14001 ha recibido mejores calificaciones bajo los criterios económicos y estratégicos.

Pasando a la segunda parte (relativa al conocimiento de los consumidores), el capítulo cuatro investiga la cobertura mediática de las compañías y las instituciones certificadas CN. Mediante una búsqueda en los periódicos electrónicos de Costa Rica realizada entre 2013 y 2016, se encontraron 141 artículos relacionados con las acciones emprendidas y los beneficios obtenidos por las empresas en relación con el proceso de certificación. Las tres acciones principales destacadas en los artículos incluyen la compensación de las emisiones de carbono, el reemplazo de insumos contaminantes por otros más limpios y la capacitación de los empleados. Los principales beneficios son la reducción de los costos de producción, la mejora de la imagen de las organizaciones y el logro de la diferenciación del mercado debido a la certificación CN. Además, mediante el uso de procedimientos estadísticos no paramétricos, la investigación muestra que las "organizaciones altamente citadas" tienden a estar certificadas con CN antes y tienen una mayor cantidad de certificaciones ambientales que las "organizaciones poco citadas". En 2017, se aplicó una encuesta sobre el reconocimiento de los consumidores de las organizaciones neutras en carbono, los resultados muestran que las "organizaciones reconocidas" tienden a ser las más antiguas, las más grandes y las que se han citado con más frecuencia en la prensa. Además, las "entidades reconocidas" también tienden a ser aquellas que obtuvieron la certificación CN antes que las entidades no reconocidas, lo que probablemente significa que existe una recompensa en términos de reconocimiento público para las empresas que corrieron el riesgo de ser innovadoras.

Los capítulos cinco y seis utilizan la información de una encuesta aplicada a 1.191 consumidores en Costa Rica. En el capítulo cinco, se construye un perfil socioeconómico de los consumidores con conocimiento de certificaciones ambientales y empresas certificadas. Utilizando modelos probabilísticos, nuestra investigación muestra que los consumidores con mayores ingresos familiares, que tienen un título técnico o universitario y que participan en grupos ambientales o comunitarios tienen más probabilidades de tener un mayor conocimiento general y específico. Además, la edad está leve y negativamente relacionada con la probabilidad de tener ese conocimiento. Finalmente, los consumidores son más propensos a nombrar compañías certificadas como ISO 14001 y Carbono Neutral que las compañías certificadas como Comercio Justo.

La tercera parte de la tesis se centra en el efecto de las certificaciones ambientales sobre los precios. Específicamente, el capítulo seis determina la disposición a pagar (DAP) de los consumidores costarricenses por dos etiquetas ecológicas de café comercializadas (CJ y CN) y una certificación de la empresa (ISO 14001). Primero se realizó un método de valoración contingente abierto. En segundo lugar, se aplicó un experimento de elección. Los resultados de la valoración contingente abierta muestran que los consumidores costarricenses están dispuestos a pagar primas de precios de alrededor del 30% por todas las certificaciones ambientales consideradas. Los ingresos y la educación muestran una influencia positiva en su disposición a pagar, mientras que las personas casadas presentan una menor DAP que las solteras. En el experimento de elección, las DAPs tienden a ser más altas que el método contingente con pregunta abierta, específicamente, las primas de precios estimadas están entre 141% para ISO14001 y 178% para un café de Comercio Justo en comparación con un café normal, dichas brechas de precios son similares a las existentes entre algunas marcas de café certificadas vs marcas no certificadas en el mercado de consumo final de café en Costa Rica.

El capítulo siete estudia los determinantes de los precios de las bayas de café en Costa Rica, prestando atención a si los aspectos ambientales (como las certificaciones ambientales) generan o no alguna diferenciación de precios. Utilizando un conjunto de datos de panel de compras de bayas de café entre 2008 y 2016, la investigación muestra que el precio internacional del café es la principal referencia de los precios internos. Asimismo, hay algunas características intrínsecas de las bayas que están positivamente relacionadas con sus precios promedio: principalmente, el uso de un sistema de producción de café orgánico, la altitud de la región donde se cosecha el café y el rendimiento de las bayas. Las estimaciones también muestran que las empresas multinacionales de café tienden a pagar precios promedio más bajos que otras empresas. Finalmente, los molinos de café certificados como Productores de Comercio Justo no necesariamente pagan precios más altos a los productores. En realidad, las fábricas certificadas tienden a pagar, en promedio, un precio más bajo que las no certificadas.

Chapter 1: Conceptual framework: Costs and benefits of voluntary approaches for adopting companies

Abstract: This chapter sets the main conceptual framework for the dissertation in a double perspective. First, it presents a review of the literature related to the main benefits and costs that companies derive from adopting a voluntary environmental approach (VEA). Second, a basic theoretical model is presented in order to illustrate the role of some variables in the decision-making process of a company on whether or not to adopt a VEA. We present a simple static version and then enrich it by including a time dimension. This model generates some testable theoretical predictions by identifying necessary and sufficient conditions for VEAs to be adopted. One of these predictions is that large companies are more prone to adopt voluntary approaches. Also, the concern about the future, as reflected in the discount rate is a relevant factor for such adoption.

1.1 Introduction

The most traditional approach of environmental policy is based on coercive instruments in the form of mandatory command and control regulations, like emission or technological standards (Clemens and Douglas, 2006; Khanna, 2001). These instruments have been criticized by economists for being economically inefficient in the sense that they fail to accomplish the desired environmental results at the lowest possible cost. It has also been claimed that command and control instruments tend to be administratively difficult, inflexible, slow, and costly, especially when the regulator faces numerous heterogeneous companies (Khanna 2001; Higley, Convery and Lévêque 2001).

A second approach to environmental policy is based on incentives in the form of taxes or subsidies (Pigou 1924), property rights (Coase 1960) and tradable permits (Baumol and Oates 1971). These instruments rely on price signals and aim at introducing more flexibility for companies to reduce emissions at the lowest economic cost (Alvarez, Mazón and André 2017; Ellerman, Convery and de Perthuis 2010).

Some more recent approaches to control firms' emissions is based on so-called voluntary approaches (VAs), which are non-coercive instruments as they do not involve any

punishments for entities that do not adopt them and the companies' decisions to improve their environmental sustainability practices are not formally required by a regulatory agency or law (Higley, Convery and Lévêque 2001; Khanna 2001; OECD 2000).

Although the theoretical analysis of VAs to environmental regulations in the economic literature is scarce as compared to other instruments like taxes, standards or tradable permits, there are hundreds of them functioning around the world. As noted by OECD "VAs provide pragmatic responses to new policy problems, namely the need for more flexible ways to achieve sustainability, and the need to consider the rising concerns about industrial competitiveness and the increasing administrative burden (OECD 2000, p. 9)" . Depending on the magnitude and the nature of the government intervention involved in the design of voluntary initiatives; Carraco and Lévêque (1999), Khanna (2001) and OCDE (2000) classified them into three broad categories: public voluntary programs designed by regulators, negotiated agreements and unilateral commitments by firms. Table 1.1 summarizes the characteristics of these three categories.

Table 1.1 Type of voluntary approaches to environmental regulations according the magnitude of government interventions.

Types of VAs	Main features
Public voluntary programs or schemes	Participating firms agree on commitments or standards, which are developed by public environmental agencies. Economic benefits like subsidies, technical assistance, and reputation in using an environmental logo can be provided by public authorities. Carbon emissions, toxic pollutants, industrial waste, and wastewater are environmental problems targeted by these programs.
Bilateral initiatives (private agreements) **and** **Negotiated agreements**	Generally, they are agreed by means of contracts between a firm (sometimes a group of firms) and those who suffer the effects of emissions (workers, local inhabitants, neighboring firms, etc.) or their representatives (community organizations, environmental associations, trade unions, business associations). Require a negotiation between a public authority and the industry or an individual firm and on a target for emission abatement or other actions for environmental protection. The government and firms negotiate on abatement target and a time schedule to achieve it. Free riding is a major problem under collective liability.
Unilateral initiatives,	Set by the industry acting independently without any involvement of a public authority. There are three main types:

commitments, and environmental voluntary certifications	(i) Developed individually by each company to improve their own environmental performance and communicate it to their stakeholders (employees, shareholders, clients, etc.) (ii) Voluntary codes of conduct or guidelines on environmental issues developed by trade or industry associations. (iii) Registering with a certifying organization, such as the International Organizations for Standardizations (ISO).

Source: Carraro & Lévêque (1999), Khanna (2001) and OCDE (2000).

It is well-known that adopting some of these approaches, such ecolabels, environmental certifications and programs generates costs for companies, such as paperwork, administrative and verification costs and required investments in green technologies or in-job training (Babakri, Bennett, & Franchetti, 2003; Bansal & Bogner, 2002; Yiridoe, Clark, Marett, Gordon, & Duinker, 2003). Nevertheless, it has been pointed out that they also bring some important benefits for companies, such as improving the green image of the firm, enhancing public recognition and social and environmental legitimacy, saving production costs, obtaining a price premium for their products, among others (Bansal & Bogner, 2002; Hillary, 2004; Khanna, 2001).

Although ecolabels, environmental certifications and programs have been more traditionally used in high-income countries, they are also being increasingly adopted by companies in developing countries. This thesis is carried out in Costa Rica, a middle-income country that is considered an international leader in environmental education, ecotourism, conservation, and climate change policies (Blum, 2008; Jiménez et al., 2017). For more than 50 years, the Costa Rican government has developed policies to conserve biodiversity and reduce greenhouse gas emissions (Flagg, 2018; Sánchez-Azofeifa et al., 2007). Environmental certifications and programs are an important part of such policies (see e.g. Blackman A. et al., 2014; Birkenberg and Birner, 2018; Blackman and Naranjo, 2012; Lyngbæk et al., 2001; Musmanni, 2014; Rivera, 2002; Snider et al., 2017).

In this introductory chapter, we review the literature about the benefits and costs perceived by firms when adopting voluntary environmental approaches and we propose a simple way to conceptualize the incorporation of such costs and benefits in a simple theoretical framework.

1.2 Possible benefits of voluntary approaches for companies

The companies' benefits to adopt VAs, i.e, ecolabels, environmental certifications or participate in environmental programs have been studied by different authors. This literature is summarized in Table 1.2. According to this literature, one of the main benefits obtained by certified companies is the possibility of increasing sales, market share or prices through market differentiation (Bansal & Bogner, 2002; Khanna, 2001). For example, Barham et al. (2011), Lyngbæk et al. (2001), Méndez et al. (2010) and Weber (2011) found that FT and organic coffee growers in Mexico and Central America received higher coffee prices than not-certified ones, while Dragusanu & Nunn (2018) found similar results in the case of FT cooperatives in Costa Rica.

Zeppel & Beaumont (2013) found that the second motivation for tourist companies in Queensland, Australia, for adopting a carbon offset program was "to market my business as a climate friendly tourism enterprise" (p.13). Gaining market access is also a motivation for companies that adopted ISO 14001 certifications (see, e.g. Mariotti, Kadasah, & Abdulghaffar, 2014; Pan, 2003; Zeng, Tam, Tam, & Deng, 2005).

A second motivation is related to financial feasibility. It has been found that polluting behavior reduces the company's stock prices and its access to credit or investments from banks or institutional investors (Dasgupta et al., 1995). Thus, certified companies can reduce their financial costs and/or increase their market value with respect to their uncertified counterparts (Endrikat, 2016; Manrique and Carmen-Pilar, 2017). Fenger et al. (2016), Gavronski et al. (2008), Zeppel and Beaumont (2013) found that financial support is an important prompt for companies to adopt some environmental certifications.

In some cases, certified companies can save production costs or increase their productivity because standards specified in the voluntary certifications can help to foster improvements in the production processes and the internal organization of the firm (Lim & Prakash, 2014). Okereke (2007) showed that energy efficiency and cost savings are some factors that motivate the UK Financial Times Stock Exchange 100 Index (FTSE 100) companies to undertake carbon management activities. Bansal & Bogner (2002) showed how some companies in the United States saved thousands of dollars after been certified as ISO 14001. According to Morrow & Rondinelli (2002), five German energy and gas companies reported that improving the documentation and increased efficiency were primary motives for developing and registering their Environmental Management Systems (EMS). Reducing cost also was a motivation for implementing an EMS in the case of Spanish and Italian companies

(Ormazabal & Sarriegi, 2014). Fryxell & Szeto, (2002); González-Benito & Gonzáles-Benito (2005); Mariotti et al. (2014); Pan (2003); Quazi, Khoo, Tan, & Wong, (2001); Zeng, et al. (2005) also showed that saving costs and/or increasing company productivity are among the most important motivations for companies when adopting the ISO 14001 certification.

Added to the above, in some cases, certified companies can receive free technical assistance and information from public and private environmental agencies (Darnall & Sides, 2008; Fenger et al., 2016; Khanna, 2001) facilitating their transition towards cleaner production processes (Klooster, 2005).

Improving green image, public visibility and social legitimacy of the companies have been profusely investigated as benefits to adopt an ecolabel or an environmental and/or social certification (see e.g. Khanna, 2001). Zeppel & Beaumont (2013) showed that the main reason stated by tourism enterprises for adopting a carbon offset program was: "to attract tourists concerned about the carbon emissions of travel" (p.13). Okereke (2007) argued that UK companies that reduce their carbon footprint also seek to improve their green reputation. According to Ormazabal & Sarriegi (2014) improving the green image was the second main important motivation for Spanish and Italian companies to implement an EMS. This driver turns out to be also one of the main reasons for companies to get ISO 14001 certification (see, e.g. Hillary 2004; Mariotti et al., 2014; Morrow & Rondinelli 2002; Schylander & Martinuzzi 2007; Yiridoe et al., 2003; Zeng, et al., 2005).

Table 1.2 Literature review of companies' benefits to adopt environmental certifications and programs.

Benefits and motivations	Source
Increasing sales, market shares or prices	André & Valenciano-Salazar (2020); Bansal & Bogner (2002), Barham et al. (2011), Khanna (2001), Lyngbæk et al. (2001), Mariotti et al. (2014), Méndez et al. (2010), Pan (2003), Weber (2011), Zeppel & Beaumont (2013), Zeng et al. (2005).
Reducing the financing cost or increasing market value of the company	Dasgupta et al. (2000), Endrikat (2016), Fenger et al. (2016), Gavronski et al. (2008), Hamilton (1995), Manrique & Carmen-Pilar (2017), Zeppel & Beaumont (2013).
Saving production costs or increasing productivity	Bansal & Bogner (2002), Fryxell & Szeto (2002), González-Benito & Gonzáles-Benito (2005), Hillary (2004), Lim &

	Prakash (2014), Mariotti et al. (2014), Mathiyazhagan, Diabat, Al-Refaie, & Xu (2015), Morrow & Rondinelli (2002), Okereke (2007), Pan (2003), Quazi et al. (2001), Ormazabal & Sarriegi (2014), Zeng, et al. (2005).
Receiving technical assistance and information from environmental agencies	Darnall (2006), Darnall & Sides (2008), Fenger et al. (2016), Khanna (2001), (Klooster, 2005).
Improving green image, enhancing public recognition and social legitimacy of the company.	André & Valenciano-Salazar (2020); Faggi, Zuleta, & Homberg (2014), Hillary (2004), Khanna (2001), Mariotti et al. (2014), Morrow & Rondinelli (2002), Okereke (2007), Ormazabal & Sarriegi (2014), Pérez-Ramírez, Phillips, Lluch-Belda, & Lluch-Cota (2012), Schylander & Martinuzzi (2007), Yiridoe et al., 2003; Zeng, et al. (2005), Zeppel & Beaumont (2013).
Improving the company's relationship with stakeholders	Bansal & Bogner (2002), Fryxell & Szeto (2002), Gavronski, et al. (2008), Khanna (2001), Lim and Prakash (2014), Mariotti et al. (2014), Poksinska, Dahlgaard, & Eklund, (2003)
Preparing firms for mandatory regulations	Delmas (2001), Bansal & Bogner (2002), Khanna (2001), Ormazabal & Sarriegi (2014).
Certification demands on the part of the companies that lead the value chain	Bansal & Bogner (2002), Babakri et al. (2003) Darnall (2006), Mariotti et al. (2014), Morrow & Rondinelli (2002).
Mimicking the strategy of the competitors	Bansal & Bogner (2002), Dai, Chan, & Yee (2018), Ormazabal & Sarriegi (2014)

A number of authors have shown that an additional benefits to adopt environmental certifications is the possibility to improve the company's relationship with stakeholders, such as government, communities, environmental groups, and consumers (see, e.g. Bansal & Bogner, 2002; Fryxell, & Szeto, 2002; Gavronski, et al., 2008; Khanna, 2001; Lim and Prakash, 2014; Mariotti et al., 2014; Poksinska et al., (2003), preparing firms for mandatory regulations

(Bansal & Bogner, 2002; Khanna, 2001; Ormazabal & Sarriegi, 2014) and helping public authorities to establish industrial standards and future dynamics (Delmas, 2001).

Some companies -mainly multinational companies- require their suppliers to be certified. Bansal & Bogner (2002), Babakri et al. (2003) and Morrow & Rondinelli (2002) reported that some large companies such as General Motors, Ford, Daimler-Chrysler, IBM, Xerox, Honda, Toyota, The Royal Dutch/Shell Group, Bristol-Myers Squibb and Quebec Hydro have encouraged their suppliers to become ISO 14001-certified (see also Darnall, 2006; Mariotti et al., 2014). In other cases, some companies adopt environmental programs or certifications in order to imitate their competitors' strategy (Dai et al., 2018). For example, Bansal & Bogner (2002) showed that some companies are likely to adopt ISO 14001 as a follower behavior when most of the companies in the same industry are already certified; see also Ormazabal & Sarriegi (2014).

1.3 Companies' costs to adopt voluntary approaches

Based on an exhaustive literature review, we have made an inventory of the main costs that companies face when adopting an environmental certification voluntarily, that is shown in Table 1.3.

Investment and certification costs, were found to be among the explicit costs faced by certified companies in different countries. Companies faced these expences to get the ISO 14001 certification in the United States (Babakri et al., 2003; Bansal & Bogner, 2002); Portugal (Santos et al., 2016) and Canada (Yiridoe et al., 2003). Also, Ormazabal & Sarriegi (2014) remarked these costs for companies when implementing an EMS in Spain and Italy. High costs of certification and tecnological change were also found to be important barriers for Fairtrade coffee cooperatives in Costa Rica (Snider et al., 2017) and El Salvador (Tellman, Gray, & Bacon, 2011).

Searching for information and preparing documentation during and after the certification process were also shown to be a relevant company s' costs, both in developed countries (Bansal & Bogner 2002; Ormazabal & Sarriegi; 2014; Zutshi & Sohal 2005) and developing countries (Mariotti et al., 2014).

Table 1.3 Costs for companies to adopt environmental certifications

Costs	Source
Investment costs in clean technologies	André & Valenciano-Salazar (2020); Chin et al. (1999), Babakri et al. (2003), Bansal & Bogner (2002), Ho et al. (2016), Ormazabal & Sarriegi (2014), Pérez-Ramírez et al. (2012), Santos, et al. (2016), Snider, et al. (2017).
Costs of certification (External auditors, verification costs)	André & Valenciano-Salazar (2020); Babakri et al. (2003), Bansal & Bogner (2002), Mariotti et al. (2014), Ormazabal & Sarriegi (2014), Santos et al. (2016), Snider et al. (2017), Tellman et al. (2011), Yiridoe et al. (2003).
Costs of finding information and preparing documentation	Bansal & Bogner (2002), Mariotti et al. (2014), Ormazabal & Sarriegi (2014), Zutshi & Sohal (2005).

1.4 Incorporating voluntary approaches into the firms' costs and benefits

In this section we suggest a way to conceptualize the costs and benefits of adopting a VA in the framework of the conventional microeconomic theory of the firm. For simplicity, we assume a framework without uncertainty and abstract from interactions with other firms. We first consider a static one-period setting and then we include a time dimension.

Consider a certain firm that operates in a competitive environment and has the option to incorporate a certain voluntary approach, say, a voluntary environmental certification (VEC), such as Organic, Fairtrade, Rainforest Alliance, or the like. If the firm does not adopt the certification, its profit, π, is given by

$$\pi = I - C \qquad \textit{Equation 1}$$

where I is total income and C is total cost of the firm. Income is given by $I = p \cdot q$, where q is the amount of output produced by the firm and p is the price of its product when it is not certified. For simplicity, we normalize fixed cost to zero and assume that variable cost is linear in output, implying that $C = MC \cdot q$, where CM is the marginal cost. Thus, firm's profit can be written as

$$\pi = (p - MC) \cdot q \qquad Equation\ 2$$

Assume now that the firm adopts a VEC and denote as π^c the profit of firm *i* once it is certified, which is given by

$$\pi^c = (p^c - MC^C) \cdot q - FC \qquad Equation\ 3$$

where the superscripts *c* refers to the value of the corresponding values when certification has been adopted. For simplicity, we assume that the expected volume of output, is the same with and without the certification, i.e., $q = q^C$. We assume that the certification entails some fixed costs, FC, which are not present otherwise. These may include specific costs directly associated to the certification, such as investment costs in clean technologies, paperwork and verification costs, or indirectly associated ones, such as required investments to meet certain legal standards or in-job training for the employees to become familiar with the news practices.

Standard firm's theory predicts that the company will adopt the certification when, in expected terms, the profit under the certification is higher than without the certification. The difference between both values of the profit is given by

$$\begin{aligned} \Delta\pi = \pi^C - \pi = \ & \Delta p \cdot q - \Delta MC \cdot q - FC \\ & = [\Delta p - \Delta MC] \cdot q - FC \end{aligned} \qquad Equation\ 4$$

where $\Delta p = (p^c - p)$ is the difference in price and $\Delta MC = (MC^C - MC)$ is the difference in marginal cost between both situations: with and without the certification.

From theoretical arguments and the empirical literature, we can expect $\Delta p > 0$, meaning that, typically, consumers are be willing to pay a higher price for an environmentally certified product or a product produced by an environmentally certified company. The size of Δp may vary depending on several factors, such as the specific certification, the specific product, and the market environment. It can also depend on the stage of the value change. For example, in Chapter 7 of this dissertation, we conclude that coffee berries that are certified as "Organic" are, on average, sold at a higher price from farmers to coffee cooperatives and mills. Nevertheless, this is not necessarily the case for Fair Trade certified buyers, who paid lower average coffee prices to growers. This is so although Fair Trade coffee is sold with a price

premium to the final consumer. In Chapters 5 and 6 we shed some light on the factors that might determine consumers' awareness and willingness to pay for environmental certifications. At this introductory level, we can assume that, in general terms, the sign of Δp is expected to be positive.

Regarding the difference in marginal cost, ΔMC, the expected sign is not clear. As we have reported in our previous literature review, there are arguments to expect ΔMC to be negative in some cases. This may be the case, for example, when the environmental certification refers to an environment management system (EMS). Some authors have noted that adopting such a system can entail efficiency gains due to improved internal control routines. As a result, it might be case that a firm operates with lower marginal costs when it is certified. Nevertheless, maintaining a certified environmental management system or keeping other types of environmental certifications also entails additional paperwork and bureaucracy, which may mean more costs. In a theoretical study, Alonso-Paulí and André (2015) claim that a (typically certified) standardized EMS tends to generate a better internal control of internal processes than an informal EMS, but this comes at cost of more rigidity, so no general statement can be made about one being superior to the other for a specific firm. The optimal decision depends on different factors such as the existence of uncertainty regarding the effectiveness of the managers' effort to reduce polluting emissions and the presence of a tough environmental public policy.

The condition for the firm to decide adopting a certification can be written as

$$[\Delta p - \Delta MC] \cdot q > FC \qquad Equation\ 5$$

meaning that the added revenue and/or the potential reduction in variable costs must be large enough to compensate for the fixed adoption costs. A necessary condition of this to be true is $\Delta p - \Delta MC > 0$, i.e., either marginal costs are lower under the certification ($\Delta MC < 0$) or, if the opposite situation holds ($\Delta MC > 0$), this effect must be overcompensated by the higher price of the product (i.e., $\Delta p > \Delta MC$). Provided the necessary condition $\Delta p - \Delta MC > 0$ holds, the sufficient condition is

$$q > \frac{FC}{\Delta p - \Delta MC} \qquad Equation\ 6$$

which means that the firm will find it optimal to adopt the certification only if its output is large enough because, otherwise, it would not be possible to recover the fixed adoption costs. An empirical implication of this result is that large firms are more expected to adopt voluntary

certifications than small ones. This conclusion is consistent with the evidence reported in the literature (see e.g. Blackman & Guerrero, 2012; Grolleau, Mzoughi, & Thomas, 2007; Nishitani, 2009).

This simple static framework can be extended in different directions. One of them is to account for the time dimension. The following specification assumes that all the fixed certification costs must be paid upfront (say, at time 0) whereas the benefits are distributed along the lifetime of the certification (say, periods 1, 2, etc.). In a Cost-Benefit-Analysis logic, the decision of the firm should be based on the difference of the discounted profit between both situations, given by

$$\Delta\pi = -FC + (\Delta p_0 - \Delta MC_0)\cdot q_0 + \frac{(\Delta p_1 - \Delta MC_1)\cdot q_1}{(1+r)} + \frac{(\Delta p_2 - \Delta MC_2)\cdot q_2}{(1+r)^2} + \cdots$$
$$+ \frac{(\Delta p_T - \Delta MC_T)\cdot q_T}{(1+r)^T} = -FC + \sum_{t=0}^{T} \frac{(\Delta p_t - \Delta MC_t)\cdot q_t}{(1+r)^t} \quad Equation\ 7$$

where r represents the discount rate, T is the lifetime of the certification and, for variables Δp_t, ΔMC_t and Δp_t, the subscript refers to the time period. In this formulation, apart from revenues and costs, the decision of the firm is also determined by its time preference. To see this in a simple way assume that price, marginal cost and output are constant across periods, i.e., $\Delta p_0 = \Delta p_1 = \cdots = \Delta p_T = \Delta p$, etc. and take the lifetime as infinity. Under these circumstances, equation 7 can be written as

$$\Delta\pi = -FC + \frac{(1+r)\cdot(\Delta p - \Delta MC)\cdot q}{r} \quad Equation\ 8$$

where the fact that $\sum_{t=0}^{T} \frac{1}{(1+r)^t}$ corresponds to the infinite terms of convergent geometric series with common ratio $\frac{1}{1+r}$, which is equal to $\frac{1+r}{r}$.

Once again, a necessary condition for the certification to be optimal for the firm is $\Delta p > \Delta MC$. Provided that this condition holds, the sufficient condition can be written as

$$r < \frac{(\Delta p - \Delta MC)\cdot q}{FC - (\Delta p - \Delta MC)\cdot q} \quad Equation\ 9$$

or, in other words, the discount rate must be low enough. A low discount rate means that the firm puts enough weigh on future values with respect to present values. In a long-term interpretation, this can be interpreted as a preference for intergenerational equity or also for environmental preservation. This type of effect can be seen as a non-purely economic, but social and environmental motivation (see e.g. Mariotti et al., 2014; Morrow and Rondinelli, 2002;

Ormazabal and Sarriegi, 2014). In chapters 2 and 3 we confirm that, as has been put forward in the previous literature, non-market motivations are essential to understand many companies' decisions to adopt voluntary environmental certifications and programs.

1.5 Concluding remarks

In this chapter to set the main conceptual basis for the rest of the work. We have identified several channels by which the adoption of a voluntary environmental certification can affect a firm's benefits and costs. We have also shown how these effects can be incorporated in a simple a conventional theoretical framework.

Our simple theoretical framework allows us to highlight some important features: first, the adoption of an environmental certification is prone to entail some fixed costs, which represent a negative incentive to such adoption. On the other hand, the certification will probably come along with a positive price premium as far as consumers acknowledge the value of the certification and are willing to pay for it. The effect of the certification on marginal operating costs is undetermined, but according to the literature, it is not unrealistic to assume that it may bring some efficiency gains and costs reductions. Firms are more likely to adopt a certification the lower the adoption costs, the higher the price premium and the lower the marginal operating costs associated to the certification. Moreover, big firms are more likely to adopt voluntary certifications because a large volume of output will make it easier to recover the fixed adoption costs.

By including a time dimension, we have shown that "patience", i.e., a lower discount rate makes firms more prone to adopt voluntary certifications whose benefits are typically delayed in time while adoption costs are paid upfront. There is a number of relevant extensions that have not been incorporated in our theoretical framework for the sake of space but may give rise to future developments. These include the consideration of uncertainty and interactions between firms, among others.

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Part I: Companies' motivations and obstacles to implement environmental voluntary approaches

Chapter 2: Motivations and obstacles for Costa Rican companies to adopt voluntary environmental certifications: the case of Carbon Neutral and Fairtrade

Abstract: Sustainable development, which incorporates to firm's economic mission the awareness of environmental and social concerns, represents a new challenge for the economy and business world, especially for companies operating in developing countries. In that sense, this research, using both qualitative and quantitative approaches, explores the motivations and obstacles that Costa Rican companies face when adopting Carbon Neutral (CN) and Fairtrade (FT) certifications. The former is a domestic certification aimed at reducing or offsetting carbon emissions and fight climate change. FT is a well-known international label that guarantees compliance with environmental and social standards. Among the main results, Costa Rican's managers are concerned about ethical motives such as environmental respect, along with economic and strategic incentives, such as improving the image of the company and the relationship with stakeholders. Regarding obstacles, high investment and certification costs are ranked as the most difficult to overcome. By splitting the sample, we find out that increasing sales, market shares or prices are more important motivations for the FT companies than for CN ones. The resistance of shareholders, owners or managers is perceived as a less serious obstacle by CN than by FT companies.

Keywords: Fairtrade; Carbon Neutral; Motivations; Obstacles; Costa Rica.

2.1 Introduction

Incorporating the Sustainable Development Goals (SDGs) of the UN (United Nations, 2019) represents an important challenge to countries, markets, companies, managers, and policy makers, involving environmental, economic, and social concerns. According to the World Commission on Environment and Development (1987) SD is defined as development that "meets the needs of the present without compromising the ability of future generations to meet their own needs".

The SD concept was popularized in the business and management literatures thanks to the Stuart L. Hart's 1995 seminal work on the "Natural Resource-Based View (NRBV)". Such view is understood as the most proactive environmental and social firm's strategy, which

'dictates that effort be made to sever the negative links between environment and economic activity in the developing countries of the South' (Hart, 1995:996). Thus, SD is strongly related to the developed-developing countries link. As Hart (1995) remarked, SD implies recognizing the link between material consumption in the North (developed countries) and environmental degradation in the South (developing countries).

Under a NRBV and Stakeholders' logics (Freeman, 1984), companies adopting SD principles, should understand these links building markets in developing countries, while reducing environmental negative externalities created by this new business activity. In doing so, companies develop social and environmental resources and capabilities that reinforce their business models (Aragón-Correa and Sharma, 2003; Bansal and Clelland, 2004). These capabilities can lead to competitive success and superior performance, achieving both cost reductions and increased operations' efficiency (Porter and van der Linde, 1995) -by reducing energy, inputs and waste, or avoiding the costs of future penalties or stakeholders' conflicts- and improving firm' sales and markets or better funding, due to stakeholders' engagement and a good corporate image, reputation and legitimacy (Bansal and Hunter, 2003).

In response to the SD challenge, and under the logic of the Institutional Theory (Bansal and Hunter, 2003), we can frame voluntary environmental and social certifications and programs (VESCPs) as non-mandatory instruments available for companies willing to adopt the SD principles and improve their social and environmental behavior (Carraro and Lévêque, 1999; OECD, 2000). This can be done by reducing the environmental impact of business activities and promoting social development (Delmas and Toffel, 2008; Martín-de Castro et al, 2017).

VESCPs tend to generate costs for companies, such as paperwork, administrative and verification costs and required investments in green technologies or in-job training (Babakri et al., 2003; Bansal and Bogner, 2002; Yiridoe et al., 2003). Nevertheless, they can also bring important benefits such as improving its green image, (Amores-Salvadó et al., 2014), enhancing public recognition, giving social and environmental legitimacy (Bansal and Clelland, 2004), saving production costs and obtaining higher prices among others (André and Valenciano-Salazar 2020; Aragón-Correa and Sharma, 2004; Bansal and Bogner 2002; Hillary 2004; Khanna 2001).

Finally, in order to understand why companies go to sustainable development, the Micro-Foundations of the strategy framework (Foss, 2011; Barney and Fellin, 2013; Molina-Azorín, 2014) highlights as the ultimate driver of corporate environmentalism the top

management personal characteristics, such as personal and ethical motives, which influences firms' social and environmental commitment.

Although VESCPs have been more traditionally used by firms operating in developed and high-income countries, they are being increasingly adopted by companies in developing countries (see, e.g., ISO 2019). As Hart (1995) highlighted, SD is mainly concerned with environmental and social issues of companies operating in the South. In this vein, our field study is carried out in Costa Rica, which is considered a developing country, but, at the same time, an international leader in promoting SD (Blum 2008; Jiménez et al. 2017).

For more than 50 years, the Costa Rican government has developed social and environmental policies. In the social field, the country has a strong democratic political system with a proven structure of respect for human rights. On the other hand, environmental actions include the conservation of biodiversity, the reduction of greenhouse gas emissions, the promotion of ecotourism and an active international role in the fight against climate change (Flagg 2018; Sánchez-Azofeifa et al. 2007). VESCPs are an important part of such policies, seeking to improve the economic, environmental, and social performance of Costa Rican companies (see e.g. André and Valenciano-Salazar, 2020; Blackman A. et al. 2014; Birkenberg and Birner, 2018; Blackman and Naranjo, 2012; Lyngbæk et al. 2001; Musmanni, 2014; Rivera, 2002; Snider et al., 2017).

Based on the previous arguments, we explore the companies' benefits and costs of two VESCPs of especial interest in Costa Rica: Carbon Neutral (CN) and Fairtrade (FT). To this end, we carry out two complementary research approaches. First, as an exploratory qualitative approximation, we perform in-depth face to face interviews with managers of certified Costa Rican companies. Second, as a quantitative approach, we use a survey to measure the importance given by CN and FT certified firms to different motivations and obstacles. Then, we compare the answers of both groups of companies using non-parametric statistical methods.

This work responds to the call for in-depth and qualitative research on SD in the countries of the South (Hart, 1995) and shed light on the drivers and obstacles of VESCPs in these countries. Although both CN and FT are voluntary approaches, there are significant differences between them that may have a reflection in the motivations and obstacles perceived by firms. First, while FT is an international label, CN is basically a domestic program, although in other countries, there exist different certifications that are similar in nature (see e.g. Ball et al. 2009; Birchall et al. 2015; Murray and Dey 2009; Okereke 2007, Zeppel and Beaumont 2013; Wen-Tien 2017). Second, FT is mainly oriented to agricultural producers and agroindustrial companies (typically, cooperatives) while CN includes companies of all the

economic sectors and even public institutions. Third, FT entails the differentiation of goods by guaranteeing their traceability and ensuring that they have been produced in better social and environmental conditions. These conditions include a minimum price for producers, and thus FT products are expected to be, on average, more expensive than non-certified ones (Ruben 2009). CN, for its part, does not guarantee differentiated prices for adopting companies.

Section 2 presents the main elements on both certifications and summarizes the companies' motivations and obstacles to adopt VESCPs reported in the literature. Section 3 describes our methodology. Section 4 presents and discuss our findings. Section 5 concludes and identifies the main limitations and future research directions.

2.2 Background

The implementation of SD principles implies the adoption of environmental and social management initiatives pointed at the heart of the firm's strategy and mission (Martín-de Castro et al., 2016). Such initiatives, which sometimes constitute a strategic response to institutional pressures, help signal environmental and social commitment (Connelly, Certo, Ireland and Reutzel, 2011) to relevant company's audiences, such as investors, competitors, customers, Public Administrations, or non-governmental organizations (NGOs), and confer to the company the necessary legitimacy in the eyes of society and the subsequent 'license to operate'. This is especially important for companies operating in developing countries (Hart, 1995).

Social and environmental management systems are management processes that enable companies to reduce their negative impact on the natural environment and increase their positive impact on social development. These systems require the assessment of social and environmental impacts, establishing social and environmental goals, their monitoring attainment, and undergoing management review (Darnall and Edwards, 2006). In sum, they constitute a set of management processes focused on the identification, measurement, and control of firm's social and environmental impacts (Bansal and Hunter, 2003).

An effective way of public adhesion to these social and environmental practices is through the adoption of voluntary certifications. Although the well-known 'Porter's hypothesis' (Porter and van der Linde, 1995) states a generalized positive effect of environmental management and firm performance, the effective implementation of each social and environmental certification involve associated benefits and obstacles, as Darnall and Edwards (2006) remarked.

In Costa Rica, the government has developed a plan to decarbonize the economy in accordance with the Paris Climate Agreement and the UN SDGs. An important element of this plan is the CN Program introduced in 2012 (Flagg 2018; Ministerio de Ambiente y Energía 2018). Within this program, after measuring their carbon emissions and reducing or offsetting them, companies and organizations can obtain a CN certification, which can be seen as an environmental certification (Dirección de Cambio Climático 2014; Musmanni 2014). In the case of FT, it can be seen as an environmental and social certification as it involves both environmental and social requirements (see below). Below we analyze both certifications, their nature, as well as their main motivations and obstacles, in the context of a developing country – Costa Rica- in order to have a picture of firm's sustainable practices in a specific setting.

2.2.1 The Carbon Neutrality Program

The CN program was introduced in Costa Rica in accordance with the government strategy of moving towards a low carbon development model (André and Valenciano-Salazar 2020; Flagg 2018). It prompts companies and organizations, first to measure their greenhouse gas emissions, and second, to develop strategies to reduce, capture or compensate them (MINAE and IMN 2015; Musmanni 2014). When the program began in 2012, only 2 companies decided to take part in it, but the number quickly increased and there are currently around 84 organizations certified as CN (Ministerio de Ambiente y Energía, 2020).

The information provided by the firm is verified, first, by an external certifying agency and then by the Climate Change Department of the Costa Rican Government, which gives to the companies the CN certification. Companies can use three mechanisms to fulfil the CN requirements: reducing emissions, capturing, and storing emissions and purchasing carbon credits according to the following equation (Dirección de Cambio Climático 2014):

$$E_{t-1} - R_t - C_t - P_t = 0 \qquad Equation\ 1$$

where t is the current year and t-1 is a base year. E_{t-1} is the amount of greenhouse gas emissions generated by the company, measured in carbon equivalent tons in the base year. R_t is the quantity of emissions abated by adopting less polluting projects and technologies in year t, so that effective emissions in period t are given by $E_t = E_{t-1} - R_t$. C_t is the amount of carbon captured and stored in carbon sinks in land owned by the company in year t. Finally, P_t is the number of carbon credits purchases in year t by the company.

2.2.2 Fairtrade certification

According to the World Fair Trade Organization and Fairtrade Labelling Organizations (2018), the FT certification seeks compliance with some basic social and environmental principles in developing countries. On the social side, these principles include gender equality, access of workers to social security, freedom of association and collective bargaining and no discrimination in any aspect of employment (race, age, national origin, religion), among others. Regarding the environmental aspects, certified companies must reduce the environmental impact of their production and adopt "an efficient use of raw materials from sustainable sources, reducing use of energy from nonrenewable sources, and improving waste management" as well as a restricted use of polluting agrochemicals in plantations (World Fair Trade Organization & Fairtrade Labelling Organizations International 2018, 10). Moreover, the FT certification helps agricultural producers, mainly cooperatives located in developing countries, to reach consumers concerned about environmental, social, and ethical issues. According to Fairtrade International (2018) 1,599 certified producer organizations in 75 countries were certified as FT in 2017. In the same year, the retail sales of FT companies exceeded €8.4 billion.

2.2.3 Motivations and obstacles to implement Voluntary Environmental and Social Certifications

There is a growing number of works dealing with VESCPs and the companies' motivations and obstacles to adopt them. Through an extensive literature review search, we have identified ten motivations and six obstacles as the most relevant (see Table 2.1).

Taking into account companies' motivations, in coherence with the well-known Porter's hypothesis and strategic thinking (Hart, 1995; Aragón-Correa and Sharma, 2003; Martín-de Castro et al, 2017), these motivations are mainly related to economic and strategic aspects for certified companies (M1 to M9). However, apart from purely economic and strategic motivations, some studies show that companies adopt environmental certifications in order to improve their environmental performance, which is related to their concern for ecological and social sustainability (M10).

Table 2.1 Motivations and obstacles for companies to adopt voluntary environmental and social approaches

Motivations	**Obstacles**
Increasing sales, market share or prices through market differentiation (M_1)	High investment cost in clean technologies (O_1)
Reducing the financing cost or increasing market value of the company (M_2)	High certification s' cost (O_2)
Saving production costs or increasing productivity (M_3)	Searching for information and preparing documentation during and after the certification process (O_3).
Receiving technical assistance and information from environmental agencies (M_4)	The resistance of employees to incorporate new environmental practices (O_4)
Improving green image, enhancing public recognition and social legitimacy of the company (M_5)	Designing and implementing an EMS (O_5)
Improving the company's relationship with stakeholders (M_6)	The aversion of shareholders and owners (O_6)
Preparing firms for mandatory regulations (M_7)	
Certification demands on the part of the companies that lead the value chain (M_8)	
Mimicking the strategy of the competitors (M_9)	
Commitment to sustainability development goals of the country (M_{10})	

When managers or owners consider environmental quality as a public good to be preserved, their decisions can be guided, not only by profit maximization, efficiency, or competitiveness, but also by an ethical and social notion that places the interest of others ahead of self-interest. In this respect, see e.g. González-Benito and González-Benito (2005), Rest (1986), Sen (1977), Schaltegger and Burritt (2018), Zeppel and Beaumont (2013). In addition, Ostrom (1990) showed that, under certain circumstances, individuals can cooperate, instead of just maximizing individual utility, with the aim of preserving some commons.

Table 2.2 presents a selection of studies that have empirically analyzed some of these motivations, specifying the sample size and the country or countries of each study.

Table 2.2 Survey of studies about companies' motivations to adopt VESCPs

Authors	Location	Certifications or approaches	Sample Size	Motivations
Chin et al. (1999)	Hong Kong, China	ISO 14000	6	M_1, M_{10}
Quazi et al. (2001)	Singapore	ISO 14000	61	M_3, M_7
Lyngbæk et al. (2001)	Costa Rica	Organic	20	M_1, M_5
Fryxell and Szeto (2002)	Hong Kong, China	ISO 14001	29	M_3, M_5, M_6, M_{10}
Morrow and Rondinelli (2002)	Germany	ISO 14001 and EMAS	5	M_3, M_5, M_8, M_7, M_{10}
Pan (2003)	Taiwan, Hong Kong. Japan and Korea	ISO 14001	2,951	M_3, M_5, M_6, M_9
Poksinska et al. (2003)	Sweden	ISO 14001	135	M_1, M_3, M_6, M_9, M_{10}
Babakri et al. (2003)	United States	ISO 14001	177	M_8
Yiridoe et al. (2003)	Canada	ISO 14001	41	M_2, M_5, M_7, M_{10}
Zeng et al. (2005)	China	ISO 14001	108	M_1, M_3, M_5,
González-Benito and Gonzáles-Benito (2005)	Spain	ISO 14001	184	M_3, M_{10}
Zutshi and Sohal (2005).	Australia	EMAS	3	M_3, M_5, M_1
Darnall (2006)	The United States	ISO 14001	135	M_4, M_8
Okereke (2007)	UK		100	M_3, M_5, M_{10}
Schylander and Martinuzzi (2007)	Austria	ISO 14001	71	M_2, M_5, M_{10}
Gavronski et al. (2008)	Brazil	ISO 14001	63	M_2, M_3, M_6
Méndez et al. (2010)	Central America and Mexico	Fairtrade	18	M_1
Barham et al. (2011)	Southern Mexico	Fairtrade-organic	845	M_1
Weber (2011)	Southern Mexico	Fairtrade-organic	845	M_1
Zeppel and Beaumont (2013)	Queensland, Australia.	Carbon Offset Programs	83	M_1, M_2, M_5, M_{10}
Faggi et al. (2014)	Argentine	VEAs	3	M_5, M_7, M_{10}
Mariotti et al. (2014)	Saudi Arabia	ISO 14001	66	M_1, M_3, M_6, M_8, M_{10}
Ormazabal and Sarriegi (2014)	Spain and Italy	EMAS	70	M_3, M_5, M_7, M_9, M_{10}

Fenger et al. (2016)	Assin North District, Ghana	Rainforest Alliance	30	M_1, M_2, M_3, M_4
Santos et al. (2016)	Portugal	ISO 14001	46	M_3, M_5, M_7, M_{10}
Cater et al. (2017)	The United States	Fairtrade	35	M_{10}
Manrique and Carmen-Pilar (2017)	Worldwide	VEAs	2982	M_2
Martín-de Castro et al. (2017)	Spain	ISO 14001	157	M_1, M_5, M_6
Dai et al. (2018)	China	VEAs	250	M_6, M_7, M_8, M_9
André and Valenciano-Salazar (2020)	Costa Rica	ISO 14001 and Carbon Neutral	24	M_1, M_3, M_5, M_{10}

Notes: EMAS- Eco-management and audit scheme, VEAs- Voluntary environmental approaches, MSCC- Marine Stewardship Council Certification

Continuing with the literature review on the obstacles to adopt social and environmental certifications, Table 2.3 shows a review of related studies.

Table 2.3 Empirical studies about obstacles for companies to adopt voluntary environmental and social approaches

Authors	Location	Certifications or approaches	Sample Size	Obstacles
Chin et al. (1999)	Hong Kong, China	ISO 14001	6	O_1, O_3, O_5
Babakri et al. (2003)	United States	ISO 14001	177	O_1, O_2, O_4, O_6
Yiridoe et al. (2003)	Canada	ISO 14001	41	O_1, O_2
Zutshi and Sohal (2005).	Australia	EMAS	3	O_3, O_4, O_6
Schylander and Martinuzzi (2007)	Austria	ISO 14001	71	O_1, O_3, O_5
Tellman et al. (2011)	El Salvador	Fairtrade	2	O_2
Mariotti et al. (2014)	Saudi Arabia	ISO 14001	66	O_2, O_3, O_4, $0_{6.}$
Ormazabal and Sarriegi (2014)	Spain and Italy	Environmental Management	70	O_1, O_2, O_3, O_4,
Ho et al. (2016)	Malaysia	MES	25	O_1, O_2, O_4
Santos et al. (2016)	Portugal	ISO 14001	46	O_1, O_2, O_4, O_6
Snider et al. (2017)	Costa Rica	VEAs in coffee	20	O_1, O_2, O_5, O_6,

André and Valenciano-Salazar (2020)	Costa Rica	ISO 14001 and Carbon Neutral	24	O_1

Note: MES- Material Efficiency Strategy, VEAs- Voluntary environmental approaches.

The majority of works have analyzed the most widely adopted corporate environmental certification ISO14001, launched in Geneva in 1996 by the International Organization for Standardization (Bansal and Hunter, 2003), in the context of industrialized and developed countries. Therefore, focusing on different approaches, such as CN and FT, in a developing country, such as Costa Rica, can enrich the vision given in the literature and help to compare how motivations and obstacles differ across different certifications and contexts.

2.3 Methodology

The relative scarcity of studies dealing with VESCPs in developing countries, and more specifically in Costa Rica, led us to carry out an exploratory research by mixing qualitative research through in-depth face-to-face interviews with managers-, and a quantitative approach through a questionnaire and the statistical treatment of the answers.

2.3.1 In-depth face to face interviews

In order to get some first-hand knowledge of the Costa Rican companies' motivations and obstacles to implement, we conducted nine in-depth face-to-face interviews with managers in charge of the environmental area in some firms (see Table 2.4). The interviews were unstructured, i.e., we allowed for free feedback during the interviews. On September 2016 we conducted a first round of three interviews, which provided us with some preliminary knowledge about the firms' motivations and obstacles to adopt VESCPs (not only CN or FT). Based on this first round and our literature review we elaborated a questionnaire that we used later for the online survey. We used a second found, conducted in August 2017, to deepen some details and validate the questionnaire.

Table 2.4 Experts interviewed in Costa Rica about companies' motivations and obstacles to get VESCPs.

Company number	Interviewees' position	Sector	Environmental certifications
C_1	MM	Industrial (Cleaning Products)	CN, ISO 14001, EBF
C_2	MM, EM	Service (Financial)	CN, ISO 14001
C_3	CSRC, EM	Service (Car Sales)	CN, ISO 14001
C_4	MM	Industrial (Plastic)	ISO 14001
C_5	MM	Services (Financial)	ISO 14001, EBF, OHAS 18000.
C_6	MM	Service (Financial)	CN, ISO 14001
C_7	GM	Agro-industrial (Coffee and Sugar Cane)	Fairtrade, Eco-LOGICA, USDA organic
C_8	GM	Services (Travel agency)	CST, CN, EBF
C_9	CCRC	Services (Car Sales)	CN, ISO 14001

Notes: GM-General Manager, MM- Management Manager, EM- Environmental Manager, CSRC- Corporate Social Responsibility Coordinator, CST- The Costa Rican Certification for Sustainable Tourism; CN-Carbon Neutral, EBF- Ecological Blue Flag, OHAS - Occupational Health and Safety Management, USDA - The United States Department of Agriculture.
*The name of the interviewees and companies are omitted for the sake of anonymity.

2.3.2 Questionnaire

We designed a five-point Likert scale questionnaire to assess the main motivations and obstacles that companies faced to obtain the CN or the FT certification. The interviewees were asked to rate the importance level of the 10 motivations and the 6 obstacles specified above (see Table 2.1) in relation to the process of achieving an environmental certification (either FT or CN). In the case of the motivations, 1 means very low importance, 2 low, 3 moderate, 4 high, and 5 very high importance. When assessing the obstacles, 1 means that the associated obstacle was easily overcome by the company and 5 that it was very complicated to overcome.

In 2017 there were 74 CN certified companies in Costa Rica (Ministerio de Ambiente y Energía 2018) and 29 companies certified as FT (COCAFE 2019; Coordinadora de Comercio Justo para Costa Rica y Panamá 2017; FLOCERT 2017). On September 2017, our questionnaire

was sent to all of them by e-mail. In March 2018, 11 of the CN companies and 11 of the FT cooperatives had returned the questionnaire properly answered.

In Costa Rica, all FT cooperatives belong to the agroindustry sector, so all the FT respondents in our sample belong to this economic sector. In the case of the CN companies, 7 of the respondents (around 64%) belong to the service sector (see Table 2.5). This feature is consistent with the productive structure of Costa Rica, where the services sector contributed with the 68% of the GDP value added in 2017 (see World Bank 2019). In order to compare the answers between CN and FT companies, we use the Mann-Whitney test, which is a non-parametric statistical test commonly used to compare the distributions of two samples (Mann and Whitney 1947).

Among the respondents, 9 were General Managers, 5 Quality Managers, 5 Environmental Managers and 3 of the respondents have other leadership positions within the companies.

Table 2.5 Participating companies and position of the respondent in the quantitative evaluation

Respondent Position	**Activity**	Evaluated certification
GM	Service (tourism agency)	Carbon Neutral
EM	Service (financial)	Carbon Neutral
GM	Service (rent a car)	Carbon Neutral
EM	Agro-industrial (pineapple)	Carbon Neutral
QM	Manufacture (technology)	Carbon Neutral
QM	Industrial (electrical energy)	Carbon Neutral
CSRC	Service (car sales)	Carbon Neutral
QM	Service (financial)	Carbon Neutral
EM	Industrial (cleaning products)	Carbon Neutral
EM	Service (hospital)	Carbon Neutral
EM	Service (hotel)	Carbon Neutral
GM	Agro-industrial (coffee)	Fairtrade
GM	Agro-industrial (coffee and sugar)	Fairtrade
GM	Agro-industrial (pineapple)	Fairtrade
GM	Agro-industrial (sugar)	Fairtrade
MMa	Agro-industrial (coffee)	Fairtrade

EA	Agro-industrial (coffee and sugar)	Fairtrade
GM	Agro-industrial (coffee)	Fairtrade
GM	Agro-industrial (coffee)	Fairtrade
QM	Agro-industrial (coffee)	Fairtrade
QM	Agro-industrial (coffee)	Fairtrade
GM	Agro-industrial (coffee)	Fairtrade

Notes: Position: EA-Working into the environmental area, GM-General Manager, MMa-Market Manager, QM- Quality Manager, EM- Environmental Manager, CSRC- Corporate Social Responsibility Coordinator.

*The name of the interviewees and companies are omitted for the sake of anonymity.

Among the respondents, 9 were General Managers, 5 Quality Managers, 5 Environmental Managers and 3 of the respondents have other leadership positions within the companies.

2.4 Results and discussion

2.4.1 Qualitative results

Table 2.6 presents the main motivation and the main obstacle highlighted by each company during the face-to-face interviews. SD concern (M_{10}) was mentioned as the most prominent driver in four of the interviews. Commitment to the quality of the environment and social aspects, which we can see as an ethical concern, was highlighted by managers with statements like "it is part of the social and environmental concert of the company", "it is within the policy of social and environmental responsibility of the company" and "we want to collaborate with the SDGs of Costa Rica".

Improving green image and enhancing public recognition (M_5) was highlighted in two of the interviews, in which environmental certifications and ecological labels were identified as mechanisms of market differentiation for the company. This is consistent with previous studies in the literature. For example, Morrow and Rondinelli (2002) in Gernamy, Zutshi and Sohal (2004) in Australia and Faggi et al. (2014) in Argentine, using qualitative approaches, showed that environmental sustainability and improving green image of the company were important companies' motivations for adopting social and environmental certifications.

Improving the company's relationship with stakeholders (M_6) was the main motivation for two companies. For managers, VESCPs can be "a tool to maintain fit relationships with the government or organized consumer groups".

Regarding barriers, aspects related to costs, including investment in clean technologies and certification and verification costs, were emphasized as the most important during the in-depth interviews. Nevertheless, some managers of CN companies reported that "many of the investments in green technologies can be recovered in the long term mainly through induced cost savings".

Table 2.6 Main companies' motivations and obstacles to adopt social and environmental certifications highlighted in interviews

Motivations		**Obstacles**	
Main motivation	Companies	**Main obstacle**	Companies
M_{10}	C_1, C_2, C_4, C_9	**O_1**	C_1, C_2, C_7
M_5	C_3, C_6,	**O_2**	C_4, C_5, C_8
M_6	C_5, C_8	**O_3**	C_3, C_9
M_1	C_7	**O_4**	C_6

2.4.2 Quantitative results

2.4.2.1 Motivations

In a first global look at the results, we jointly consider the motivations of all firms to adopt a certification, either FT or CN, without making distinctions between them (see Fig. 1). Afterwards, we differentiate between both certifications.

When looking at the aggregate results, the three highest ranked motivations (in order of importance) are the following: (i-M_{10}) commitment to environmental quality, the aims of the CN Program and the SDGs of the country (mean = 4.59), (ii-M_5) improving the green image, enhancing public recognition and social legitimacy of the company (mean = 4.23) and (iii-M_6) improving the relationship with stakeholders, such as government, communities, environmental groups and consumers (mean = 3.95). In all cases, the valuations are quite homogeneous across firms, with standard errors less than 0.34. The results are illustrated in Figure 2.1.

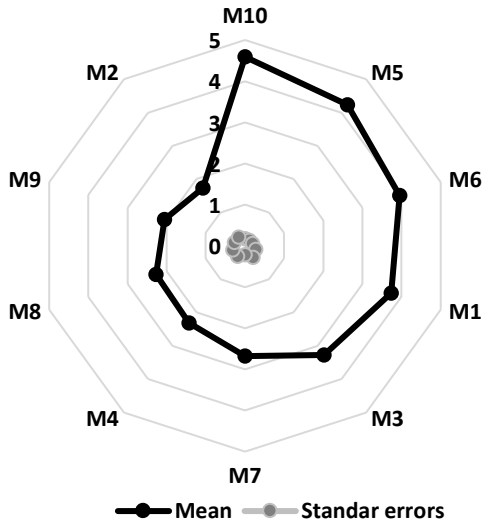

Figure 2.1 Mean of overall results about motivations for Costa Rican companies to achieve CN and FT certifications.

Notice that the top motivations include, on the one hand, environmental concerns (M_{10}) and, on the other hand, economic and strategic elements (M_5 and M_6). We can conclude that both sets of motivations are not mutually exclusive and can coexist as drivers for managers when adopting social and environmental certifications.

Our results show the relevance of ethical motives such as the environmental concern, which confirms the answers we got in the face-to-face interviews. This conclusion is consistent with the recent theoretical stream of Micro-Foundations in strategy and corporate environmentalism (Foss 2011; Barney and Fellin 2013; Molina-Azorín 2014), which remarks the key role of top management individual features and their interaction as determinants of firm environmental strategic posture, such as top management individual beliefs, ethical motivations and competences. Jamali and Karam (2016) highlight the importance of doing more research on micro foundations on sustainability in emerging economies and its effective implementation in corporate practices, such as the adoption of environmental and social certifications.

Ethical and environmental concerns have been widely documented in the literature as companies' drivers to adopt environmental or social certifications. For example, in a study of 35 small businesses in the U.S., Cater et al. (2017) concluded that "shared values" (ethical, religious, or business) and the desire to help others (altruism), often triggered by a critical incident, lead social entrepreneurs to find and sustain FT businesses. The relationship between shared values and altruism and the engagement in FT are strengthened by four motivating factors: direct relationships with producers, support for social causes, the desire for the preservation of craftsmanship, and the desire to share aesthetic products" (p.185). André and

Valenciano (2020) concluded that environmental sustainability criteria are very important for Costa Rican managers when adopting ISO14001 and CN certifications. According to Zeppel and Beaumont (2013), New Zealand tourism entrepreneurs reported motivations such as "personal concern about the environmental impacts of climate change" and "because it is the right thing to do for the environment" (p.14) when their companies adopted carbon offset programs. Okereke (2007,481) found that UK FTSE 100 companies declared that they undertook carbon management activities because of a genuine concern about their own environmental impact. González-Benito and González-Benito (2005), Mariotti, et al. (2014), Poksinska et al. (2003), and Santos et al. (2016) showed that the ecological and ethical concerns were important for many companies to obtain the ISO 14001 certification.

The second main motivation is improving green image, enhancing public recognition and social legitimacy of the company (M_5). These results fit with two of the most prominent theoretical frameworks used in environmental studies to understand why companies go green and social. The first one is the Institutional Theory (Bansal and Clelland 2004), which states that, in response to institutional and legal pressures, companies strategically respond adapting their behavior to social and institutional norms and uses, such as corporate social and environmental certification adoption, in order to achieve legitimacy and social acceptance in their respective societies. This fact is especially relevant for companies operating in developing countries (Hart 1995). In a parallel research stream, the NRBV (Hart 1995; Aragón-Correa and Sharma 2003) understands social and environmental postulates, such as corporate certifications, as strategic tools to improve companies' corporate image and reputation (Amores-Salvadó et al. 2014; Martín-de Castro et al 2020) and reinforce their sustainable business models. Similar feedback was obtained in the in-depth interviews, where managers highlighted particularly the importance of "improving the green image of the company". André and Valenciano-Salazar (2020) also found that green image is an important criterion for some Costa Rican managers when they decide to implement ISO 14001 and CN. Green image and public recognition have been also found in different countries among the main motivations for companies when adopting carbon reduction actions (Okereke 2007; Zeppel and Beaumont 2013), ISO 14001 (see, e.g. Hillary 2004; Mariotti et al. 2014; Morrow and Rondinelli 2002; Schylander and Martinuzzi 2007; Yiridoe et al. 2003; Zeng et al. 2005) or developing an EMS (Ormazabal and Sarriegi 2014).

The third most important motivation f is to improve the relationship with stakeholders, such as the government, communities, environmental groups, and consumers. In short, VESCPs constitute a clear signal of company's globally accepted management practices towards its

external stakeholders, both in developed countries (Bansal and Bogner 2002; Delmas 2001; Fryxell and Szeto 2002; Martín-de Castro et al. 2017; Poksinska et al. 2003) and developing countries (Gavronski et al. 2008; Mariotti et al. 2014), including Costa Rica (André and Valenciano, 2020). Stakeholders' engagement is a strategic tool to effectively implement proactive corporate environmentalism (Hart 1995) that can be framed under the Stakeholders framework (Freeman, 1984) and Signaling Theory (Connelly, Certo, Ireland and Reutzel, 2011). These theories remark the implications of mission statement and strategic behavior for all company's constituencies, and the relevance of trustworthy and solid relationships between the company and their main audiences, both from the market, such as customers, suppliers, competitors, allies, investors, and beyond-the market, such as NGOs, the Media, Public Administrations or local communities where the company operates, in carrying out effective social and environmental initiatives.

When we split the sample in CN and FT companies, we observe that the ranking of motivations is not exactly the same, although the Mann-Whitney test shows that, in statistical terms, the scores given by both groups are not significantly different except for two of the motivations (see table 2.7).

First, "increase sales, market shares or prices" (M_1), which is the first driver for cooperatives to achieve the FT certification (mean = 4.73), is ranked only in the sixth position by CN companies (mean = 2.73). This difference is consistent with the different nature of both certifications. FT is regarded by cooperatives as an opportunity to sell their products in differentiated markets, particularly in developed countries, getting access to concerned consumers and obtain price premiums. CN, for its part, does not guarantee to obtain higher prices. Barham et al. (2011), Lyngbæk et al. (2001), Méndez et al. (2010) and Weber (2011) found that FT and organic producers in Mexico and Central America received higher prices than not-certified ones, while Dragusanu and Nunn (2018) found similar results in the case of FT cooperatives in Costa Rica. Although in one depth-interview and in the comments section of the questionnaires, some managers of FT companies said they had not fully met their sales expectations in the FT market (see also Haight, 2007; Sick, 2008; Snider et al, 2017), this element still seems an important motivation for them.

Table 2.7 Motivations for Costa Rican companies to achieved environmental certifications

Motivations	FT firms (n=11)		CN firms (n=11)		Mann-Whitney
	R	Mean	R	Mean	p value
Commitment to the quality of the environment and the sustainable development goals of the country (M_{10})	2	4.54 (0.31)	1	4.64 (0.14)	0.5563
Improving green image, enhancing public recognition and social legitimacy (M_5)	3	4.09 (0.25)	2	4.36 (0.24)	0.4165
Improving the relationship with stakeholders (M_6)	4	3.73 (0.30)	3	4.18 (0.23)	0.2684
Increasing sales, market shares or prices (M_1)	1	4.73 (0.19)	6	2.73 (0.27)	0.0002***
Saving production costs or increasing productivity (M_3)	8	2.64 (0.53)	4	3.91 (0.37)	0.1019
Preparing firm for mandatory regulations (M_7)	9	2.45 (0.28)	5	2.91 (0.34)	0.2603
Receiving technical assistance and information from environmental agencies (M_4)	5	2.91 (0.49)	8	1.73 (0.27)	0.0763
Certification demands on the part of the companies that lead the value chain (M_8)	6	2.73 (0.43)	7	1.82 (0.42)	0.063
Following competitors' strategy (M_9)	7	2.73 (0.38)	10	1.36 (0.28)	0.0126*
Reducing the financing cost or increasing market value of the company (M_2)	10	1.73 (0.38)	9	1.73 (0.36)	1

Legend: * $p<0.05$; ** $p<0.01$; *** $p<0.001$. Standard errors in parentheses.

Notes: R=Ranking; Likert scale (level of importance): 1=very low, 2=low, 3=moderate, 4=high, 5=very high

On the other hand, CN is not an ecolabel as such, but rather a company certification, which is perceived as a moderately important market instrument by companies. Moreover, CN is a domestic program and it is less international recognized than FT. Finally, the result is also consistent with the result that the main motivation of CN companies is to contribute to the environmental sustainability of Costa Rica rather than increasing direct economic benefits.

The second significant difference refers to the motivation "following competitors' strategy (M_9)", which has a moderate importance to get FT certification (7th position, mean = 2.73) but is in the last position for CN firms (mean = 1.36). Since FT is adopted only by companies and cooperatives belonging to the same sector (the agricultural one), this adoption seems to be a relevant market differentiation strategy. Those producers which were not yet FT-certified may be at a disadvantage and have an important incentive to do so in order to get a market share within the green and ethical chains (see, Dragusanu and Nunn 2018; Ruben 2009). Since CN includes companies from all sectors, there is no such a direct pressure from the industry to follow the competitors' strategy.

2.4.2.2 Obstacles

As we obtained in the qualitative interviews, the survey results show that high investment costs in clean technologies (O_1) and certification costs (O_2) are, on average, the most difficult obstacles faced by CN and FT companies during the certification process (see Table 2.8). No significant statistical differences were found between the managers' mean scores for these two aspects in both sub-samples. However, it is worth noticing that monitoring costs and technological investments are different in nature for each certification. FT cooperatives have to implement monitoring and plot management processes, restrict the use of non-permitted pesticides, and guarantee good working conditions (Dragusanu and Nunn 2018; Snider et al. 2017). In the case of CN companies, most managers reported that the main costs are related to the purchase of carbon credits, job employees' training, reductions or substitution of fossil fuels in the production and transportation processes and the installation of solar panels and diode lamps (see also Chung 2015; Fallas 2016).

Previous studies have also pointed out certification cost and clean technology costs as important barriers in developed countries (Babakri et al. 2003; Bansal and Bogner 2002; Ormazabal and Sarriegi 2014; Santos et al. 2016; Yiridoe et al. 2003) and developing countries (Mariotti et al. 2014; Pérez-Ramírez et al. 2012; Tellman et al. 2011) including Costa Rica (André and Valenciano, 2020; Snider et al., 2017).

Table 2.8 Obstacles for Costa Rican companies to achieve environmental certifications

Obstacles	Total (n=22)		FT firms (n=11)		CN firms (n=11)		Mann-Whitney test
	R	Mean	R	Mean	R	Mean	p value
High investment costs in clean technologies (O_1)	1	3.59 (0.28)	1	3.54 (0.43)	1	3.64 (0.36)	0.9459
High costs of certification (external auditors, verification costs) (O_2)	2	3.23 (0.33)	2	3.36 (0.53)	3	3.09 (0.41)	0.7109
Difficulty finding information and preparing documentation (O_3)	3	2.95 (0.33)	6	2.73 (0.51)	2	3.18 (0.42)	0.5444
Resistance of employees (O_4)	4	2.77 (0.30)	3	3 (0.43)	4	2.54 (0.43)	0.4192
Difficulty in designing and implementing an EMS (O_5)	5	2.54 (0.24)	4	2.82 (0.38)	5	2.27 (0.31)	0.2906
Resistance of shareholders, owners, or managers (O_6)	6	2 (0.29)	5	2.82 (0.44)	6	1.18 (0.12)	0.0020***

Legend: * p<0.05; ** p<0.01; *** p<0.001. Standard errors in parentheses.

Notes: R: Ranking. Likert scale: 1=very easy, 2=easy, 3=moderate, 4=difficult, 5=very difficult.

When comparing both groups of firms, we conclude that their perceptions seem to be closer in the case of obstacles than in the case of motivations. The Mann-Whitney test indicates that there are no statistically significant differences between both groups, except in the case of "the resistance of shareholders, owners or managers (O_6)", which is on average more difficult to face by FT cooperatives (mean = 2.82) than CN companies (mean = 1.18) (see Table 2.8). This difference is probably due to the fact that the FT certification is typically adopted by cooperatives, which require the agreement of the majority of the shareholders, who are agricultural producers that, in case cases, may be reluctant to make technological changes in their plots. On the contrary, the CN certification is normally adopted by private companies, where the decisions are more easily made by owners or managers.

An interesting result is that companies considered that “finding information and preparing documentation (O_3)” was the second most difficult obstacle to achieving CN certification (mean = 3.18), but the lowest for FT companies (mean = 2.73). Although the differences in the scores are not statistically significant, it seems natural to wonder why this obstacle is ranked so differently. A plausible explanation is that CN companies must register all greenhouse gas emissions and then demonstrate their reduction or compensation, which can be expected to be an important obstacle.

2.5 Conclusions

Managers who voluntarily adopted CN or FT certifications in Costa Rica declared to be genuinely concerned about the environment. This result is consistent with the country's policy, which maintains a strong component of environmental education and sensitization. This finding is also consistent with previous studies reporting that ethical aspects are similar in importance to economic and strategic ones when adopting environmental certifications or taking part in environmental programs.

According to our findings, for both CN and FT certifications, the main barriers are related to auditing/certification costs and the required investment costs in clean technologies. Achieving a neutral carbon footprint, or to get high standards of ecological and social production in the agriculture sector are challenges that companies must overcome through technological change. Companies in developing countries such as Costa Rica perceive these changes as expensive and difficult to implement. Thus, in order to encourage firms to move towards sustainable production systems, it seems crucial that consumers become informed and concerned and they acknowledge the efforts of green companies through public recognition and the willingness to pay higher prices for certified goods.

This environmental sensitization seems particularly important for those firms taking part in the Costa Rican Carbon Neutrality Program as compared to FT firms, which also consider environmental motivations as important but less important than increasing sales or getting price premiums. The CNP program is becoming an important instrument to fight climate change and achieve a cleaner economy in Costa Rica, since CN companies must guarantee the reduction or offset of their greenhouse gas emissions.

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Chapter 3: Becoming Carbon Neutral in Costa Rica to be more sustainable: An AHP approach[1]

Abstract: The organization's adoption of an environmental certification is addressing as a multicriteria problem considering environmental sustainability as well as economic and strategic aspects. The Analytical Hierarchy Process (AHP) is the methodological approach used, AHP is used in an empirical application to analyze the adoption decision of several Costa Rican firms and institutions. Firstly, a set of economic, strategic, and environmental criteria were selected according to an extensive literature review and a series of face-to-face interviews with scholars and companies' managers. As an environmental certification, the chapter focus on Carbon Neutral (CN), which is a domestic certification aimed at reducing or offsetting carbon emissions. For the sake of comparison, ISO 14001 was also considered, which is a well-known international standard aimed at compliance with environmental norms. The research conducts the AHP analysis using the answers given by 24 companies and institutions, which in aggregate terms, give CN a higher score than ISO 14001. This result is mainly due to the fact that CN ranks above ISO 14001 when attending to environmental sustainability, although ISO 14001 tends to be preferred in economic and strategic terms.

Keywords: Analytical Hierarchy Process (AHP); carbon neutral; ISO 14001; multicriteria; economic-strategic; environmental sustainability; Costa Rica

3.1 Introduction

The 2030 Agenda for Sustainable Development (United Nations, 2019) established 17 Sustainable Development Goals (SDGs) as a roadmap to guarantee a more sustainable future and overcome some of the most urgent challenges of mankind. These challenges include social and economic problems such as poverty and inequality and environmental threats such as global warming and climate change (Intergovernmental Panel on Climate Change, 2014). By shifting from conventional, polluting patterns to cleaner and more sustainable ones, companies can play a crucial role to achieve the SDGs, especially some of them such as providing affordable and clean energy (SDG 7), decent work and economic growth (SDG 8), ensuring sustainable

[1] This chapter was published as an article in the journal Sustainability 2020, 12, 737. https://doi.org/10.3390/su12020737

consumption and production patterns (SDG 12) and fighting climate change and its impacts (SDG 13); see e.g., (Manni, et al., 2018; Marseglia, et al., 2019; Shayegh, Sanchez, & Caldeira, 2017).

This change in companies' policies can involve adopting some voluntary environmental certification (VEC) or program (VEP). VECs and VEPs are non-mandatory approaches by which companies commit to improve their environmental standards in accordance with the specific requirements of each certification or program (Khanna, 2001). According to the OECD, these voluntary approaches "provide pragmatic responses to new policy problems, namely the need for more flexible ways to achieve sustainability, and the need to consider the rising concerns about industrial competitiveness and the increasing administrative burden" (OECD, 2000). Moreover, it can be argued that VECs and VEPs are win-win approaches for companies and for society, because they improve the environmental performance of firms, while yielding them some economic and strategic benefits such as improving their competitiveness (André, 2016; Ibanez & Blackmanb, 2016; Porter & van der Linde, 1995).

There is a wide variety of VECs and VEPs available for companies. Choosing one or some of them can be a complex task for business managers, since this decision will typically involve multiple criteria, including strategic, economic, environmental, or even ethical ones. The Analytical Hierarchy Process (AHP) can be a helpful tool to assist managers in taking certification decisions. AHP was developed by Saaty (1980) and has become one of the most used methods, both in the public and the private sector, for making decisions that involve multiple criteria.

In business, AHP is typically used in contexts of uncertainty that require evaluating different alternatives based on qualitative and quantitative criteria. For example, Chin et al. (1999) used AHP to rank success factors and develop strategies to implement an Environmental Management System (EMS) in Hong Kong manufacturing companies, as well as to decide whether to implement ISO 14001. Also, in Hong Kong, Pun and Hui (2001) investigated the companies' criteria, sub-criteria, and benefits of implementing ISO 14001. Mathiyazhagan et al. (2015) used AHP in combination with experts' opinions to rank the pressures to adopt Green Supply Chain Management in the Indian mining and mineral industry. In the same country and sector, Shen et al. (2015) evaluated the relative importance of social, economic, and environmental criteria of green supply chain management. Cuadrado et al. (2015) ranked the main factors involved in the construction of an industrial building in Europe. Ho et al. (2016) used AHP to determine the importance of the barriers faced by electrical and electronics manufacturing companies in Malaysia when implementing material efficiency strategies.

Thanki et al. (2016) evaluated the influence of lean and green paradigms on the overall performance of small and medium enterprises. Malik et al. (2016) applied AHP to evaluate the environmental performance of healthcare suppliers in the United Arab Emirates. Wang et al. (2018) calculated the effect of the technical measures implemented in the tobacco industry for energy conservation and emissions reduction. Karaman and Akman (2018) applied AHP to identify key criteria and sub-criteria of a Corporate Social Responsibility program in the airline industry.

In this study, an AHP is used to evaluate the preferences of firms when choosing between different VECs and, ultimately, the propensity of the same firms to choose a specific VEC. The proposal is applied to the selection of an environmental certification in a group of Costa Rican firms and public institutions. Costa Rica is considered an international leader in terms of environmental sustainability, especially in forest conservation and the reduction of the Greenhouse Gas (GHG) footprint (United Nations Environment Programme, 2019). Different public and private environmental approaches contributed to improve the environmental quality and green image of Costa Rican companies and the country itself (Birkenberg & Birner, 2018, Blackman, et al., 2014; Blum, 2008; Flagg, 2018; Rivera, 2002; Sánchez-Azofeifa, et al., 2007).

The Carbon Neutrality Program is a recent public initiative looking for a cleaner economy in Costa Rica. After measuring their carbon emissions and reducing or offsetting them, participating organizations can obtain a Carbon Neutral (CN) certification (Dirección de Cambio Climático, 2014; Ministerio de Ambiente y Energía, 2018; Musmanni, 2014). The chapter focus on finding out the managers′ preferences and criteria that determine their decision to take part in this program. For the sake of comparison, an alternative certification is considered, namely ISO 14001, which is a well-known international standard.

The first methodological aim of the chapter is to establish a relevant set of criteria that firms, and institutions consider when choosing an environmental certification. To do so, three preliminary steps were preformed, which include an exhaustive bibliographic review, a series of in-depth interviews with 11 managers of certified companies and a discussion with two scholars' experts in the field. As a result, two subgroups of criteria were selected and classified: i. environmental sustainability and ii. economic-strategic factors. Then, the AHP methodology was used with a double purpose: first, to measure the weights given by Costa Rican firms and institutions to the relevant criteria. Second, evaluating how firms perceive the CN certification versus ISO 14001 in terms of those criteria. The AHP was applied by conducting an e-mail survey that was successfully completed by 22 managers of private companies and two managers of public institutions.

The remainder of the chapter has the following structure: The following section provides a background of the certifications and the relevant criteria to evaluate them according to the previous literature. Section 3 presents the methodological steps that we followed in our research. Section 4 shows our results and provides some discussion. Finally, Section 5 concludes the chapter.

3.2 Background

In this section, we review the main aspects of the two certifications under study, CN and ISO 14001, and the main criteria identified in the literature regarding firms' selection of environmental certifications.

The CN Program was introduced in Costa Rica in 2012 as a policy instrument in accordance with the government strategy to have a zero-carbon economy in 2050 (Flagg, 2018; United Nations Environment Programme, 2019; Valenciano-Salazar, 2016). The program began with the participation of two companies and currently involves around 84 organizations (Ministerio de Ambiente y Energía, 2018). This program requires participants first to create GHG emissions inventories, and second, to build strategies to cut down, capture or offset those emissions. An auditing agency must verify both the inventories and the veracity of the reduction and offset strategies. All this information is corroborated by the Climate Change Department of the Costa Rican Government, which gives to the companies the "Carbon Neutral Declaration or Certification" (Dirección de Cambio Climático, 2014; Musmanni, 2014).

ISO 14001 is an international environmental standard for companies that want to implement or improve an EMS. The number of worldwide ISO 14001 certified firms increased by 134% between 2007 and 2017. In the case of Costa Rica, 119 organizations were certified in 2017, showing a 18% growth in 10 years (International Organization for Standardization, 2019). The aim of ISO 14001 is to help organizations improve their environmental performance in different dimensions. These include creating and putting into operation an EMS, with objectives, policies, and assignment of responsibilities within the firm to comply with them, generating some corrective and preventive actions in order to reduce the polluting emissions of the company and complying with national environmental laws (International Organization for Standardization, 2015).

We conducted a literature review about the criteria related to environmental aspects that companies consider when adopting different VECs and VEPs (not only those under

consideration in our study). We grouped these criteria in two blocks: first, those related to environmental sustainability and, second, those associated with economic and strategic aspects.

Regarding environmental sustainability, there are two broad elements that are explicitly or implicitly present in most of the previous studies, namely:

- the reduction in the use of materials and energy (Abdul Rashid, 2009; Cuadrado et al., 2015; Doczy & Abdel Razig, 2017; Eltayeb, Zailani, & Ramayah, 2011; Govindan, et al., 2015; Karaman & Akman, 2018; Malik, Abdallah, & Hussain, 2016; Mathiyazhagan et al., 2015; Pun & Hui, 2001; Shen, Muduli, & Barve, 2015; Thanki, Govindan, & Thakkar, 2016; Verschoor & Reijnders, 2000)
- and the reduction in the company′s emissions (Abdul Rashid, 2009; Cuadrado et al., 2015; Doczy & Abdel Razig, 2017; Eltayeb, Zailani, & Ramayah, 2011; Govindan et al., 2015; Karaman & Akman, 2018; Malik, Abdallah, & Hussain, 2016; Pun & Hui, 2001; Shen, Muduli, & Barve, 2015; Thanki, Govindan, & Thakkar, 2016; Verschoor & Reijnders, 2000; Wang, et al., 2018).

Regarding economic and strategic aspects, the most frequently reported ones include:

- improving the green image of the firm (Faggi, Zuleta, & Homberg, 2014; Hillary, 2004; Khanna, 2001; Mariotti, Kadasah, & Abdulghaffar, 2014; Mathiyazhagan et al., 2015; Morrow & Rondinelli, 2002; Okereke, 2007; Ormazabal & Sarriegi, 2014; Pérez-Ramírez et al., 2012; Schylander & Martinuzzi, 2007; Yiridoe et al., 2003; Zeng et al., 2005; Zeppel & Beaumont, 2013),
- increasing market shares or prices (Bansal & Bogner, 2002; Barham & Callenes, 2011; Khanna, 2001; Lyngbæk, Muschler, & Sinclair, 2001; Mariotti, Kadasah, & Abdulghaffar, 2014; Mathiyazhagan et al., 2015; Méndez, et al., 2010; Pan, 2003; Zeng et al., 2005; Zeppel & Beaumont, 2013; Weber, 2007),
- saving production costs or increasing productivity (Bansal & Bogner, 2002; Fryxell & Szeto, 2002; González-Benito & Gonzáles-Benito, 2005; Hillary, 2004; Lim & Prakash, 2014; Mariotti, Kadasah, & Abdulghaffar, 2014; Morrow & Rondinelli, 2002; Pan, 2003; Okereke, 2007; Ormazabal & Sarriegi, 2014; Quazi et al., 2001; Zeng et al., 2005),
- improving the company's relationship with stakeholders (Bansal & Bogner, 2002, Fryxell & Szeto, 2002; Khanna, 2001; Lim & Prakash, 2014; Mariotti, Kadasah, & Abdulghaffar, 2014; Poksinska, Dahlgaard, & Eklund, 2003),

- adapting to mandatory regulations, and imitating the strategy of competitors (Bansal & Bogner, 2002; Khanna, 2001; Ormazabal & Sarriegi, 2014),
- managers also consider the costs related to the certification (Babakri, Bennett, & Franchetti, 2003; Bansal & Bogner, 2002; Chin, Chiu, & Tummala, 1999; Ormazabal & Sarriegi, 2014; Pérez-Ramírez et al., 2012; Santos et al., 2016; Snider et at., 2017; Tellman, Gray, & Bacon, 2011; Yiridoe et al., 2003).

3.3 Materials and methods

3.3.1 In-depth face-to-face interviews with firms' managers and scholar experts

To complement the conclusions obtained in our literature review and get a more detailed vision of firms' motivations to adopt VECs and VEPs, we conducted several in-depth face-to-face interviews with two groups of experts. Firstly, we interviewed 11 managers in charge of the environmental certification process in some Costa Rican companies (see Appendix A, Table A1). The interviews were not structured, i.e., we allowed for feedback comments during the interviews. This approach provided us some first-hand knowledge about the companies′ reasons to adopt VECs.

Secondly, as a further validation, we also consulted two academic experts of the Faculty of Economic and Business Sciences at the Complutense University of Madrid, namely Gregorio Martín-de-Castro and Javier Amores-Salvadó. The aim of this discussion was to come up with a set of criteria that was representative enough of the relevant criteria, but not extremely large and detailed to make it manageable and easy to be handled by our survey respondents.

3.3.2 Questionnaire and AHP application

Table 3.1 displays the set of criteria that we selected based on the literature review, the interviews to the managers and the academic experts' advice. We used these criteria to elaborate the questionnaire for our AHP application.

Table 3.1 Criteria used in the AHP questionnaire

Economic-strategic	Environmental sustainability
Improving green image, public visibility, and social legitimacy of the company (E_1).	Materials and energy use reductions during the production and distribution (S_1)
Increasing sales, market shares or prices* (E_2).	Reduction in the amount and damage of emissions (gas, solid and water) generated by the company (S_2)
Saving production costs or increasing productivity (E_3).	
Cost of the certification and investment in clean technologies (E_4).	

Note: * Since public institutions do not have a profit motive, we reformulate sub-criterion E_2 for them as "the possible improvements in the quality of the services offered and the increase in user satisfaction."

We have a double purpose: first, to evaluate the perception of a group of Costa Rican firms and public institutions with respect to the selected criteria and, second, to measure the propensity of those organizations to adopt a specific environmental certification according to this set of criteria. Among all the available certifications, this study focusses on CN for its relevance for the sake of pursuing sustainability in Costa Rica. As an alternative, we take ISO 14001, which as an important and well-established certification oriented to the EMS of the company.

We conducted a four-level-AHP exercise as shown in Figure 3.1. The first level ("Goal") is the organization's objective to choose an environmental certification. The second level refers to the general-purpose criteria (or simply "Criteria") that we consider relevant for the decision. According to our classification, these are the economic-strategic aspects, on the one hand, and environmental sustainability, on the one hand. The third level ("Sub-criteria") disaggregates the general-purpose criteria into more specific aspects. We refer to the latter as "sub-criteria" to differentiate them form the aggregate "criteria" on the second level. The lower level ("Alternatives") refers to the environment certifications that the respondents will evaluate in terms of the criteria and sub-criteria.

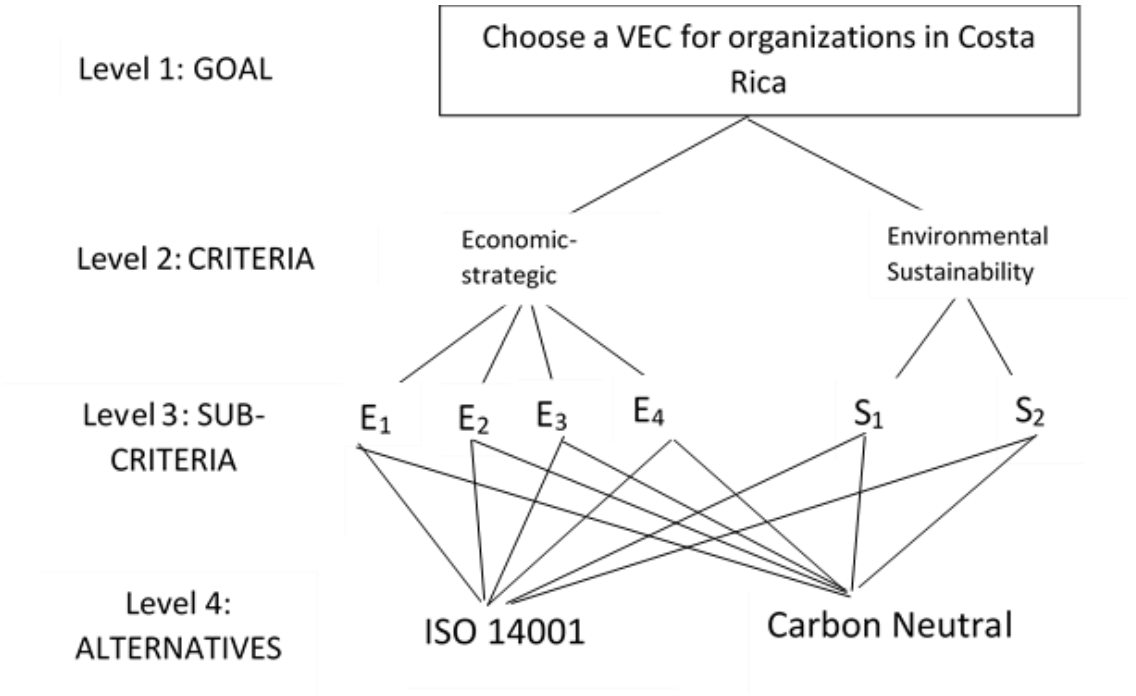

Figure 3.1 Analytic hierarchy structure

To conduct the exercise, we identified a group of companies holding the CN certification, the ISO 14001 certification, or both. For the sake of completeness, we also included some companies that did not hold any of them. Apart from companies, we also addressed some public institutions to check if the latter had somewhat different perceptions and preferences than the former. We identified the CN companies and institutions from the Climate Change Department (Ministerio de Ambiente y Energía, 2018) and the ISO 14001 organizations from the Institute of Technical Standards of Costa Rica (INTECO, 2019). In the case of non-certified companies, we searched the emails' contacts on their webpages.

In 24 May 2019, we invited 171 companies and 12 certified public institutions to complete the questionnaire on the Google's survey platform. In the group of companies, 58 of them did not have the CN or ISO 14001 certification, 62 were CN but not ISO 14001 certified, 33 were 14001 but not CN certified and 18 had both certifications. With respect to public institutions, six of them were CN certified, 2 were ISO 14001 certified and four did not have any of both certifications.

In October 2019, 22 companies 'managers had completed the questionnaire correctly; four of them were CN certified, four ISO 14001 certified, seven had both certifications and seven had neither. In addition, two respondents were from public institutions (a university and a governmental department), both of which were CN but not ISO 14001 certified. Appendix A Table A_2 lists the organizations' features and the positions of the respondents.

Following standard AHP methodology, the questionnaire sets pairwise comparisons of elements (criteria, sub-criteria, or alternatives) belonging to the same level with respect to their contribution to the immediate superior level. It is based on Satty's scale (Saaty, 1980; 2012), which allows us to convert the qualitative judgments into numerical values (see Table 3.2).

Table 3.2 Saaty s' scale of preference between two elements.

Numerical values	Definition	Explanation
1	Equal	Two elements contribute equally to the objective
3	Moderate	Experience and judgment slightly favor one aspect over another
5	Strongly	Experience and judgment strongly or essentially favor one aspect over another
7	Very strongly	An aspect is strongly favored over another and its dominance demonstrated in practice
9	Extremely	The evidence favoring one aspect over another is of the highest degree possible for affirmation
2,4,6,8	Intermediate values	Used to represent a compromise between preferences listed above

Source: Saaty (1980)

At the beginning of the questionnaire, we explained the structure of the questions and the Saaty scale. Then, we asked the respondents for their pairwise judgments within each level of the study, i.e., about the importance level of criteria (with respect to the goal of selecting a VEC), sub-criteria (with respect to each of the general criteria) and the relative merit of the alternatives, CN and ISO 14001 (with respect to each of the sub-criteria). Figure 3.2 shows three examples of the questions presented to the managers for levels 2, 3, and 4. The rest of questions had the same structure.

The individual responses give rise to the individual Satty's comparison matrices. Then, we use the geometric mean to combine the individual matrices and obtain the consensus pairwise comparison matrices (Aczél & Alsina, 1986; Saaty, 2012; Xu, 2000). These combined matrices are the ones that we use to compute the consensus priority weights for each level of the study, first for the whole group of respondents, and then to different subgroups.

Comparing between criteria: Consider that we group all the aspects that concern your company or public institution in two blocks, putting on a balance, on the one hand, all the ECONOMIC-STRATEGIC aspects and, on the other, all those that have to do with ENVIRONMENTAL SUSTAINABILITY. Between these two blocks, which one do you think is more important for the company when choosing an environmental certification?

- ○ Economic-strategic criteria
- ○ Environmental sustainability criteria
- ○ Both groups of criteria have the same importance for the company or institution (if you chose this option, then check 1 in the next question)

Compare the above criteria using the scale ranging from 1 to 9

	1	2	3	4	5	6	7	8	9	
Both are equally important	○	○	○	○	○	○	○	○	○	The sub-criterion chosen by you is extremely more important

Comparing between sub-criteria: Which of the following two sub-criteria is more important for your company or public institution when choosing an environmental certification?

- ○ Increasing sales, market shares or prices
- ○ Improving green image, public visibility and social legitimacy
- ○ Both sub-criteria have the same importance (if you chose this option, then check 1 in the next question)

Compare the above sub-criteria using the scale ranging from 1 to 9

	1	2	3	4	5	6	7	8	9	
Both are equally important	○	○	○	○	○	○	○	○	○	The sub-criterion chosen by you is extremely more important

Choosing an alternative: Which of the following environmental certifications do you think can contribute more to reduce the amount and damage of emissions produced your company or institution?

- ○ ISO 14001
- ○ Carbon Neutral
- ○ Both certifications contribute to the same extent (if you chose this option, then check 1 in the next question)

Compare both certifications using the sub-criteria presented above

	1	2	3	4	5	6	7	8	9	
both contribute equally in reducing emissions and damage	○	○	○	○	○	○	○	○	○	the chosen certification contributes extremely more than the other

Figure 3.2 Three examples of questions used in the questionnaire to compare criteria (level 2), sub-criteria (level 3) and alternatives (level 4).

Before computing the priority weights, we computed the consistency ratios (CR) of each of the relevant consensus comparison matrices. The consistency ratio is defined as CR= CI/RI, where CI is the consistency index of each matrix and RI is the consistency index of a random matrix of the same size. See Saaty (1980; 2012) for details about the calculation of the consistency indexes (CI) and the average consistency values (RI) of randomly generated matrices. The consistency ratios of all the consensus comparison matrices that we use in the study (for the whole group and the subgroups) are well below 0.10, which is the threshold value recommended by Saaty (Chin, Chiu, & Tummala, 1999; Malik, Abdallah, & Hussain, 2016; Saaty, 1980;2012).

We calculated the priority weights for the criteria, sub-criteria and alternatives using a variant of the traditional eigenvector method. For each level, we multiply the associated comparison matrix iteratively by itself. In each iteration, we add up the elements of each row of the matrix and normalize the resulting vector yielding an approximation to the first eigenvector of the initial matrix (Perron, 1907). The process stops when the approximate eigenvector obtained in one iteration does not change significantly (up to four decimal places) from the previous iteration. The result is taken as the vector of relative importance or priority weights; see e.g., (Aznar Bellver & Caballer Mellado, 2005; Vázquez-Burgos, et al., 2019).

We denote the criteria eigenvector (level 2) as V_C. It indicates the weights or relative importance of economic-strategic and environmental sustainability criteria. In level 3, we have two eigenvectors: One for the economic-strategic sub-criteria, denoted as V_{EC}, and one for the environmental sustainability sub-criteria, denoted as V_{SC}. By combining levels 2 and 3 we can obtain the eigenvectors representing the global contributions of each sub-criterion to the goal of the study. Thus, the global eigenvector associated with the economic-strategic sub-criteria (V_{GEC}) is obtained as follows: $V_{GEC} = V_{EC}$ x w_e, where w_e is is the weight given to the economic-strategic criterion in level 2, i.e., the first element of V_C. Similarly, the global eigenvector of all the sustainability sub-criteria (V_{GSC}) is obtained as follows: $V_{GSC} = V_{SC}$ x w_s, where w_s is the weight given to the environmental sustainability criterion (the second element of V_C).

At level 4, we have 6 two-components eigenvectors, V_{Ai} (i =1,…,6), each of one indicates the weight or relative score of the alternatives in terms of sub-criterion i. Specifically, we get 4 eigenvectors related to the economic-strategic sub-criteria, that can be grouped as $V_{AE} = [V_{AE1,}V_{AE2,}V_{AE3,}V_{AE4}]$. and 2 eigenvectors related to the environmental sustainability sub-criteria, $V_{AS} = [V_{AS1,}V_{AS2}]$.We can order the alternatives according only to the economic-

strategic criteria by computing $W_{AE} = V_{EC} \text{x}\, V_{AE}$ or only to the environmental sustainability criteria by computing $W_{AS} = V_{SC} \text{x}\, V_{AS}$. Finally, the globally preferred alternative can be determined by computing the global weight vector as follows: $W_{GA} = [V_{GEC} \text{x}\, V_{AE}] + [V_{GSC} \text{x}\, V_{AS}]$.

3.4 Results and discussion

3.4.1 Overall results

As a first approximation, we take the results arising from the combined answers of all 24 respondents, as shown in Table 3.3. At level 2, the participants considered, on average, that the economic-strategic criterion is more important (with a relative weight of 0.6) than environmental sustainability (0.4) when adopting a VEC.

Regarding level 3, it is illustrative to compare the different sub-criteria related to economic and strategic aspects among themselves and do the same with the two sub-criteria related to environmental sustainability. Regarding economic-strategic aspects, saving production costs or increasing productivity (sub-criterion E_3) and improving green image, public visibility and social legitimacy of the company or the public institution (E_1) turn out to be the most important ones. Similar conclusions were found in previous studies about companies' motivations to adopt environmental certifications in Europe (González-Benito & Gonzáles-Benito, 2005; Hillary, 2004; Morrow & Rondinelli, 2002; Okereke, 2007; Ormazabal & Sarriegi, 2014; Poksinska, Dahlgaard, & Eklund, 2003; Schylander & Martinuzzi, 2007), North America (Bansal & Bogner, 2002; Morrow & Rondinelli, 2002; Yiridoe et al., 2003), and Latin-America (Faggi, Zuleta, & Homberg, 2014; Pérez-Ramírez et al., 2012).

On the environmental side, the respondents consider that sub-criterion S1, related to materials and energy use reductions during the production and distribution processes is slightly more important than S2, which refers to reducing the amount and damage of emissions generated by the company (relative weights 0.52 vs. 0.48). The same or similar motivations were identified in previous studies applied to European (Abdul Rashid, 2009; Cuadrado et al., 2015; Karaman & Akman, 2018; Verschoor & Reijnders, 2000), Asian (Eltayeb, Zailani, & Ramayah, 2011; Ho, Abdul-Rashid, & Raja Ghazilla, 2016; Karaman & Akman, 2018; Malik, Abdallah, & Hussain, 2016; Mathiyazhagan et al., 2015; Pun & Hui, 2001; Shen, Muduli, & Barve, 2015; Thanki, Govindan, & Thakkar, 2016), and American companies (Doczy & AbdelRazig, 2017; Verschoor & Reijnders, 2000).

Table 3.3 Priority weights by level (criteria, sub-criteria, and alternatives). All respondents (n = 24).

Criteria	V_c	Sub-criteria	V_{EC} and V_{SC}	V_{GEC} and V_{GSC}	Comparing alternatives (V_{Ai})	
					ISO 14001	CN
Economics-strategic (E_i)	w_e 0.6001	E_1	0.2911	0.1747	0.4478	0.5522
		E_2	0.2292	0.1376	0.6491	0.3501
		E_3	0.2950	0.1770	0.5849	0.4151
		E_4	0.1847	0.1108	0.4355	0.5645
Environmental sustainability (S_i)	w_s 0.3999	S_1	0.5207	0.2082	0.4863	0.5137
		S_2	0.4793	0.1917	0.2581	0.7419

Notes: The question regarding the comparison of alternatives in terms of sub-criterion E4 was answered by 23 respondents.

When comparing the alternatives (certifications) according to each sub-criterion at level 4 (V_{Ai}), we conclude that CN is preferred under sub-criteria E_1, E_4, S_1 and S_2, but ISO 14001 is preferred under E_2 and E_3. Thus, as is typically the case in any multicriteria decision problem, our decision problem involves some degree of conflict in the sense that, by adopting a specific certification it is unlikely to get the best possible result in all the (sub) criteria at the same time.

In Table 3.4 we show the results of evaluating the alternatives, first, in terms of the economic-strategic criterion (and, implicitly, the associated sub-criteria), second, in terms of the environmental sustainability criterion (and sub-criteria) and, finally, combining both. It turns out that ISO 14001 is preferred to CN when considering only the economic-strategic criterion (0.53 vs. 0.47). On the contrary, CN is preferred to ISO 14001 in terms of the environmental sustainability aspects (0.62 vs. 0.38). When considering both criteria (and all the corresponding sub-criteria), CN turns out to be preferred to ISO 14001 (0.53 vs. 0.47).

Table 3.4 Choosing an alternative according to the criteria. All respondents (n=24).

	According to each criterion		According to global weights		
Alternatives	W_{AE}	W_{AS}	V_{GEC} x V_{AE}	V_{GSC} x V_{AS}	W_{GA}
CN	0.4679	0.6231	0.2808	0.2492	0.5300
ISO 14001	0.5321	0.3769	0.3193	0.1507	0.4700
Total	1	1	0.6001	0.3999	1

A general reflection about these results has to do with the current relevance of environmental criteria in the organizations' decision-making process. In our case, considering environmental sustainability makes organizations, in aggregate terms, more prone to adopt CN rather than ISO 14001, although the latter is the preferred option when considering only economic and strategic aspects. This is the case even though the respondents place a larger weight on the economic-strategic criterion. The reason for this is that the respondents perceive CN as clearly preferred to ISO 14001 in environmental terms while the advantage of ISO 14001 over CN in economic-strategic terms is not so pronounced. This conclusion is in line with previous studies in the literature reporting that ethical and environmental concerns beyond purely economic motivations are becoming increasingly relevant in corporate decision-making; see e.g., (Cater, Collins, & Beal, 2017; González-Benito & Gonzáles-Benito, 2005; Mariotti, Kadasah, & Abdulghaffar, 2014;Okereke, 2007; Poksinska, Dahlgaard, & Eklund, 2003; Santos et al., 2016; Zeppel & Beaumont, 2013).

3.4.2 Differences across groups

In this section, we split the respondents in five mutually exclusive sub-groups to explore how different they are in terms of their perceptions and preferences as regards criteria and alternatives. The groups are the following:

i) Non-certified firms: Companies that are not CN nor ISO 14001 certified (n=7),

ii) CN firms: Companies that are CN but not ISO 14001 certified (n=4),

iii) ISO 14001 firms: Companies that are ISO 14001 but not CN certified (n=4),

iv) Companies that are CN and ISO 14001 certified (n=7),

v) public institutions (n=2), which include a university and a governmental department. Both of them are CN but not ISO 14001 certified.

3.4.2.1 Relative importance of the criteria and sub-criteria

Figure 3.3 illustrates the average weights given by the different groups to the general criteria (level 2). Notice that there are no differences between the weights given by "CN" and "ISO 14001" firms, both of which declare to consider both criteria equally important.

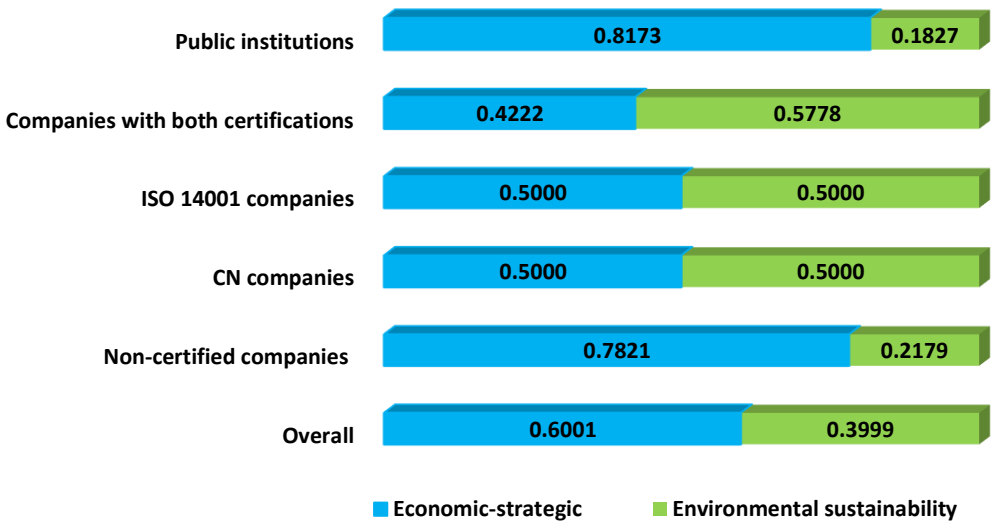

Figure 3.3 Weights' vector of criteria by respondents' subgroup

The only group that gave larger importance to environmental sustainability (0.58) than to the economic-strategic criterion (0.42) is the one of firms that hold both certifications. This contrasts with firms without any of the certifications, which consider the economic-strategic criterion, by far, the most important one. We can interpret this difference as the former group being more concerned with sustainability, which is consistent with their decision to adopt more than one certification. As noted above, it was reported that ethical and environmental concerns are becoming more and more relevant for practical decisions in companies. In our respondents, this feature is particularly visible in the groups of certified companies, while the group of non-certified ones seem to be more concerned about more traditional, economic, and strategic factors. Inevitably, such priorities are institution-specific. Probably, if the answers were from other entities such as the Ministry of Tourism or Environment, the answers would be different, but those institutions were not among our respondents

It is not so intuitive that the respondents belonging to public institutions constitute the group that give more importance to economic-strategic issues and less to environmental sustainability. One possible explanation for this fact is the existence of important legal and

administrative barriers and rigidities in the management process of those institutions. Each of the consulted public entities has a delineated annual budget under which it must meet strategically defined and evaluated objectives (Muñoz, 2018). Thus, they may consider environmental sustainability a complement rather than their central target, as they have other defined priorities, which are probably more directly linked to economic and strategic aspects.

Moving to level 3, Figure 3.4 shows the weights given by different groups to the economic-strategic sub-criteria. This comparison reveals that "public institutions" is clearly the group that gives larger importance to sub-criterion E1 (improving the green image, public visibility, and social legitimacy of the organization), with nearly half of the total weight within the economic-strategic sub-criteria. It is also the most important one for companies holding the ISO 14001 certification (either alone or jointly with CN), although the difference with other sub-criteria is not so pronounced.

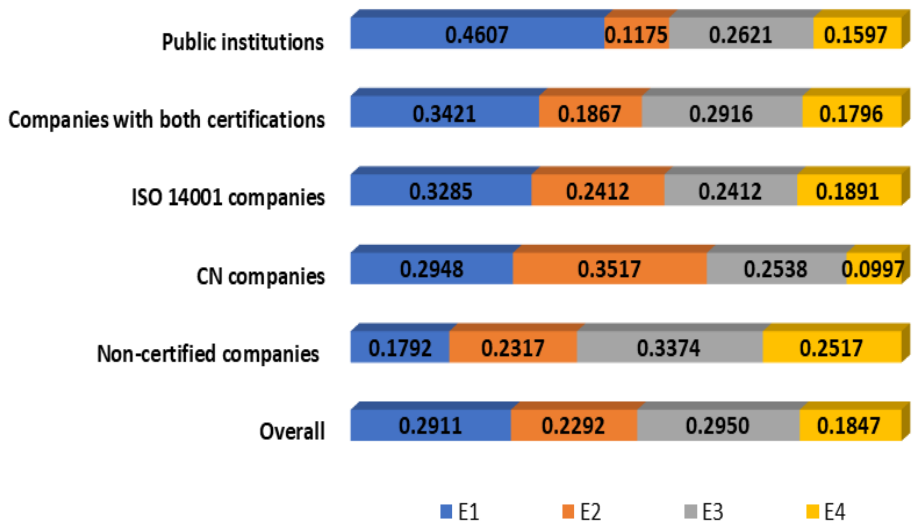

Figure 3.4 Weights' vector of economic-strategic criteria by respondents' subgroup.

Note. For public institutions, we present sub-criterion E2 as "the possible improvements in the quality of the services offered and the increase in user satisfaction".

It is also revealing that "non-certified companies" is the group that gives greater importance to sub-criteria E3 (saving production costs or increasing productivity) and E_4 (the cost of certification and investment in clean technologies). These results seem consistent with their decision of not adopting any of the alternatives, which we can naturally understand as the result of a traditional and purely economic cost-benefit analysis.

Once again, CN and ISO 14001 companies are not very different regarding their assessment of economic and strategic criteria, although it is noticeable that the CN group seems particularly concerned about "increasing sales, market shares or prices" (E_2) and, on the other hand, they attach the smallest importance to the sub-criterion associated with costs (E_4).

Regarding the sub-criteria related to environmental sustainability (see Figure 3.5), those companies holding the CN certification (either alone or together with ISO 14001) are the only ones that give more importance to "reduction in the amount and damage of emissions (gas, solid and water)" (S_2) than to saving materials and energy use (S_1). This is an expected result since the CN certification requires the reduction and/or compensation of the GHG footprint of participating organizations (Dirección de Cambio Climático, 2014). We can argue that CN companies are more concerned about the current environmental threat of climate change (Birkenberg & Birner, 2018), which is more directly linked to polluting emissions than to saving materials and energy. It may be surprising to some extent that the same result does not hold for the public institutions, which are also CN certified. The explanation can be like the one given in level 2 regarding the rigidity of institutional targets and budgets.

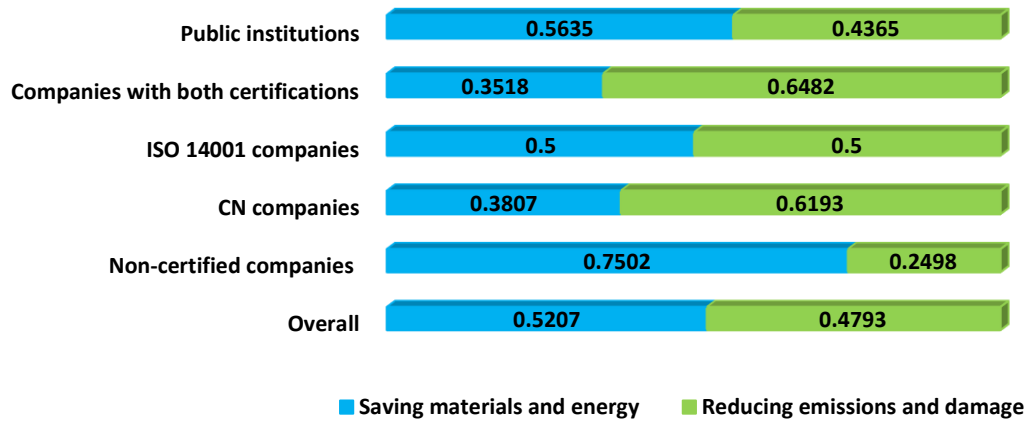

Figure 3.5 Weights' vector of environmental sustainability criteria by respondents' subgroup.

3.4.2.2. Choosing a certification

At level 4, the two proposed certifications are evaluated in terms of the criteria and sub-criteria. Firstly, consider that the decision is made attending only at the economic-strategic criteria and sub-criteria. The results are shown in Figure 3.6. Consistent with their current behavior, CN companies and institutions consider that CN is preferable to ISO 14001 in

economic-strategic terms. The rest of groups consider the opposite, although the differences in this respect are not very large.

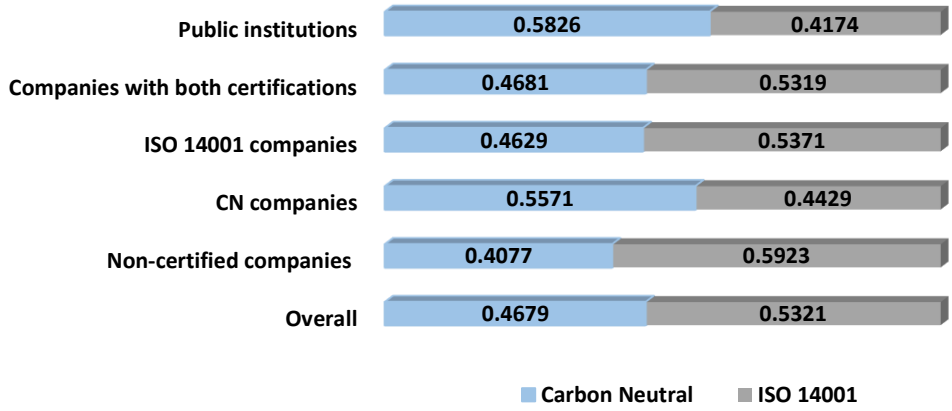

Figure 3.6 Deciding an alternative based on the economic-strategic criteria.

The situation is much clearer when we focus only on environmental sustainability (see Figure 3.7). All the groups consider that CN is clearly preferable to ISO 14001 except for the group of non-certified firms, which slightly consider the opposite. CN certification receives higher scores by all the sub-groups regarding S_2 (amount and damage of emissions), which is consistent with the nature of the CN program as it aims at reducing or offsetting the GHG footprint (see the evaluation of the alternatives according to each sub-criterion on Appendix A Table A3).

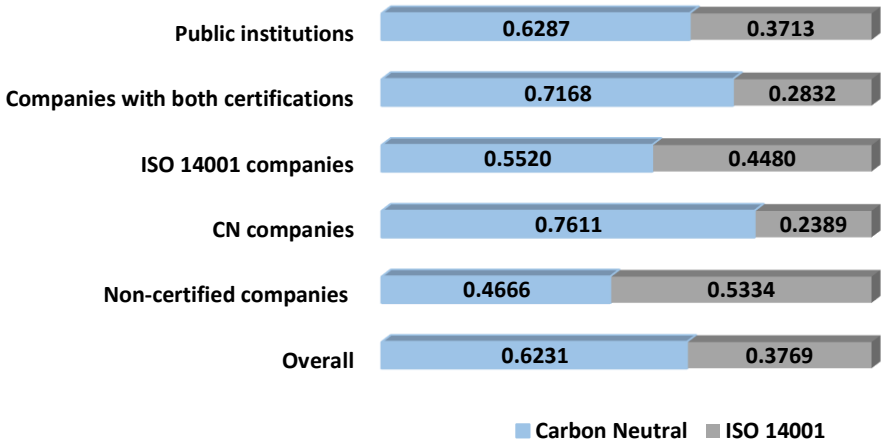

Figure 3.7 Deciding an alternative based on environmental sustainability criteria.

Other expected associated benefits of this program include generating income to pay environmental services to farm owners who maintain forests or arboreal plantations. In addition to capturing carbon emissions, forests generate other environmental services such as biodiversity protection, watershed protection and scenic beauty (Sánchez-Azofeifa et al., 2007).As expected, the relative valuation of the CN certification in environmental terms is particularly notable for those institutions and companies that are CN certified (either alone or together with ISO 14001).

Finally, by using the global weights of all the criteria and sub-criteria, we can determine the most preferred option, as shown in Figure 3.8. Except for the group of companies without any certification, CN always receives higher global scores than ISO 14001. As expected, CN is particularly well considered among those institutions and companies that already adopted it, which we can interpret as a proof of consistency between their reported preferences and their observed behavior. It is remarkable; anyway, that even those companies that adopted only ISO 14001 also attach a marginally higher score to CN than ISO 14001 (roughly, 0.51 vs. 0.49). Although this is not a strong result, the fact that these firms do not give a higher score to the certification that they adopted is already a surprise.

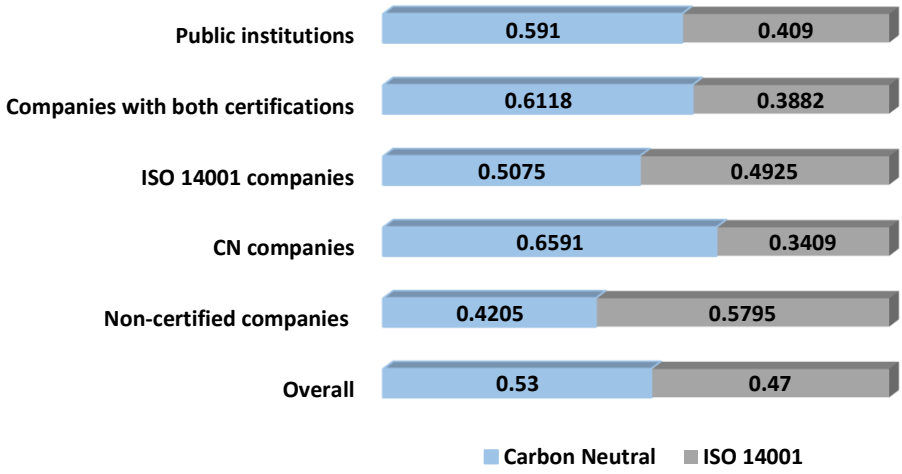

Figure 3.8 Deciding an alternative based on environmental sustainability and economic-strategic criteria.

This counterintuitive result merits some explanation. One partial reason is that on average, "ISO 14001" companies considered that CN certification was clearly preferable to ISO 14001 as regards sub-criterion S_2, "amount and damage of emissions" (0.74 vs. 0.26), which has a reflection in the final score. Moreover, two of the companies in the ISO 14001 group obtained this certification more than 18 years ago, when climate change and carbon emissions

were not considered to be important as they are today, and the CN program did not even exist. Our findings suggest that their certification decision would not be necessarily the same if they had to decide right now for the first time.

As a future extension of this analysis, it would be interesting to perform a more detailed analysis of how different firms' characteristics influence their preferences and propensity to adopt each certification. A statistically significant test would require a larger sample and is beyond the scope of this chapter but, to have a glimpse, in Appendix A Figure A1 we show a preliminary approach by splitting our group of respondents, in two different ways: By size (large vs. small and medium, where "large" means more than 100 employees) and by sector (industry vs. services). The distinction in terms of size does not seem very relevant in qualitative terms in the sense that both groups of firms (large and small-medium) give a larger aggregate score to CN than ISO 14001 but, in quantitative terms, small and medium firms tend to have a more pronounced preference towards CN, while for larger companies there is almost a tie between both certifications. On the other hand, the activity sector seems to matter in qualitative terms since the service sector (where we included the relevant companies and the two public institutions in our sample) turns out to prefer CN while manufacturing companies give a higher score to ISO 14001 than to CN. Given the limited number of respondents and the possible interactions among different effects, these results should be taken with care, but they provide us with useful hints for future developments.

3.5 Conclusions

Both environmental sustainability and economic-strategic aspects appear to be important for Costa Rican organizations (firms and public institutions) when adopting an environmental certification. The group of firms and institutions that participated in our AHP study reported that on average, they consider the economic-strategic criterion more important than environmental sustainability. When considering both criteria with their corresponding weights, the CN certification is preferred, on average, to ISO14001. We can consider this result as a reflection of the increasing concern about climate change and the impulse given by the Costa Rican Government to the CN Program.

By splitting the respondents into groups, we find that the environmental sustainability criterion is the most important one only for firms that hold both CN and ISO 14001 certifications, which is consistent with their observed behavior.

In economic and strategic terms, ISO 14001 is considered superior to CN, except by those companies and institutions that are CN (and not ISO 14001) certified. On the other hand, the CN certification received, on average, a much higher score in terms of environmental sustainability by all groups of certified organizations and institutions (CN or ISO 14001). This clear preference under the environmental component makes CN be the preferred almost unanimously across different subgroup of respondents.

One central conclusion is that presently, environmental sustainability is becoming more and more relevant in managers′ decisions. Considering this criterion apart from purely economic and strategic ones can lead them to implement deeper environmental improvements, such as carbon neutrality.

Although AHP is a decision methodology designed to rank alternatives and ultimately choosing among them, it is important to underline that the two certifications that we considered are not mutually exclusive. On the contrary, they could be complementary in improving the environmental performance of organizations.

3.6 Appendix A

Table A1. Managers interviewed face-to-face in Costa Rica about companies' reasons to get environmental certifications

Number of interviewees*	Position	Activity	Environmental certifications	Interview day
1	MM	Industrial	CN, ISO 14001, EBF	09/09/2016
2	MM, EM	Financial	CN, ISO 14001	22/09/2016
2	CSRC, EM	Car Sales	CN, ISO 14001	13/09/2016
1	CSRC	Car Sales	CN, ISO 14001	16/08/2017
1	MM	Industrial	ISO 14001	11/08/2017
1	MM	Internal Audit	ISO 14001, EBF, OHAS 18000.	17/08/2017
1	MM	Financial	CN, ISO 14001	18/08/2017
1	GM	Agricultural	Fairtrade, Eco-LOGICA, USDA organic	22/08/2017
1	GM	Travel agency	CST, CN, EBF	23/08/2017

Notes: GM-General Manager, MM—Management Manager, EM—Environmental Manager, CSRC—Corporate Social Responsibility Coordinator, CST—The Costa Rican Certification for Sustainable Tourism; CN-Carbon Neutral, EBF—Ecological Blue Flag. * The name of the interviewees and companies are omitted for the sake of anonymity.

Table A2. Position of the questionnaire respondents and companies' features.

Respondent position	Activity	Size	Certifications	
			CN	ISO 14001
EM	Construction	L	Yes	Yes
EA	Energy	L	Yes	Yes
MM	Information and communication	L	Yes	Yes
MM	Pharmaceutical industry	L	Yes	Yes
EM	Internal Audit	L	Yes	Yes
MM	Industrial	M	Yes	Yes
CSRC	Car Sales	L	Yes	Yes
MM	Education*	L	Yes	No
CSRC	Pension Fund Administration	L	Yes	No
Sub MM	Machinery sales	M	Yes	No
EM	Food Industry	M	Yes	No
HRM	Tourism Agency	M	Yes	No
EM	Government Department*	L	Yes	No
MM	Technology	L	No	Yes
EA	Agriculture	M	No	Yes
MMa	Industry	N.A.	No	Yes
MM	Industry	M	No	Yes
GM	Food Industry	L	No	No
MMa	Consulting services	S	No	No
N.A.	Manufacture	M	No	No
MM	Commercialization	S	No	No
MM	Food Industry	M	No	No
GM	Food Industry	M	No	No
MM	Industry	L	No	No

Notes: Position: EA-Working into the environmental area, GM-General Manager, HRM-Human Resources Manager, MMa-Market Manager, MM- Management Manager, EM-Environmental Manager, CSRC- Corporate Social Responsibility Coordinator.

Size: S-Small (less than 5 employees), M-Medium (between 6 and 100 employees), L-Large (more than 100 employees). * Public Institutions

Table A3. Deciding an alternative based on different individual criteria.

Groups	**Overall**		**Non-certified firms**		**CN firms**		**ISO 14001 firms**		**Firms with both certifications**		**Public institutions**	
Sub criteria	CN	ISO 14001	CN	ISO 14001	CN	ISO 14001	CN	ISO 14001	CN	ISO 14001	CN	ISO 14001
E_1	**0.5522**	0.4478	**0.5397**	0.4603	**0.6271**	0.3729	**0.5319**	0.4681	0.4442	**0.5558**	**0.8093**	0.1907
E_2	0.3509	**0.6491**	0.3290	**0.6710**	**0.5432**	0.4568	0.4633	**0.5367**	0.2643	**0.7357**	0.2052	**0.7948**
E_3	0.4151	**0.5849**	0.2901	**0.7099**	**0.5114**	0.4886	0.3660	**0.6340**	**0.5895**	0.4105	0.2240	**0.7760**
E_4	**0.5645**	0.4355	**0.5439**	0.4561	**0.5157**	0.4843	0.4663	**0.5337**	**0.5285**	0.4715	**0.7948**	0.2052
S_1	**0.5137**	0.4863	0.4091	**0.5909**	**0.7180**	0.2820	0.3660	**0.6340**	**0.5832**	0.4168	**0.5000**	**0.5000**
S_2	**0.7419**	0.2581	**0.6392**	0.3608	**0.7876**	0.2124	**0.7380**	0.2620	**0.7893**	0.2107	**0.7948**	0.2052

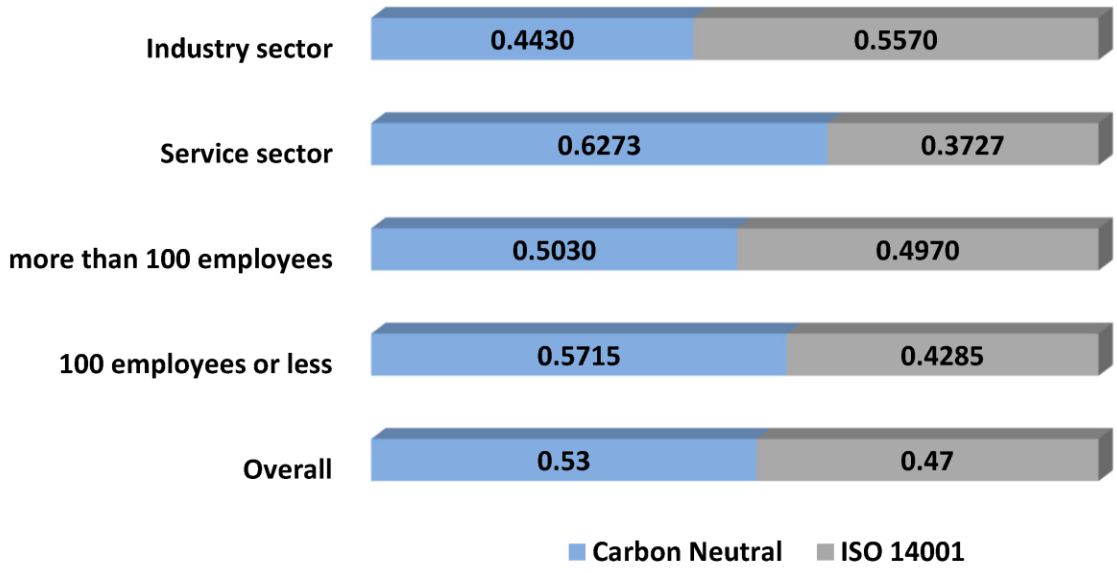

Figure 3.9 Deciding an alternative based on environmental sustainability and economic-strategic criteria. According to sector and size of the organizations.

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Part II: Consumers' recognition of voluntary environmental certifications

Chapter 4: Carbon Neutral organizations in Costa Rica: Sustainable management, media coverage and consumers' recognition [2]

Abstract: This chapter investigates the media coverage of companies and institutions participating in the Carbon Neutrality Program (CNP) in Costa Rica and the extent to which such media coverage determines the consumers' recognition of those companies. Online newspaper articles between 2013 and 2016 referring to Carbon Neutral (CN) companies were reviewed, identifying the benefits perceived and the actions taken by participants in the CNP. A survey (n=387) was used to assess the consumers' recognition of CN companies. The differences between highly and scarcely cited organizations and between recognized and not recognized ones are tested non-parametrically. The main actions propitiated by the program include offsetting carbon emissions, replacement of polluting inputs by cleaner ones and employees' training. The main benefits are reducing costs, improving organizations' image, and market differentiation. Highly cited organizations tend to be those that were certified earlier and have a larger number of certifications. No significant differences regarding age or size were found between highly cited and scarcely cited organizations. Recognized organizations tend to be those that have been cited more often in the press; also, they tend to be older, larger, and certified sooner.

Keywords: Media coverage; public recognition; green image; sustainability.

4.1 Introduction

Voluntary approaches for environmental policy (VEAs) are non-coercive instruments in the sense that they do not involve any punishments for entities that do not adopt them, and the companies' decisions are not formally enforced by a regulatory agency or law (Higley *et al.*, 2001; Khanna, 2001; OECD, 2000). "VEAs provide pragmatic responses to new policy problems, namely the need for more flexible ways to achieve sustainability, and the need to consider the rising concerns about industrial competitiveness and the increasing administrative burden" (OECD, 2000, p. 9).

[2] This article is being evaluated in INNOVAR

Carraro and Lévêque (1999), Khanna (2001) and OCDE (2000) classified VEAs into three broad categories according to the nature of government intervention: First, *Public voluntary programs* are established by environmental regulators to invite firms to voluntary improve their ecological performance related to greenhouse emissions, efficiency in the use of materials and energy, recycling process, environmental education, among others. Second, *Bilateral initiatives* between a firm or group of firms and a public authority. Finally, *Unilateral initiatives* in which industries or companies act independently without any involvement of a public authority; for example, by improving their own environmental codes or registering with a certifying organization.

Although adopting a VEA entails some burden for firms, such as the need to perform technological changes and bearing auditing and certification costs (Babakri et al., 2003; Ho et al., 2016; Ormazabal and Sarriegi, 2014; Santos, et al., 2016; Yiridoe et al., 2003) it also brings some benefits in terms of improving the company's image, enhancing visibility and public recognition (Hillary, 2004; Mariotti et al., 2014; Morrow and Rondinelli, 2002; Yiridoe et al., 2003) including the case of some VEAs in Costa Rica (see e.g. André and Valenciano-Salazar, 2020; Blackman, et al., 2014; Prado et al., 2004; Rivera, 2002).

In order to take advantage of this positive image effect in terms of social legitimacy and public recognition, the companies that adopt VEAs will naturally seek ways to inform the society about their environmental actions. This can be accomplished through different channels, such as press releases, newsletters, awards (Aerts and Cormier, 2009; Khanna, 2001), reports and social media activity (Reilly and Larya, 2018) and through companies' websites (Bansal and Bogner, 2002; Wang, 2016). Newspaper articles are also an important channel to communicate the environmental actions of companies and public institutions (see, e.g. Aerts and Cormier, 2009; Carroll, 2013; Haddock-Fraser, 2012; Jonkman *et al.*, 2020).

In this chapter, we focus on the Costa Rican online newspapers' coverage of the Carbon Neutrality Program (CNP), and more specifically, the environmental actions carried out by Carbon Neutral (CN) organizations and the benefits perceived by them because of joining the program. To this aim, we searched and analyzed the newspaper articles that cited CN organizations from 2013 to 2016 and identified the main topics addressed in these articles.

In Costa Rica, the Government has been making great efforts to promote the CNP (Ministerio de Ambiente y Energía, 2018). However, to the best of our knowledge, a systematic analysis about the media coverage of this program has not been done yet and the relation between

media coverage and consumers' recognition of CN-certified organizations has not been studied either.

From a statistical point of view, we address two related questions. First, we wonder about the features of the certified firms that determine their level of media coverage. We have grouped CN organizations in "highly cited" (those that were cited in press articles a number of times equal to or above the median) and "scarcely cited" (those below the median) and test if there are significant differences between both groups.

Second, we wonder to what extent the fact of being cited in the press has an influence on the consumers' recognition. To shed some light on this question, in 2017 we have conducted a survey (n=387) about Costa Ricans ability to named certified entities. Then, we grouped CN organizations between recognized and unrecognized by consumers; and we sought for differences between both groups of CN organizations according to their features as well as the number of articles in which they were cited. In this way we try to determine if the firms and organizations that are more recognized by consumers as "Carbon Neutral" tend to be those that are more cited in the press.

The rest of the chapter has the following structure. In Section 2 we present a background of the CNP, the media coverage of the ecological actions and the improvement in the green image of organizations. Section 3 presents our methodology about the data sources and variables, the selection of press articles, the description of the survey and the non-parametric statistics. Section 4 presents and discuss our findings, finally Section 5 concludes.

4.2 Background

4.2.1 The Carbon Neutrality Programs in Costa Rica

The CNP can be considered as a public voluntary program. It was introduced in Costa Rica in 2012 in accordance with the government strategy of moving towards a low carbon footprint development model (see, e.g. Flagg, 2018; Musmanni, 2014). This program seeks to encourage companies and public organizations, first to measure their greenhouse gas emissions, and second, to develop strategies to reduce, capture or compensate them (Ministerio de Ambiente y Energía and Instituto Meteorológico Nacional, 2015). After being successfully certified by a validating company, the companies and institutions that take part in the CNP obtain a declaration issued by

the Government of Costa Rica called "Carbon Neutral Declaration" (Dirección de Cambio Climático, 2014; Ente Costarricense de Acreditación, 2014; Musmanni, 2014), which, to use standard terminology, we will also refer to as "Carbon Neutral Certification".

The number of entities opting for the CN certification has noticeably increased since its introduction. In 2012, the year in which this program started, only 2 firms adopted it, while as of December 2016 there were 77 certified entities (Ministerio de Ambiente y Energía, 2018), 74 of them were companies.

In this program, all the emissions of greenhouse gases from each organization are measured in carbon equivalent units. Every institution has three mechanisms to obtain the CN certification, namely, i) reducing the amount of emissions, ii) capturing and storing emissions in carbon sinks located in its own lands or iii) offsetting their emissions by purchasing carbon credits (Dirección de Cambio Climático, 2014; Flagg, 2018; Monge R., 2014). Moreover, an external certifying agency must verify that the information showed by entities is true. Finally, all the information is checked by the Costa Rican Climate Change Department.

4.2.2 Carbon Neutral Programs: Empirical experiences

Other countries have enacted CNPs as a policy instrument for environmental sustainability. However, only a few studies have shown in empirical terms the economic and environmental improvements that these programs have on companies.

In Queensland, Australia, Zeppel and Beaumont (2013) showed that motivations for tourist companies to participate in carbon offsetting programs were related to environmental concern, commercial benefits of climate friendly tourism, and financially supporting offset projects. Okereke (2007) argued that the first motivation underpinning companies' carbon management programs in the UK is profit enhancement, especially due related to cost savings and more efficient technologies, as well as improving their green reputation.

In terms of companies' environmental sustainability, there are mixed results. Wen-Tien (2017) found that energy-saving and carbon-reduction policies were successful in curbing carbon emissions in the Taiwan High Speed Rail Corporation. Hao *et al.* (2015) got similar findings for carbon neutral's wastewater treatment plants in China. However, Birchall *et al.* (2015) concluded that carbon accounting is not necessarily an evidence of organizational action or climate change abatement in New Zealand.

Ball *et al.* (2009,p. 575) in a comparative analysis of the adoption of carbon neutral programs by public institutions in three countries - New Zealand, the United Kingdom and Australia – reported that the implementation process for carbon neutrality is not sufficiently understood, there is a need to identify and critically examine the 'offset threshold' at which mitigation efforts cease and offsetting is adopted; and there is also an absence of any evaluation of the 'leading by example' rationale.

In Costa Rica, André and Valenciano-Salazar (2020) conclude that the economic-strategic criteria and environmental sustainability have a similar level of importance for companies when they decide to participate in the CNP. In economic-strategic terms, companies seek market differentiation, a green image and cost savings; while the criteria of environmental sustainability are related to the reduction of emissions and damages and the saving of materials and energy.

4.2.3 Media coverage as a communication channel

Communication and reputation are widely recognized as important factors that influence the public perception of an organization (Karnaukhova and Polyanskaya, 2016). Therefore, companies have a strong incentive to look for ways to convey information about their environmental and social behavior in order to build a good reputation (Dowling, 2001).

Media coverage patterns reflect but also affect the process of recognition and reputation of companies (Rindova *et al.,* 2007). In other words, mass media are one way through which the consumers learn about companies and organizations, even those they are not familiar with (Carroll and McCombs, 2003). As Carroll (2013) argued, the news media enable people to learn about the issues they care about but are not easy to personally observe, such as corporate social responsibility, innovation, or environmental performance.

Previous empirical research has shown that public recognition and the reputation of companies are linked to their media coverage. Rindova *et al.* (2007) explored how three well-known Internet sales companies built their reputation through visible actions that were systematically covered by the media. Einwiller *et al.* (2010) found that stakeholders rely on the news media to learn about certain dimensions of the companies' reputation that are difficult to directly observe or measure. Haddock-Fraser (2012) found that companies that directly provide goods or services to the end consumer can promote their positive environmental activities to the public through newsprint media, thus leveraging opportunities for reputation enhancement.

Hamilton (1995) concluded that companies with a negative environmental performance can be penalized by media news that highlight their polluting behavior.

Newspapers can also be particularly effective in driving the community's concern about the environmental performance of organizations (Brown and Deegan, 1998; Carroll, 2013) and a channel to report current environmental problems like climate change effects in several countries such as China (Han *et al*., 2017), Canada (Stoddart *et al*., 2017), the United States, Argentina, Brazil and Colombia (Zamith *et al*., 2012).

4.3 Methodology

4.3.1 Selection criteria for press articles and the consumers' survey

We have explored online press articles published in Costa Rican newspapers from January 1st, 2013 to December 31st, 2016. The sample period began in 2013 because the CNP started in 2012 and only 2 companies achieved certification at the end of that year. In addition, we assumed that the program was not yet well known by the media in 2012.

We build an indicator of coverage in press articles (CPA_i) for each certified organization. This indicator measures the number of articles that each organization (i) is cited. For this purpose, we have selected those articles that meet the following two criteria: first, each article must mention at least one certified entity, and second, it must refer to the actions carried out or the economic benefits perceived by firms or organizations due to the CN certification.

After concluding the review of the press articles, we performed a consumer' survey about the recognized level of CN organizations in 2017. We used a stratified sampling approach, according to the distribution of provincial population and gender in order to obtain a representative sample of the Costa Rican population over 18 years old.

We randomly approached people in public places and invited them to answer the two following questions: i) "*Do you know what the CNP is?*" and ii) "*Can you name companies or institutions that achieved the CN certification? Name the ones of them that you remember now*". 387 face-to-face surveys were completed. The variable about the public recognition (Pr_i) was constructed based on the latter question.

4.3.2 Company data sources

We used data from different sources. The list of CN organizations as of December 2016 and the year of certification for each of them were taken from the website of the Costa Rican Climate Change Department (Ministerio de Ambiente y Energía, 2018). In 2017, we identified the number of environmental certifications obtained by each organization from their websites and from the Institute of Technical Standards of Costa Rica website (INTECO, 2016). The age of each entity in 2017 was obtained from the websites of certified organizations and information published in newspaper articles. The media coverage of each CN organization was computed through our own inventory and analysis of press articles published between 2013 and 2016.

The number of workers per company was collected from different sources because there is no an available uniform database; the Institute of Statistics and Censuses of Costa Rica (INEC, 2019) provided information for 65 companies, while the information for 10 other organizations was obtained from the websites of the companies themselves, information published in articles and directly from the companies. For 2 companies it was not possible to obtain the data on the number of workers.

Table 4.1 shows the main descriptive statistics of the variables used in our study.

Table 4.1 Descriptive statistics of the variables

Variables	**Description**	**N=77**		
		Mean	Median	SD
CPA_i	Coverage in press: total number of press articles in which entity "i" was cited.	9.73	9	7.72
Cq_i	Number of environmental voluntary certifications held in 2017.	2.31	2	1.24
Age_i	Age in years in 2017.	32.16	27	20.04
Ycn_i	Number of years since CN certified until 2017.	1.96	2	1.12
Pr_i	Public recognition: number of respondents who named organization i.	2.19	0	6.09
W_i*	Number of workers in 2018	399.77	159	749.75

Notes. * Information for number of workers was available for 75 CN organizations.

4.3.3 Non-parametric statistics

4.3.3.1 Correlation among variables

The lack of normality of the data and the presence of outliers (see frequency distribution of variables in Appendix A) leads us to use non-parametric (distribution-free) methods for the statistical analysis. Firstly, the correlations between pairs of variables are calculated using the Spearman Correlation Coefficient (Spearman, 1904), which is a widely used non-parametric alternative to the Pearson Correlation Coefficient (see, e.g., Restrepo and González, 2017; Romijn and Albaladejo, 2002; Sánchez-Gonzalez *et al*., 2017). Although correlation is not enough to demonstrate the existence of causality among variables, this analysis provides us with some intuition about the factors that are connected to visibility and public recognition.

4.3.3.2 Differences between groups of certified entities

In order to study how media coverage is connected to the attributes of CN organizations, we split them in "highly cited" and "scarcely cited" entities in press articles, by making two groups above and below the median of CPA_i (which is equal to 9; see table 4.1) and check how both groups differ in terms of the attributes of the certified entities (Cq_i, Age_i, Ycn_i and W_i) using the Mann-Whitney test (Conroy, 2012). The Mann-Whitney (1947) test is a widely used non-parametric test to compare differences between two independent groups. For example, Capmany *et al.*, (2000), Doyle *et al*., (2007) applied it to compare financial and environmental variables between two groups of companies.

Then, to study how media coverage relates to consumers' recognition (Pr_i), we group CN organizations as "recognized" (those that were named at least once by consumers in the survey) and "unrecognized". Using the Mann-Whitney test, we check to what extend both groups differ in terms of the variables of interest (CPA_i, Cq_i, Age_i, Ycn_i, and W_i).

4.4 Results and discussion

4.4.1 Media coverage and information disclosed

Figure 4.1 shows that both the number of CN organizations and the number of related articles had an increasing trend during the sample period, which seems to confirm the growing relevance of the CNP.

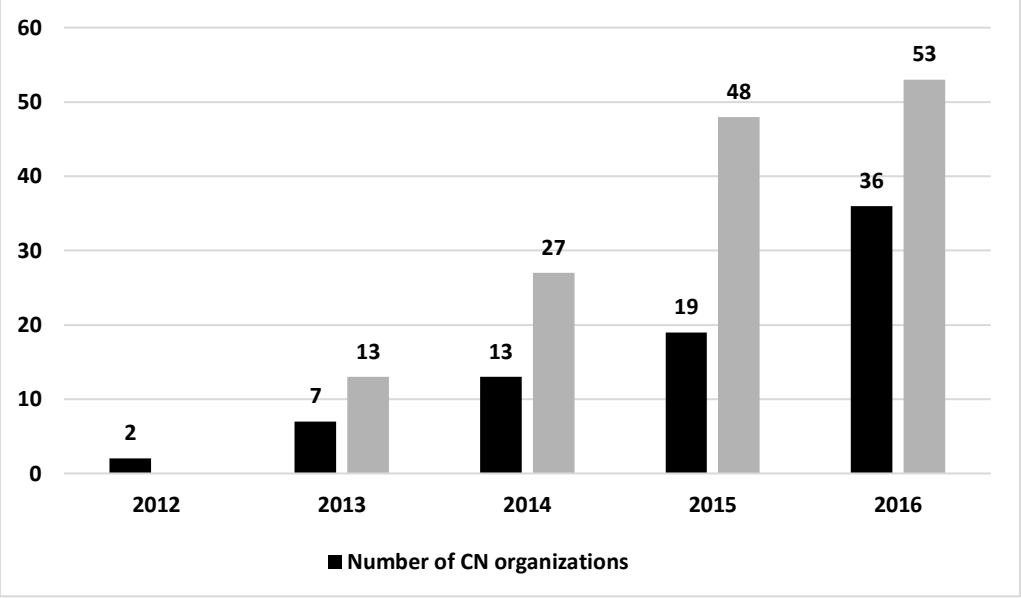


Figure 4.1 Carbon Neutral Organizations certified per year and press articles identified per year in Costa Rica. Period 2012-2016.

In the whole sample period, we found 749 citations of CN organizations in 141 press articles. On average, each entity was mentioned 9.7 times in press articles during the period, but the number of citations is not uniform, with a standard deviation of 7.72 across firms. The frequency of CN organizations by number of articles is shown in Table 4.2. As a general observation, all certified organizations were cited at least once, and 50 percent of them appeared in 9 or more articles.

Table 4.2 Frequency distribution of Carbon Neutral entities by number of articles that cite them.

CPA_i (articles)	**Frequency of CN organizations**		
	Absolute	Relative	Cumulative
1 – 4	29	37.66	37.66
5 – 8	9	11.69	49.35
9 – 12	12	15.58	64.94
13 – 16	9	11.69	76.62
17 – 20	9	11.69	88.31
21 – 24	6	7.79	96.10
25 - 28	3	3.90	100.00
Total	77	100.00	

Source: Own elaboration from press articles analysis.

The information contained in the articles can be grouped into two main categories: the first one refers to the benefits perceived by the organizations. The second category has to do with technological changes and other environmental actions implemented by certified organizations.

Regarding the first group, 51 percent of the articles mentioned some of the benefits or advantages received by the organizations for being CN certified. Specifically, 39 percent revealed that entities reduced their costs or increase their productivity after the certification, 18.4 percent reported improvements of the organizations' image, and 14.2 percent referred to market differentiation due to the CN certification. Concerning cost savings, Table 4.3 shows the top 5 actions highlighted in the press articles.

Table 4.3 Top 5 of cost saving actions of Costa Rican CN organizations (2013-2016).

Company' activity	Source	Cost saving in U.S. $[a]	
		Aspect	Amount
Finance	El Financiero (Fallas, 2016)	Paper, printing, and post saving (electronic sending of information)	776,000/year
Agricultural	La Nación, 2016	Electricity saving	172,500/month
Sports	EKA La Revista Empresarial (Chung, 2015) Elmundo.cr (Angulo, 2015).	Electricity saving	150,000/year
Hotel	El Financiero (Fallas, 2016a); El Financiero (Císneros, 2016).	Gas saving	100.000/year
Finance	El Financiero (Fallas, 2016b)	Electricity saving Water saving Paper saving	28,170/year 23,768/year 7,923/year

Notes. [a] Based on the annual average of exchange rate of the Central Bank of Costa Rica
Source: Own elaboration from press articles analysis.

As for the second category of information, 78.7 percent of the collected press articles mentioned some environmental actions performed by CN organizations, including technological and organizational changes. More specifically, the main reported changes were the following: 41.1 percent of the articles mention that organizations offset emissions through the purchase of carbon credits, 37.6 percent of them inform about the replacement of polluting inputs by cleaner ones, 27.7 percent refer to in job employees' training about more sustainable consumption and production processes, 26.2 percent show how firms accomplished water use reductions or took actions to protect water basins, 22 percent report reductions or substitution of fossil fuels in production and transportation processes. Finally, 16.3 percent of the articles refer to the separation and recycling of waste. Other clean production practices mentioned in the articles were reforestation programs, the installation of solar panels and light-emitting diode lamps (Led lamps).

Table 4.4 shows the top ten investments in technological change and environmental actions reported in the newspapers. The largest ones are related to job employees' training, the installation of solar panels, heat exchangers and Led luminaires.

Table 4.4 Top ten of Costa Rican CN organizations' investments in technological change and environmental actions reported in the press (2013-2016).

Company' activity	**Source**	**Investments in U.S. $**	
		Aspect	Amount ($)
Sports	EKA La Revista Empresarial (Chung, 2015) Elmundo.cr (Angulo, 2015)	864 solar panels. The project consists of 1,728 m2 of photovoltaic panels.	550,000
Hotel	El Financiero (Fallas, 2016a) El Financiero (Císneros, 2016)	Installation of heat exchangers, improving the efficiency on refrigerant equipment	500,000
Car sales	La República (Navas, 2016)	Job employees' training	250,000
Finance	La República (Díaz, 2015)	Installation of Led luminaries	150,000
Gas station	La República (Chaves, 2014)	Installation of solar panels, new luminaries, wastewater treatment system and separation and recycling of waste.	50,000
Hospital	EKA La Revista Empresarial (Chung, 2014)	Installation of solar panels	41,000
Manufacturing	El Financiero (Fallas, 2016b).	New luminaires and solar panels	40,000

Construction	El Financiero (Fallas, 2015); La Prensa Libre (Mesén, 2015).	Led luminaries and job employees' training	33,000
Education	La República (Monge E., 2016)	Water purification plant, new luminaries and improving in electrical system	10,000
Finance	Revista Construir América Central y el Caribe (Rojas, 2016)	Ecological building improvements	3,800

Source: Own elaboration from press articles analysis.

As a first remark, the online press articles reveal that certified companies have invested in new production and distribution technologies to reduce their carbon footprint, while the remaining greenhouse gases have been offset by carbon credits. Thus, at least to some extent, CNP has been a successful sustainability management approach and, on top of that, it has generated some economic-strategic improvements such saving cost and enhancing the green image of participants into the program (see also André and Valenciano-Salazar, 2020). Other voluntary environmental programs have also been shown to improve the environmental management and economic benefits of participating Costa Rican companies to some extent. This is the case of the Costa Rican Certification for Sustainable Tourism (Rivera, 2002), and the Costa Rica's Blue Flag Program (Blackman et al., 2014).

4.4.2 Correlation between the relevant variables

The Spearman correlation analysis displayed in Table 4.5 provides us with a first approach to study how the different variables interact with each other. This analysis suggests that the press coverage (CPA_i) is positively and significantly correlated with the number of certifications (Cq_i) and how long the company has been certified as Carbon Neutral (Ycn_i). Besides, the public recognition of CN organizations (Pr_i) is positively and significantly correlated to their newspaper coverage (CPA_i), the size of the company measured by the number of workers (W_i) and how long the company has been certified as a Carbon Neutral (Ycn_i).

Table 4.5 Spearman's Correlation Matrix Between 77 CN Organizations.

	CPA_i	Cq_i	Age_i	Ycn_i	Pr_i	W_i
CPA_i	1					
Cq_i	0.2844*	1				
	(0122)					
Age_i	0.1292	0.0633	1			
	(0.2629)	(5846)				
Ycn_i	0.8244***	0.3037***	0.1524	1		
	(0.0000)	(0.0072)	(0.1859)			
Pr_i	0.2800*	0.1631	0.1771	0.2479*	1	
	(0.0136)	(0.2967)	(0.1233)	(0.0297)		
W_i	0.1903	0.1653	0.4125***	0.2026	0.3829***	1
	(0.1020)	(0.1565)	(0.0002)	(0.0813)	(0.0007)	

Legend. * p<0.05; ** p<0.01; *** p<0.001; p values in parentheses.

Notes. [a] The correlation between W and the other variables was performed for 75 CN organizations

Based on these correlations, in the next sections we perform two related but different comparisons in statistical terms using the nonparametric Mann-Whitney test: first, we investigate the differences between "highly cited" and "scarcely cited" organizations and, second, we compare "recognized" and "unrecognized" entities.

4.4.3 Media coverage and the organizations' features

By noting that our measure of coverage in press articles (CPA_i) is positively correlated with Cq_i and Ycn_i, we can conjecture, on the one hand, that getting more certifications causes an accumulative positive effect on media coverage and, on the other hand, that those organizations that have held the CN certification for more years also tend to be more visible in the press. In order to confirm these conjectures, we use the Mann-Whitney test to check if there are significant differences between "highly cited" (above the median) and "scarcely cited" (below the median) entities regarding these features.

Our results confirm that there are some statistically significant differences between both groups of organizations (see Table 4.6). Specifically, highly cited organizations tend to obtain CN certification before than scarcely cited ones. This result is determined by two factors. The first one responds to the fact that those entities that were not certified at the beginning of the CNP could not be cited as such in the newspapers. The second factor is less obvious and more interesting for our purposes: given that the CNP began in 2012, the environmental sustainability actions carried out by the first certified organizations were considered as innovative news by the journalists. These innovative companies have been a reference for the media throughout the sample period.

Table 4.6 Mann-Whitney test for differences between highly and scarcely cited CN organizations.

	Highly cited organizations (n=39)			**Scarcely cited organizations (n=38)**			**Test**	
	Median	Mean	SD	Median	Mean	SD	Z	p-value
Cq_i**	2	2.62	1.25	2	2	1.16	2.328	0.0199**
Age_i	31	34.18	18.43	24.5	30.08	21.62	1.504	0.1327
Ycn_i***	3	2.72	1.05	1	1.18	0.46	6.505	0.0000***
[a] W_i	195	495	837	90	302	645	1.754	0.0794

Legend. * p<0.1; ** p<0.05; *** p<0.001. Z describes the position of a raw score in terms of its distance from the mean when measured in standard deviation units.

Note: [a] When testing W_i the group sizes are 38 and 37 respectively.

In addition, highly cited CN organizations are prone to have a larger number of environmental certifications than scarcely cited organizations. One interpretation of this result is that additional certifications may have a cumulative impact on the green image and visibility of the firms and organizations. This additional information in terms of environmental certifications may help the media find out and become more interested about those companies and institutions.

Regarding age, while highly cited organizations are, on average, older than the scarcely cited, this difference is not statistically significant. In a similar fashion, Jonkman *et al.* (2020) also found a not statistically significant relationship between firms' age and media coverage in the case of 100 large corporations in the Netherlands. On the other hand, it can also be surprising to some extent that we find no significant differences in terms of size between highly cited and scarcely

cited organizations. This contrasts with Jonkman *et al.* (2020) who found out that the largest Dutch companies received more visibility on newspapers. Since our study is not focused on all the companies, but only in CN-certified ones, it seems that the size of the company becomes less important for the sake of media coverage.

4.4.4 Media coverage and consumers' recognition

Our last research question has to do with the reward of firms in terms of consumers' recognition. As discussed in the introduction, one of the aims of firms when adopting a voluntary certification is to improve their image among consumers. Thus, it seems natural to wonder to what extent the newspaper coverage that CN organizations get thanks to the certification has a reflection in terms of recognition by consumers. Additionally, we can also ask if there are other factors (apart from media coverage) that have an impact on consumers' recognition. To answer these questions, we use our survey in which we measured the number of people who name each CN organization.

As a general result, 34 CN organizations (out of 77) were correctly named by at least one respondent, of which 14 companies were named by one respondent, 7 companies were named by 2 respondents, and 11 companies were recognized by 3 or more. Since more than half of the organizations were not named by any consumer, one first conclusion from the survey itself is that there is still a long way to go in the communication of environmental initiatives of firms to the society.

Regarding the impact of media exposure on consumers' recognition, the correlation analysis shown above suggests that both variables are positively correlated as expected. Moreover, the ability of consumers to identify certified firms seems to increase with the number of years that the organizations have been holding the certification.

As an additional check, we split the sample of organizations in "recognized" ($Pr_i \geq 1$) and "unrecognized" ($Pr_i = 0$) and used the Mann-Whitney test to determine if both groups are statistically different in terms of the variables of interest (see Table 4.7).

Table 4.7 Mann-Whitney test for differences between recognized and unrecognized CN organizations

	Recognized organizations (n=32)			Unrecognized organizations (n=45)			Test	
	Median	Mean	SD	Median	Mean	SD	Z	P
CPA_i**	13	12.07	7.90	8	8.07	7.23	-2.386	0.0170**
Cq_i	2	2.5	1.22	2	2.18	1.25	-1.296	0.1950
Age_i*	31.5	37.21	21.90	24	28.55	18	-1.774	0.0761*
Ycn_i*	2	2.22	1.21	1	1.78	1.02	-1.661	0.0968*
[a]W_i***	272	723	1049	159	70	200	-3.482	0.0005***

Legend. * p<0.1; ** p<0.05; *** p<0.001.

Note. [a] For W_i variable there are two less individuals in unrecognized organizations sub-group.

The Mann-Whitney test reveals that newspaper coverage is significantly different between both groups, and so the test confirms that recognized CN organizations tend to be those that have been cited more often in the press. This evidence seems in line with the belief that the press is one of the main channels by which organizations can gain public recognition as a reward for their ecological actions, insomuch as the frequent use of the Internet and cell phones in Costa Rica facilitates the dissemination of online articles. According to the World Bank (2018), 100% of the Costa Rican population has access to electricity, the mobile cellular subscriptions (per 100 people) are about 180, and 72% of the citizens have used the Internet (from any location) in the last 3 months.

As expected, "recognized organizations" tend to be larger in terms of number of employees (W_i) despite the fact that (as we concluded above) larger organizations do not appear significantly more often in the press. This result suggests that larger firms tend to be more recognized per se, without the need of receiving larger media coverage.

Regarding other differences between both groups, recognized entities also tend to be those that obtained the CN certification sooner than unrecognized entities, which probably means that there is a reward in terms of public recognition for companies that took the risk of taking part in the program first. Finally, recognized CN entities tend to be older than unrecognized ones, which

may be related to the fact that the oldest companies probably have greater loyalty from consumers that are concerned about the environmental actions that they carry out.

4.5 Conclusions

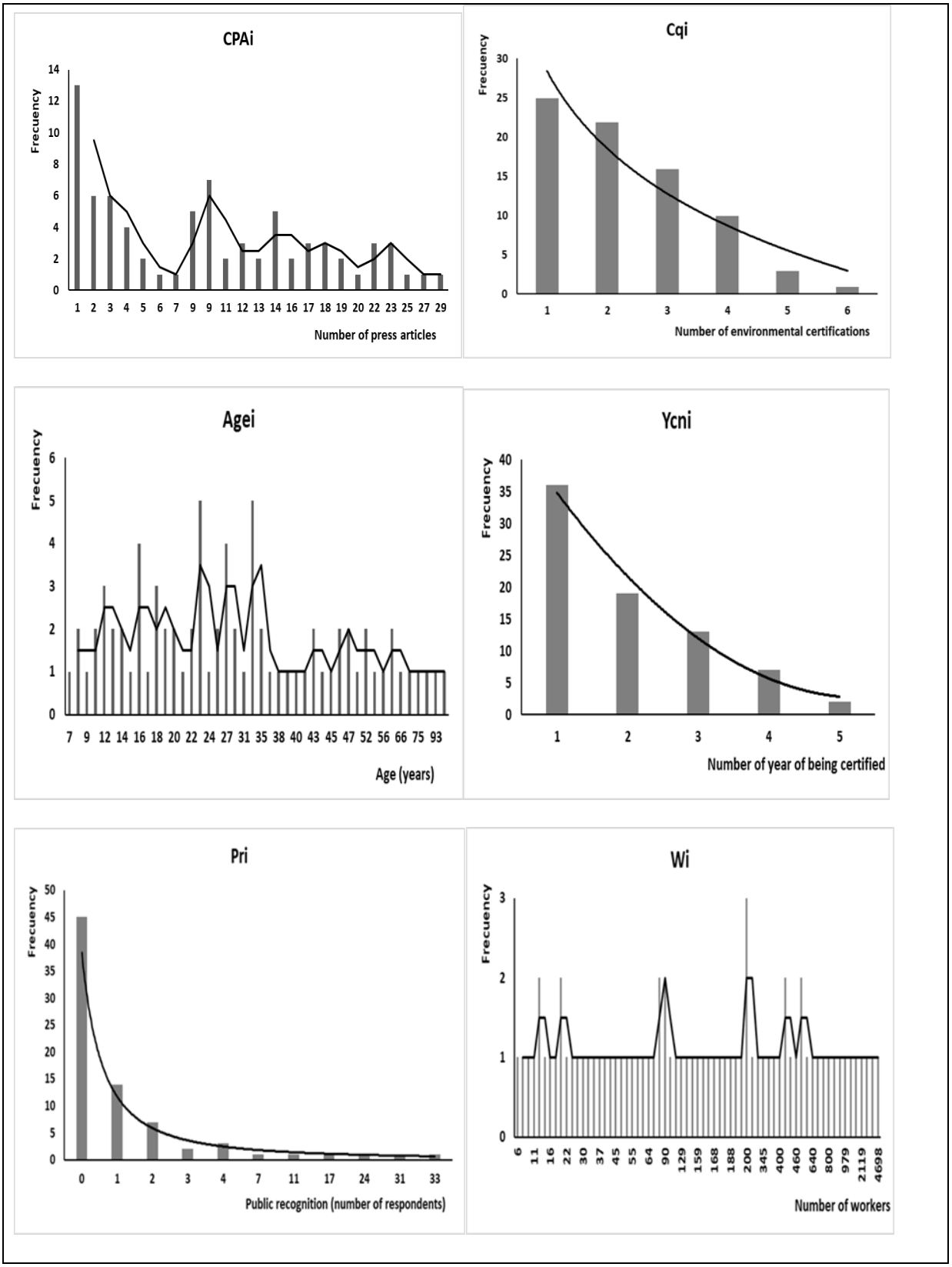
Since the introduction of the CNP, the media has reported about the environmental actions of companies participating in this program. Our results are consistent with the common belief that communication media have become an important channel to inform about the green companies and their environmental behavior.

Although getting the CN certification entails some costs for organizations such as the purchase of carbon credits, administrative costs, verification costs, technical changes, in-job training among others; entering the program can also generate some important benefits. According to our press articles inventory, the most common benefits for CN organizations were cost saving or increasing productivity, improvement of the organizations' image and market differentiation. Online newspapers also report that CN organizations invested in new technologies and took actions to improve their environmental performance. Thus, to some extent, our study supports the claim that CNP is a flexible and effective instrument of environmental policy that can help to improve both the environmental and economic management of the participants.

In statistical terms, we conclude that, as expected, there is a correlation between media coverage and consumers' recognition. This is in line with other previous studies stating that media visibility, improvement of the image and reputation of the company are some of the main motivations why companies decide to adopt voluntary environmental actions.

Regarding the relation of companies' features with their visibility and recognition, we conclude that highly cited organizations tend to be those that have a larger number of certifications. Although no significant differences between highly cited and scarcely cited organizations were found regarding age or size, these features seem to matter for the sake or recognition, since recognized organizations tend to be older and larger. The moment in which each organization was certified appears to be a relevant discriminating variable both for visibility and recognition. Highly visible and recognized organizations tend to be those that were certified earlier.

Appendix A: Relative frequency distributions of variables



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Chapter 5 Knowledge of voluntary environmental certifications: analyzing the consumers' profile in Costa Rica[3]

Abstract: Environmental voluntary approaches can improve the environmental performance, enhance the green image, and expand the public's recognition of companies that adopt them. The effectiveness of these voluntary initiatives depends on the ability of consumers to recognize and appreciate them, which can be enhanced by means of voluntary certifications. Using a large sample (n = 1191), the research analyzes the profile of consumers who are aware of the environmental certifications available to companies in Costa Rica. A differentiation between "general knowledge" (being able to identify the certifications) and "specific knowledge" (ability to identify certified firms) was made. Using probabilistic models, the research concludes that consumers with higher household income, with a university or technical degree and those participating in environmental or community groups are more likely to have better general and specific knowledge. In addition, age is slightly and negatively related to the probability of having such knowledge. These results can help design public policies to improve consumers' awareness, improve companies' implementation of environmental certifications and design marketing strategies.

Keywords: voluntary approaches; environmental programs; environmental certifications; environmental knowledge; corporate sustainability.

5.1 Introduction

Voluntary approaches to environmental policy are commitments from firms in improving their environmental performance that are not *de jure* required (Carraro and Leveque, 1999). These commitments usually take the form of Unilateral Initiatives or Voluntary Environmental Programs. In the former, firms act independently without any involvement of a public authority; for example, by improving their own environmental codes or registering with a certifying organization, such as the International Organization for Standardization (ISO). In Voluntary Environmental Programs,

[3] This chapter is under the second stage evaluation in Journal of Cleaner Production

firms agree on commitments or standards developed by some public environmental agency (Khanna, 2001; OECD, 2000).

Empirical evidence shows that, on top of the environmental benefits expected from these voluntary initiatives, the firms that adopt them can obtain important private side-benefits, such as getting technical assistance and information from environmental agencies (Darnall & Sides, 2008; Klooster, 2005), saving production costs and improving its green image and public recognition (see, e.g. André and Valenciano-Salazar, 2020; Hillary, 2004; Mariotti et al, 2014; Ormazabal and Sarriegi, 2014; Zeng et al., 2005).

Firms that adopt some voluntary approaches can receive a so-called Voluntary Environmental Certification (VEC). Such certifications can play a key role to help customers recognize and appreciate these voluntary initiatives and, ultimately, make them more effective (see e.g. Chekima et al., 2016; Maniatis, 2016; Van Loo, et al., 2015). Many studies in the literature show that consumers are increasingly concerned about the quality of the environment in general and the sustainability of companies' practices in particular. Most of these studies are conducted in developed countries (see Section 2), where environmental policies tend to be better established. Nevertheless, many developing countries are also fostering environmental policies and consumers in such countries are becoming more aware and concerned. This is the case of Costa Rica, in which this study focuses.

Costa Rica is an interesting case study. On the one hand, it is considered as a developing country but, on the other hand, it is also internationally known for having a very active role in terms of environmental policy, especially in environmental education, ecotourism, and conservation (Blum, 2008; Flagg, 2018). Costa Rican firms have a wide range of available VECs that they can adopt, such as ISO 14001, ISO 14064, Carbon Neutral, Ecological Blue Flag Program, Rainforest Alliance Certified, Organic Certifications, Costa Rican Certification for Sustainable Tourism, Fairtrade Certification and Essential Costa Rica Brand, among others.

Our study has two related aims. First, we investigate to what extent Costa Rican consumers know these certifications and the firms that adopt them. This can shed some light on how relevant voluntary environmental approaches are for Costa Rican consumers. Second, we study how this knowledge depends on the socioeconomic characteristics of consumers, which help us build a profile of the Costa Rican consumer with better knowledge of VECs. This profile can be of interest for two different stakeholders. For firms, this information can help design the market strategy more

efficiently by identifying the target consumers. For regulators, it can help design policies in order to improve consumers' awareness, especially, for those social groups which lag behind at present. The closest study we are aware of in Costa Rica is Aguirre (2007), who investigated the consumer profile of shoppers at the organic farmers market in Costa Rica. However, to our best knowledge, no one has focused on the Costa Rican consumers' knowledge of environmental certifications.

We have conducted a large survey (n=1191) among Costa Rican consumers to investigate their knowledge of VECs in connection to their socioeconomic characteristics. We address consumers' knowledge in two different levels. We refer to the first one as "general knowledge", understood as the capacity of the consumers to name at least one VEC. In the second level, which we call "specific knowledge", we choose a subset of certifications and check the respondents' ability to name at least one company or institution that obtained each of them. In this second level, we focus on three certifications that we consider of special interest in Costa Rica: ISO 14001, Carbon Neutral (CN) and Fairtrade (FT).

The CN Program, which was designed and promoted by the Government of Costa Rica, invites firms and institutions to eliminate or compensate their carbon emissions. By doing so, they can achieve the CN brand (André and Valenciano-Salazar, 2020; Musmanni, 2014). The FT certification involves producers located in developing countries that commit to comply with certain environmental and social standards (see e.g. World Fair Trade Organization & Fairtrade Labelling Organizations International, 2018). Finally, the ISO 14001 certification is adopted by companies that want to implement or improve an Environmental Management System (International Organization for Standardization, 2015). All three have in common that they are voluntarily adopted by companies, they require the fulfillment of certain environmental criteria that must be checked by a certifying entity or arbiter and they are internationally recognized.

The rest of the chapter is structured as follows: Section 2 summarizes the related literature and identifies the hypotheses of our study. Section 3 elaborates on the methodological aspects, including our study area, data collection and model specification. Section 4 presents the econometric results. Section 5 presents a discussion. Section 6 offers some policy implications and suggestions for future research. Finally, Section 7 shows conclusions.

5.2 Literature review and hypotheses

5.2.1. Environmental knowledge and behavior

A key concept of our study is *environmental knowledge*, understood as what people know about the environment, including key relationships, different environmental impacts, and actions necessary for environmental sustainability (see, e.g., Mostafa, 2007: 221). Some studies have found a positive relationship between environmental knowledge and ecological behavior and attitudes of consumers (see e.g. Arcury, 1990; Hayes, 2001; Haron et al., 2005; Olli et al. 2001; Schahn & Holzer, 1990; Vicente et al., 2013). For the purpose of our study, consumers' ability to acknowledge companies' environmental initiatives and react positively to them crucially depends on their knowledge in general (Laroche, et al., 2001; Ritter et al., 2015) and, in more practical terms, on their ability to identify and appreciate the environmental certifications adopted by firms (Van Loo et al., 2015).

Table 5.1 Literature summary of studies about socio-demographic variables and peoples' environmental knowledge, concern, and behavior.

Authors	Location	Sample Size	Environmental topics of the study			
			K	C	B	P
Arcury et al. (1986)	Kentucky, US	441	X			
Arcury et al. (1987)	Kentucky, US	516	X	X		
Ostman & Parker (1987)	Ithaca, New York.	336	X	X	X	
Arcury (1990)	Kentucky, US	680	X		X	
Schahn & Holzer (1990)	Heidelberg, Germany	105	X	X	X	
Schwepker Jr & Cornwell (1991)	Central Southern, US	146		X	X	
Grunert (1993)	Denmark (nationwide)	1476	X	X	X	
Hayes (2001)	US (nationwide)	1385	X	X	X	
Hayes (2001)	UK, (nationwide)	1102	X	X	X	
Hayes (2001)	Norway (nationwide)	912	X	X	X	

Hayes (2001)	the Netherlands (nationwide)	1207	X	X	X		
Hayes (2001)	West Germany (nationwide)	628	X	X	X		
Hayes (2001)	East Germany (nationwide)	721	X	X	X		
Hayes (2001)	Japan (nationwide)	787	X	X	X		
Olli et al. (2001)	Norway (nationwide)	3111	X		X		
Laroche et al. (2001)	North American city	907		X	X	X	
Diamantopoulos et al. (2003)	UK (nationwide)	1697	X		X		
Loureiro & Lotade (2005)	Colorado, US	284				X	
O'Garra et al. (2005)	London, UK.	362	X				
Haron et al. (2005)	Selangor, Malaysia	734	X	X	X		
Mostafa (2007)	Egypt (nationwide)	1093	X	X	X		
Aguirre (2007)	San José, Costa Rica	480			X		
Pinheiro (2012)	Portugal (nationwide)	253				X	
Zsóka et al. (2013)	Hungary (nationwide)	770	X	X	X		
Vicente et al. (2013).	USA, Spain, Mexico and Brazil	2226	X		X		
McCright (2010)	US (nationwide)	3072	X				
Yang et al. (2012)	Wuhan in Hubei province of China	564				X	
Van Loo et al. (2015)	Fayetteville, AR, US	81				X	
Ritter et al. (2015)	Porto Alegre, Brazil	337				X	
Grubor & Djokic (2016)	Republic of Serbia	400			X		
Paço & Lavrador (2017)	Beira, Portugal	800	X	X	X		
Baral (2018)	Oregon and Washington, USA.	1376	X				
Liu et al. (2019)	Taiwan (nationwide)	650				X	

Key: K— Environmental Knowledge; C — Environmental Concern; B— Environmental Behavior; P—Preferences

Several studies have investigated the impact of socioeconomic characteristics on knowledge, preferences, environmental concern, and environmental behavior. These studies are surveyed in Table 5.1.

Below, we present our hypotheses in connection with the previous literature. As it was mentioned in the introduction, all the hypotheses are formulated in a double level, referring to general knowledge and specific knowledge, respectively.

5.2.2. Socioeconomic variables and hypotheses

Our hypotheses refer to the expected effect of some key socioeconomic variables over consumers' knowledge of environmental certifications. The first of such variables is **income**. According to Abraham Maslow's (1954) hierarchy of needs, humans seek to satisfy their vital needs before moving up to higher level needs such as the concern for environmental quality. In the same line, Inglehart (1977, 1997) argued that environmental protection is primarily a post material concern, which can only develop in high-income countries. Consistent with this theory, Arcury et al. (1986), Arcury (1990), and McCright (2010) found a positive and statistically significant relationship between income and people's environmental knowledge. Aguirre (2007), Liu et al. (2019), Loureiro & Lotade (2005), Pinheiro (2012) showed positive and statistically significant relationships between income and consumers' willingness to pay for eco-friendly products.

The second variable that we include as a possible driver for environmental knowledge is consumers' **age**. Empirical studies show mixed evidence regarding this variable. While Arcury et al. (1987), Diamantopoulos et al. (2003), Hayes (2001), and McCright (2010) found that younger people have better environmental knowledge than older people, other studies such as Arcury et al. (1986), O'Garra et al. (2005), and Paço & Lavrador (2017) got the opposite result. The effect of age on environmental attitudes and behavior is not clear either in the literature. Some studies showed a positive effect (see e.g. Grubor & Djokic, 2016; Liu et al., 2019; Olli et al., 2001) but Loureiro & Lotade (2005) and Schwepker & Cornwell (1991) found that older consumers were less likely to buy ecologically packaged products. In the case of Costa Rica, the national state school curriculum requires environmental learning as part of both primary and secondary education since 1977. However, only since the 2000s environment and ecological aspects have been introduced as 'transversal issues' to the other subjects (Blum, 2008). This fact leads us to expect that younger people are more prone to be informed than older people.

In the literature, there is a difference between environmental attitudes and environmental knowledge attending to **gender**. Olli et al. (2001) concluded that women exhibit more environmentally friendly behavior than men. Aguirre (2007), Grubor & Djokic (2016), Pinheiro (2012), Laroche et al. (2001), Loureiro & Lotade (2005) and Yang, Hu, Mupandawana, & Liu (2012) estimated that women are more willing to pay for ecological products. Nevertheless, most authors find out that males tend to show more knowledge about environmental aspects (Arcury et al., 1986; Arcury et al., 1987; Arcury, 1990; Baral, 2018; Hayes, 2001; Mostafa, 2007; O'Garra et al., 2005; Paço & Lavrador, 2017; Schahn & Holzer, 1990).

Another variable that turns out to be an important driver of environmental knowledge is the **education level**. Vicente, et al. (2013) showed that individuals with higher education seem to possess a better level of environmental knowledge and pro-environmental behavior. Several studies have confirmed that the educational level is an essential determinant of environmental attitudes and preferences (Aguirre, 2007; Loureiro & Lotade, 2005; Liu et al., 2019; Ritter et al., 2015; Schwepker Jr & Cornwell, 1991) and environmental knowledge, either related to environmental issues (e.g., Arcury et al., 1986; Arcury et al., 1987; Arcury, 1990; Diamantopoulos et al., 2003; Grunert, 1993; Haron et al., 2005; Ostman & Parker, 1987; Zsóka et al., 2013), environmental features of some products (Baral, 2018; O'Garra et al., 2005), or scientific aspects of the environment (Hayes, 2001; McCright, 2010). Thus, we expect this variable to also have a positive impact on consumers' knowledge of environmental certifications.

Given the geographical structure of Costa Rica, we hypothesize that the **place of residence** can also matter, although the evidence in the literature is mixed again. Haron et al. (2005) found that the place of residence is a non-significant variable to explain the environmental knowledge, whereas Arcury (1990) and Arcury et al. (1986) concluded that urban residents tend to have a higher environmental knowledge. In Costa Rica, 75.7% of the population over 18 lives in the central provinces (San José, Alajuela, Cartago, and Heredia) (see Figure 5.1). The most important cities of the country are located in central provinces, in an area known as the Great Metropolitan Area (GMA). According to Arias & Sánchez (2012), although this area comprises only 3.8% of the Costa Rican territory, it concentrates 52.7% of the total population of the country and around 70% of industry employment. Considering the concentration of population and economic activities in these provinces, we expect consumers who live in central provinces to have more knowledge about VECs.

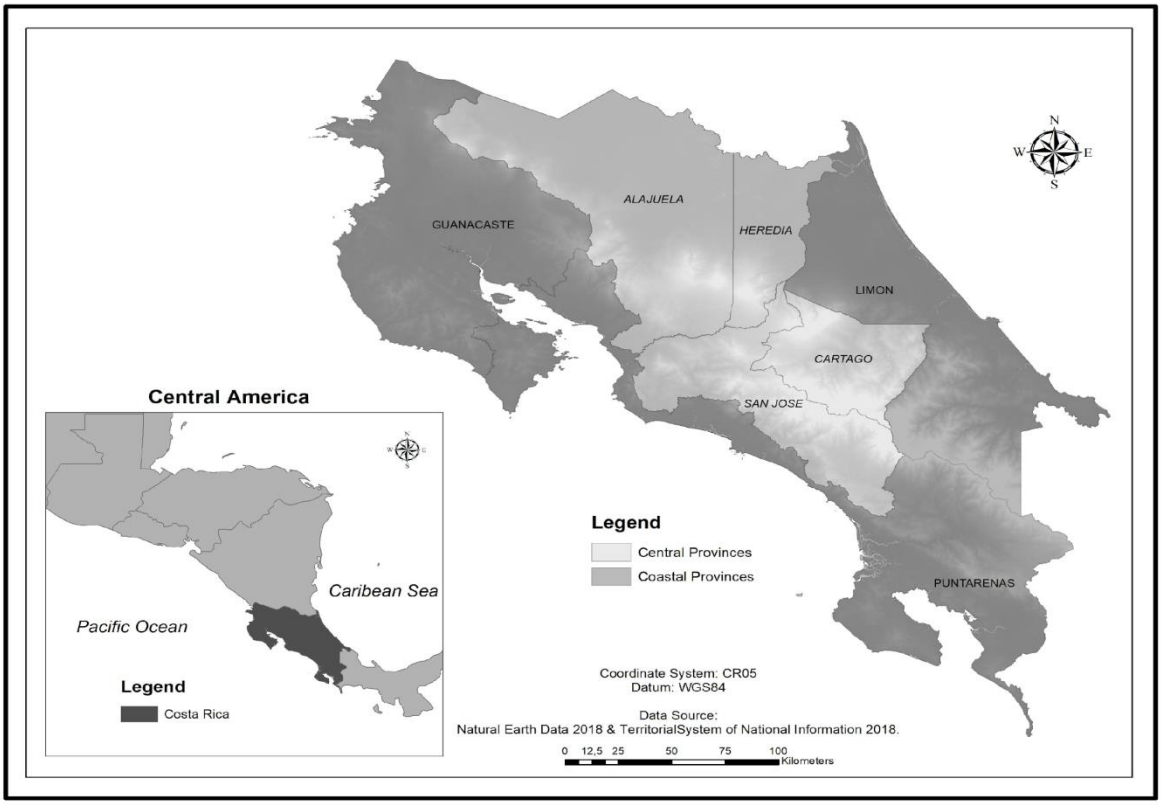

Figure 5.1 Geographical location of the central and coastal provinces of Costa Rica

For obvious reasons, **belonging to an environmentalist or community group** can be expected to be clear a sign of better environmental knowledge and involvement. Nevertheless, the effect of this type of participation on environmental knowledge and behavior has not been extensively studied. Schwepker & Cornwell (1991) did not find any relationship between the number of community organizations each person belongs to and their intention to purchase ecologically packaged products. Conversely, Olli et al. (2001) found that participation in environmental organizations is positively correlated with environmental behavior. Haron et al. (2005) found a positive correlation between participation in environmental activities and environmental knowledge. Many people in Costa Rica voluntarily participate in this type of groups, which develop different activities to improve the quality of the environment and encourage the socioeconomic development of neighborhoods (Gumeta-Gómez et al., 2015). Our guess is that such people are more prone to be informed about VECs.

The final variable that we consider in our study is the **marital status**. Schwepker & Cornwell (1991), Laroche et al. (2001), and Grubor & Djokic (2016) found a positive relation between being married and environmental attitudes. Hayes (2001) found a positive effect of this variable on environmental knowledge of scientific issues in the United States and in the United Kingdom, but not specifically on environmental scientific knowledge. Diamantopoulos et al. (2003) and Haron et al. (2005) found no effect of the marital status.

To summarize our hypotheses, we expect a positive effect of income, male, gender, having higher education, living in central provinces, and participating in environmental groups on general and specific knowledge of environmental certifications. We expect a negative effect of age and we expect no effect of the marital status.

5.3 Material and methods

5.3.1 Data collection

Our study is developed in Costa Rica, which is classified as a developing country by the International Monetary Fund (Brandao-Marques et al., 2020). In 2017, its Gross Domestic Product per capita at purchasing power parity (PPP) was $17,044 (current U.S. dollars), the second highest in Central America, only after Panama. The adult population (over 18 years) in the same year was 3,290,465 (Tribunal Supremo de Elecciones de Costa Rica, 2017). Costa Rica, however, also has a relative poverty rate around 22%, 11 percentage points higher than the average of OECD countries (OECD, 2016).

We use a sample of the Costa Rican population to study general and specific knowledge of VECs. The sample is stratified by province and gender. The first dimension aims to have an approximate representation of the geographical distribution of the population. We also consider stratification by gender important because some studies have shown gender differences in the environmental knowledge and behavior. Moreover, in order to study the specific knowledge of our three selected certifications, we split the whole sample in three subsamples (CN, FT and ISO 14001) in the second part of the study. Details about the sample distribution can be found in Table 5.2.

Table 5.2 Costa Rican population over 18 years old and survey respondent distribution.

By province	Costa Rica*	%	CN	FT	ISO 14001	Total Sample	%
San José	1,114,779	**33.9**	132	130	130	392	**32.9**
Alajuela	630,990	**19.2**	76	76	78	230	**19.3**
Cartago	387,905	**11.8**	42	42	42	126	**10.6**
Heredia	332,859	**10.1**	41	40	73	154	**12.9**
Guanacaste	240,637	**7.3**	28	28	32	88	**7.4**
Puntarenas	310,662	**9.4**	36	35	34	105	**8.9**
Limón	272,633	**8.3**	32	32	32	96	**8**
By gender							
Men	1,638,577	**49.8**	205	218	204	627	**52.6**
Women	1,651,888	**50.2**	182	165	217	564	**47.4**
TOTAL	3,290,465	**100.0**	387	383	421	1191	**100.0**

* Source: Electoral roll of the Supreme Election Tribunal of Costa Rica (2017).

We randomly approached the respondents in public places and invited them to answer the questionnaire. 1,191 face-to-face surveys were completed between July 2017 and April 2018. Consumers were approached in a personal and casual way, but we have not counted people who refused to answer the questionnaire.

The questionnaire, which has been used for a wider line of research, is structured in three sections. The first part deals with socioeconomic and demographic features of the respondents, the second one asks about consumers' knowledge of environmental certifications. The third part refers to willingness to pay and is not used in this chapter. Overall, the questionnaire included 13 closed questions and 13 open questions, and it took between 5 and 8 minutes (see the whole questionnaire in Appendix A).

The variables about consumer characterization (part 1 of the questionnaire) were mostly captured by closed questions: income quintiles, gender, education level, belonging to an environmentalist or community group, and marital status. The province of residence was asked as an open question that required a short answer.

General knowledge of VECs was measured by an open question, as follows: "Could you name some voluntary environmental certifications that companies can adopt in Costa Rica? Name those that you remember now". This information was coded by a dummy variable, *GCK* ("General Consumer Knowledge") which takes the value of 1 if the respondent was able to correctly name one or more VECs and 0 otherwise.

At the specific knowledge level, the sample was randomly divided into three subsamples corresponding to CN, FT and ISO 14001 certifications respectively. Each respondent was asked to name certified companies within one (and only one) of these certifications in an open format: "Could you name some companies or institutions that have [CN, FT or ISO 14001] certification? Please, name them". This information was coded by another dummy variable, *SCK* ("Specific Consumer Knowledge") which takes the value of 1 if the respondent was able to correctly name 1 or more certified companies and 0 otherwise.

We considered the open question format more adequate to find out about consumers' knowledge because closed questions could act as an implicit clue and increase the number of false positive answers, i.e., cases in which the consumers give a right answer by chance. The answers to the general and specific knowledge questions can only be correct or incorrect and thus the authors did not need to interpret the answers.

5.3.2 Models

Since the dependent variables (*GCK* and *SCK*) can be interpreted as a probability, we use a logit model to relate general and specific knowledge of VECs with the consumers' characteristics.[4] For general knowledge, the cumulative logistic probability function (P) for each certification is specified as:

$$P\ (GCK_i = 1) = \frac{1}{[1 + e^{-Z}]} \qquad Equation\ 1$$

where *P* is the probability that an individual "i" names at least one VEC, and Z= α + β'X, β being a vector of parameters to be estimated, α a constant term and X our set of socioeconomic and demographic variables, which include the following: monthly household income in quintiles

[4] As a robustness check we have also tried a probit model and the results are virtually the same.

(I), age (A), gender (G), education level (E), place of residence (PR), participation in environmental or community groups (PG), and marital status (M). See Table 5.3 for details about the variables.

Appendix B shows that the Pearson correlation indexes between independent variables are below 34%, except for the correlation between age and marital status, which is 44%. Income and education tend to be positively correlated and so we can wonder to what extent they are capturing basically the same effect. In our sample, the correlation index between having a university or technical degree and being in the highest income decile is below 34%. In addition, Costa Rica currently has 5 public universities, which facilitates the access of low-income people to higher education; therefore, young people can have high levels of education with medium incomes. This suggests that, although both variables (income and education) are linked, they do not capture exactly the same effects and it is relevant to keep them as separate explanatory variables.

In the case of specific knowledge, we use a similar version of equation 1 with the only difference that the dependent variable is now the probability of naming at least one certified company under the relevant certification (as determined by variable SCK). Moreover, we include three dummy variables (CN, FT or ISO 14001) identifying the specific certification the responded was asked about (for example, the variable FT takes the value 1 if the respondent was asked about FT organizations and 0 otherwise). When estimating the model, the CN variable was omitted to avoid collinearity, so the parameters associated with FT and ISO 14001 must be interpreted in relative terms as compared to CN.

In both models, we estimate the marginal effects in order to know the influence of the individual independent variable over dependent variables (GCK and SCK).

Table 5.3 Variables and descriptive statistics.

		Description	n=1191	
Dependent variables			**Mean**	**S.D.**
GCK		1 if the respondent named at least one VEC, 0 otherwise	0.2485	0.4323
SCK		1 if the respondent named at least one certified company, 0 otherwise.	0.1990	0.3994
Independent variables				
I		***Monthly household income*** *(qi=$_1$ if the respondent is in quintile i, 0 otherwise)*		
		We specify five income quintiles, in U.S. dollars as follows		
	q1	Less than 528	0.1671	0.3732
	q2	Between 529 and 1056	0.2569	0.4371
	q3	Between 1,057 and 1,761	0.2469	0.4314
	q4	Between 1,762 and 3,521	0.2124	0.4092
	q5	More than 3,522	0.1167	0.3212
A		Age of the respondent	35.03	13.50
G		Gender, 1 if the respondent is a man, 0 if the respondent is a woman	0.5264	0.4995
E		Education level, 1 if the respondent achieved a university degree or a technical education degree, 0 otherwise.	0.4030	0.4907
PR		Place of residence, 1 if the respondent lives in one of the central provinces, 0 if he/she lives in a coastal province	0.7573	0.4289
PG		1 if the consumer belongs to, at least, one environmentalist or community group, 0 otherwise	0.1385	0.3456
M		Marital status, 1 if the consumer is married or in a domestic partnership, 0 otherwise	0.3233	0.4679
TC		***Type of certification*** *(it is used only to differentiate the knowledge of certified companies)*		
	CN	1 for respondents' subgroup about Carbon Neutral organizations, 0 otherwise	0.3249	0.4685
	FT	1 for respondents' subgroup about Fair-Trade companies, 0 otherwise	0.3216	0.4673
ISO14001		1 for respondents' subgroup about ISO 14001 companies, 0 otherwise	0.3535	0.4782

5.4 Results

5.4.2 General knowledge

As a general result, roughly 25% of the respondents (296 out of 1191) were able to name at least one VEC. The eight most named ones were the following: ISO 14001 (12.01% of the respondents), CN Program (9.07%), Ecological Blue Flag (8.14%), Rainforest Alliance (3.36%), Organic Certifications (2.10%), Costa Rican Certification for Sustainable Tourism (1.51%), Fairtrade (1.51%) and Essential Costa Rica Brand (1.34%). The fact that 3 quarters of the sample was unable to name any one suggests that there is plenty of room to develop these voluntary approaches in terms of communication and public visibility. Table 5.4 shows the results for the logit model related to general knowledge.

Table 5.4 Logit model for general knowledge about environmental certifications of Costa Rican consumers.

Variable		Regression Coefficients	Average marginal effects (dy/dx)
i.I	q2	0.6133*	0.0965*
	q3	0.9656**	0.1529**
	q4	1.1293***	0.1777***
	q5	1.8106***	0.2849***
A		-0.0245 ***	-0.0039***
G		-0.0224	-0.0035
E		0.8288***	0.1304***
PR		-0.0941	-0.0148
PG		1.1212***	0.1765***
M		-0.2666	-0.0420
Constant		-1.6423***	
	n	1191	
	Log likelihood	-574.54122	
	McFadden R^2 (adj.)	0.123	

* p<0.05; ** p<0.01; *** p<0.001

According to these estimations, the probability that a Costa Rican consumer can name at least one VEC is positively related with the household income, holding a university or technical degree, and belonging to a community or environmentalist group. Conversely, age slightly reduces the likelihood that a consumer can name VECs. Marital status, gender and the place of residence do not show any statistically significant impact on general knowledge.

5.4.3 Specific knowledge

Regarding specific knowledge, only 237 respondents were able to name some company or organization when asked about a specific certification. Specifically, 164 respondents could name some ISO 14001 certified company, 57 named CN companies and only 16 were able to name some company with the FT certification.

Our estimations show that specific knowledge is explained by roughly the same variables as general knowledge: it is positively related to household income, university or technical education and participating in environmental or community groups, slightly negatively related to consumers' age and not related to marital status or gender (see Table 5.5). In addition, respondents who were asked about ISO 14001 companies were more likely to answer correctly than those questioned about CN, and both were more likely than those asked about FT certification.

Table 5.5 Logit models for specific knowledge about environmental certifications of Costa Rican consumers

Variable		Regression Coefficients	Average marginal effects (dy/dx)
i.I	q2	0.5659	0.0656
	q3	0.9456*	0.1095*
	q4	1.0962**	0.12698**
	q5	1.3976**	0.1619**
A		-0.0195*	-0.0023*
G		0.2971	0.0344
E		1.180***	0.1367***
PR		0.4198	0.0486
PG		0.6530**	0.0756**
M		-0.140	-0.0162
i. TC	ISO14001	1.1961***	0.1385***
	FT	-1.4690***	-0.1702***
Constant		-3.0930***	
	n	1191	
	Log likelihood	-436.56021	
	McFadden R^2 (ad.)	0.244	

* p<0.05; ** p<0.01; *** p<0.001

5.5 Discussion

Our results that general and specific knowledge is positively related to income is in line with previous studies that have addressed different aspects of environmental knowledge, such as Arcury et al. (1986), Arcury (1990) and McCright (2010). Other studies have shown that, apart from environmental knowledge, income is also positively related with other dimensions of consumers' ecological behavior and attitudes, such as the willingness to pay for ecolabels. For example, Aguirre (2007) showed that Costa Rican consumers who buy organic products tend to have a high income profile. For related studies in other countries, see, e.g., Liu et al. (2019), Loureiro & Lotade (2005), or Pinheiro (2012).

We also find that consumers with a university or technical degree are around 13% more likely to correctly name at least one VEC and a certified company. This positive connection between education and environmental knowledge has also been found by previous studies in the U.S. (Arcury et al., 1986; Arcury et al., 1987; Arcury, 1990; Baral, 2018; Hayes, 2001; McCright, 2010), U.K. (Diamantopoulos et al., 2003; Hayes, 2001; O'Garra et al., 2005), Europe (Grunert, 1993; Hayes, 2001; Zsóka et al., 2013), Malaysia (Haron et al., 2005), Brazil (Ritter et al., 2015), and Japan (Hayes, 2001).

Consumers' age is negatively related to their general and specific knowledge of VECs. This result is in the line with results from Arcury et al. (1987), Diamantopoulos et al. (2003), Grunert & Kristensen (1992), Hayes (2001), and McCright (2010). According to our estimated average marginal effects, for each additional year of age, consumers are 0.39% less likely to name a certification or an environmental program, and 0.23% less likely to name a certified company. We can conclude that new Costa Rican generations are more aware of VECs in accordance to the ecological position that Costa Rica maintains in international forums (Flagg, 2018), the importance of nature tourism (Rivera, 2002) and the inclusion of environmental education in the public system (Blum, 2008).

In addition, participating in community or environmental groups increases the consumers' probability to have greater general and specific knowledge of VECs. Some programs work hand in hand with environmental and community groups or organizations, such as the Blue Flag Program, recycling initiatives, and voluntary actions of some companies such as the collection of plastic on beaches and rivers (Blackman et al., 2014; Programa de Bandera Azul Ecológica, 2017). Therefore,

people who participate in environmental activities have greater knowledge of VECs and certified companies. This is consistent with the finding by Haron et al. (2005).

We found no significant effects of gender, marital status and the place of residence. Although it contradicts our original hypothesis, the lack of relevance of the place of residence is consistent with the fact that Costa Rica is a small country with a homogeneous access to information and basic education. According to the World Bank (2018), 100% of the Costa Rican population has access to electricity, the mobile cellular subscriptions (per 100 people) are about 180, and 72% of the individuals have used the Internet (from any location) in the last 3 months. The conclusion about marital status is consistent with most of the previous studies.

The lack of effect of gender contradicts most of the reviewed articles about environmental knowledge, which find that males tend to have greater knowledge of environmental issues. To interpret this difference, it is important to consider that these studies were performed in other countries and most of them in the last decades of the 20th century. It can be argued that our result is consistent with the increasing role and the access to education of women in Costa Rica. According to the "Estado de la Nación" database, 44.1% of women between 18 and 24 years old had access to university education in 2017 and only 36.4% of men.

In terms of specific knowledge, we observe that ISO 14001 companies are recognized more often by consumers than CN or FT companies. Some reasons that may explain this result are the following (i) ISO 14001 is an international standard, strongly promoted by the International Organization for Standardization (ISO, 2015), (ii) when we applied the survey, there were 111 companies certified as ISO 14001 in Costa Rica (International Organization for Standardization, 2019), 77 CN organizations (Ministerio de Ambiente y Energía, 2018), and only 33 FT companies (FLOCERT, 2019), (iii) In addition, of the top ten brands preferred by consumers in Costa Rica in 2017, three of them belong to companies with the ISO 14001 certification (Chacón, 2017), which naturally makes Costa Rican consumers more prone to be familiar with this certification.

On the contrary, FT companies are mainly cooperatives and associations located in rural areas that only produce agricultural goods. Moreover, they allocate most of their production in international markets, where consumers are willing to pay higher prices for FT products. Since FT companies have not been strongly promoted in local markets, Costa Rican consumers are not that likely to know them.

5.6 Policy implications and future research

The extent to which voluntary environmental policies will be effective in environmental and economic terms crucially depends on the degree of knowledge and response by consumers. For this reason, it is important to evaluate this degree of knowledge and the factors that determine it. Our main conclusion is that, although voluntary environmental approaches and VECs are well established in Costa Rica, there is still plenty of room to improve in terms of consumers' knowledge.

Identifying the profile of an informed consumer is a challenge for the design of companies' environmental volunteer campaigns, as well as the deepening of green businesses. Such a profile can be a key issue for those companies that seek to improve their green image through the adoption of voluntary environmental approaches. The green advertising campaigns of these companies can be addressed to a more specific public, in this case, young with medium and/or high household income, with a university or technical degree and willing to participate in environmental groups.

At the public policy level, environmental education programs can be designed to improve the knowledge of lagging groups, especially through environmental training at basic education levels (primary and secondary). Fostering participation in environmental and community groups is also an interesting avenue to promote knowledge. More information on voluntary environmental approaches is also necessary through information campaigns in the media.

5.7 Conclusions

As a general conclusion, our findings show that socioeconomic and demographic features of Costa Rican consumers are relevant to explain their general and specific knowledge of certifications and environmental programs. This result is consistent with previous studies that have related those variables with the environmental knowledge and the ecological behavior of people in other countries. A representative profile of a Costa Rican consumer with greater specific and general knowledge of VECs, would be a young, either male or female, with medium or high household incomes, with a university degree or technical education and participating in environmental or community activities and such consumer is more likely to know ISO 14001 than other certifications.

Our study is performed in a specific country, Costa Rica, which is considered a developing country. Nevertheless, the fact that our results are parallel to those obtained in developed countries can be taken as a sign that consumers' awareness is spreading and becoming a worldwide phenomenon, not limited to a small number of countries.

Appendix A.

Table A1. Questionnaire structure

First Part: Consumer Identification		
A1	Date	
A2	Name	
A3	Telephone or e mail (optative)	
A4	Labor sector	( ) Public sector employee ( ) Own account ( ) Private sector employee ( ) Student (check if you are currently studying) ( ) Pensioner ( ) Other
A5	Profession	
A6	Gender	( ) Male ( ) Female ( ) Other
A7	Age	
A8	Marital status	( ) Alone ( ) Married ( ) In a domestic partnership ( ) Divorce ( ) Widow (er)
A9	How many people live in your home?	
A10	How many people contribute income to your home?	
A11	Province	
A12	Canton	
A13	Are you a member of an environmental group or committee?	( ) Yes How many groups?_____ ( ) No
A.14	Are you a member of any community group or committee?	( ) Yes How many groups?_____ ( ) No

A.15	Could you tell me your highest educational level?	( ) Incomplete primary ( ) Complete primary ( ) Incomplete secondary ( ) Completed secondary ( ) Incomplete technical education ( ) Complete technical education ( ) Incomplete university ( ) University Degree
A16	How many years of formal education do you have? Counting from when you entered preschool or school	
A.17	Do you believe that global warming and climate change are real challenges facing humanity?	( ) Yes ( ) No
A 18	Who should pay for the efforts made by companies to produce more environmentally friendly and under the best working conditions?	( ) Consumers ( ) Companies themselves ( ) Both
A19	Individual monthly income	( ) 50 000 – 150 000 colones ( )150 001 y 300 000 colones ( ) 300 001 y 600 000 colones ( ) 600 0001 y 1 000 0000 colones ( ) 1 000 0001 y 2 000 000 colones ( ) 2 000 0001 y 3 000 000 colones ( ) more than 3 000 0001
A20	Household monthly income	( ) 50 000 – 150 000 colones ( )150 001 y 300 000 colones ( ) 300 001 y 600 000 colones ( ) 600 0001 y 1 000 0000 colones ( ) 1 000 0001 y 2 000 000 colones

		( ) 2 000 0001 y 3 000 000 colones ( ) more than 3 000 0001
Second part: Knowledge about VECs		
B1	Do you know what is an environmental or social certification? ( ) Si ( ) No (Go to question B3)	
B2	Could you name some voluntary environmental certifications that companies can adopt in Costa Rica? Name those that you remember now	
B3	Do you know the Carbon Neutral* certification? ( ) Yes ( ) No	
B4	Could you name some companies or institutions that have Carbon Neutral* certification? Please, name them	

*In others subsamples we ask for Fairtrade and ISO14001

Note: The third and last part of the questionnaire include two question about the "Consumers' willingness to pay for an environmental coffee". These questions are used in Chapter 6.

Appendix B.

Table B1. Pearson correlation indexes between independent variables

	q_5	A	G	E	PR	PG	M
q_5	1.0000						
A	0.0026	1.0000					
G	0.1195***	0.0592*	1.0000				
E	0.3358***	-0.1442***	0.0285	1.0000			
PR	0.1448***	-0.0405	0.0045	0.1736***	1.0000		
PG	0.0965**	0.1276***	0.0445	0.1164***	-0.0338	1.0000	
M	0.0171	0.4441***	0.0407	-0.0628*	-0.0820**	0.0710*	1.0000

Note: q_5 is the highest Quintile of income. * p<0.05; ** p<0.01; *** p<0.001

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Part III: Price premiums for voluntary environmental certifications

Chapter 6: Willingness to pay for coffee environmental certifications: the case of Costa Rican consumers

Abstract: This study examines the Costa Rican consumers' willingness to pay for two marketed coffee ecolabels (Fairtrade and Carbon Neutral) and a non-marketed environmental certification (ISO 14001). Two valuation method were applied. Firstly, we applied the open-ended (OE) contingent valuation method (CVM), which shows that Costa Rican consumers (n=1191) are willing to pay price premiums around 30% for all the considered environmental certifications. Moreover, we conclude that income, education, and consumers' participation in environmental committees are positively related with their willingness to pay. Secondly, a discrete choice experiment (DCE) was applied (n=220) and the price premiums estimated were between 141% for ISO14001 and 178% for FT coffee compared to a regular coffee. These results are in line with the price gaps between some coffee brands with ecolabel vs. brands without ecolabels in the final coffee consumption market.

Keywords: Coffee; Carbon Neutral; Fairtrade; ISO 14001; Willingness to Pay; Costa Rica, Contingent Valuation, Discrete Choice Experiment.

6.1 Introduction

Coffee is the second most traded commodity in the world, only after crude oil (Girotto, et al., 2018). According to the International Coffee Organization (ICO, 2019), 7.5 billion kilograms of coffee were exported from producing countries in 2017. Some environmental threats can be linked to the coffee production in those countries. In this sense, the way in which resources such as water and soil are used in coffee production is crucial to reduce environmental impacts such as wastewater (Rattan et al., 2015), deforestation (Gaveau et al., 2009; Myers and Tucker, 1987; Nygren, 1995) and soil erosion (Ataroff and Monasterio, 1997; Blanco and Aguilar, 2015; Villatoro-Sánchez et al., 2015), among others. Thus, in order to preserve natural resources, it is important to look for ecological methods, approaches and practices for coffee production and trading.

Environmental certifications constitute a key instrument to promote more sustainable practices in the coffee value chain (Birkenberg and Birner, 2018; Fairtrade International, 2016; Snider et al., 2017). Firms that implement such practices can get comparative advantages by certifying their products, or the firm itself. The certifications are expected to act as signaling devices for the society and, especially, for those consumers who are concerned about making more ecological purchase decisions (Van Loo et al., 2015).

To a large extent, the economic and environmental effectiveness of adopting environmental practices depends on the ability of consumers to identify the coffee that is produced under those practices and their willingness to pay a price premium for it. In fact, several studies have shown that consumers are willing to pay a price premium for certified coffee. Most of these studies have been conducted in high-income countries, such as Italy (Gallenti et al., 2016; Maietta, 2003; Rotaris and Danielis, 2011) Belgium (De Pelsmacker, Liesbeth, & Glenn, 2005; Maaya et al., 2018), The United States (Klimas and Webb, 2018; Loureiro and Lotad, 2005; Van Loo et al., 2015), Sweden (Schollenberg, 2012), Germany (Grebitus, Hartmann, & Langen, 2009), United Kingdom (Galarraga and Markandya, 2004) and Taiwan (Liu, Chen, & Chen, 2019). To the best of our knowledge, not so many studies have been focused on medium and low-income countries. An exception is, for example, Yang et al. (2012), who studied the willingness to pay (WTP) for Fairtrade Coffee (FTC) in China.

Most of the environmental certified coffee in the world is marketed in high-income countries (International Trade Centre, 2011). Since the potential supply of certified coffee sometimes exceeds the current world demand (see, e.g. Haight, 2007; Omidvar and Giannakas, 2015; Prasad, 2019; Sick, 2008; Snider et al., 2017; Weber, 2007) producers are looking for new markets in large developing countries, such as Brazil, India, China and also smaller ones such as Costa Rica, which is the focus of this study (see Inter-American Institute for Cooperation on Agriculture and The Fairtrade Producers and Workers from Latin America and Caribbean, 2017). Costa Rica is an upper middle-income country recognized for the public environmental policies linked to the protection of forests and biodiversity (Sánchez-Azofeifa et al., 2007), as well as for the government efforts to reduce the greenhouse gas footprint (Flagg, 2018). Accordingly, renewables represent around 98% of Costa Rica's electric energy production, and forest cover stands at more than 53%. In 2019, Costa Rica was named 'UN Champion of the Earth' for pioneering role in fighting climate change (United Nations Environment Programme, 2019).

The Costa Rican government works in a plan to decarbonize the economy by 2050. The participation of companies and consumers is essential to achieve this objective. For example, a Costa Rican cooperative has been the first organization worldwide to adopt the carbon neutrality certification for coffee production using a renowned international standard (Birkenberg & Birner, 2018).

In many regions in Costa Rica, coffee environmental certifications have improved producers' environmental performance in terms of reducing or eliminating agrochemicals, reducing and offsetting the coffee carbon footprint and increasing biodiversity due to the shade-coffee production system, which combines coffee plantations with tree species (see, e.g. Birkenberg and Birner, 2018; Blackman and Naranjo, 2012; Lyngbæk, Muschler, & Sinclair, 2001; Sick, 2008; Snider et al., 2017). Likewise, in 2017, Costa Rica was the second largest coffee consumer in Latin America with 4.1 kg. per capita (Instituto del Café de Costa Rica, 2018; ICO, 2019). Arguably, knowing whether and how much consumers are willing to pay for environmentally certified is an important piece of information to spread the environmentally positive side effects of certified coffee.

Our research objective is to determine how much are Costa Rican consumers willing to pay for certified coffee versus regular one. We consider three environmental coffee certifications, including two coffee ecolabels (Fairtrade and Carbon Neutral) and an environmental management system (EMS), namely ISO 14001. All of them specify environmental compliance standards for companies seeking certification and, thus, they are expected to have a positive impact on the environment. To this aim, we use two economic valuation approaches based on stated preferences, such as the open-ended contingent valuation method (OE-CVM), and the discrete choice experiment (DCE). In this way, we go beyond most previous studies, which normally use a single valuation procedure (see Table 6.1) and we can check the robustness of the estimated price premiums for all three environmental certifications across different valuation methods. We are not aware of any published research that addresses the Costa Ricans' WTP for any coffee certification.

Our results show that Costa Rican consumers are willing to pay price premiums for all three certifications. Regarding the differences across methods, consumers value a single certification in the OE, while in the DCE consumers value all three certifications a non-certified coffee at the same time. In the former (OE-CVM) we found price premiums for all three certifications around 30%, in addition we found a positive and statistically significant relationship between education,

participating in environmental committees, the income of the families and the respondents' WTP for a certified coffee. Finally, in the DCE, consumers are willing to pay price premiums higher than 141%, which is in line to the prices offered by some of the coffee brands certified with eco-labels versus non-certified coffee brands.

The chapter is organized as follows: Section 2 presents a literature review of previous studies about consumers' WTP for environmentally certified coffee; Section 3 presents the material and methods, including data collection and econometric specifications; Section 4 presents the main findings; that are discussed in Section 5; and finally Section 6 concludes.

6.2 Literature review

Table 6.1 shows that the most studied coffee certifications in the literature are Fairtrade and Organic coffee. Among these studies, only Van Loo et al. (2015) valued a Carbon Footprint label for coffee. However, they did not find a statistically significant premium for this certification. In addition, the most used valuation methods to address this question are discrete choice experiments (DCE), contingent valuation methods (CVM), hedonic prices (HP), and auctions (A).

Most of the previous research has found that consumers are willing to pay a positive price premium for certified coffee. However, the reported WTP largely differs across studies. The estimated price gap between regular coffee and FTC ranges between 3.33% (Loureiro & Lotad, 2005) and 110% (Rotaris and Danielis, 2011). In the case of Organic coffee, the price premium varies between 2.5% (Loureiro and Lotad, 2005) and 93% (Gallenti et al., 2016). According to Rotaris and Danielis (2011) and Van Loo et al. (2015), the difference in the consumers' WTP across studies can be explained by differences in the geographical area of study, the sampling method, sample characteristics, type of coffee, the number and type of other coffee attributes, and the certifying institution considered. Nevertheless, some of the differences in the estimates persist even between studies that have used the same methodology or are conducted in the same country (see Table 6.1).

Table 6.1 Literature summary of consumers' willingness to pay for environmental certified coffee.

Authors	Country	Method	Sample	Certification	Marginal WTP	
					WTP	Percentual price gap
Maietta (2003)	Italy	HA	3678	Fairtrade	€ 2.36/ kg.	30% more expensive than the average price, and 111% more expensive than minimum price
Galarraga and Markandya (2004)	The U.K.	HA	228	Fair Trade and Organic	€ 0.003/ gram	11.26% more compared with regular coffee
De Pelsmacker, Liesbeth, & Glenn (2005)	Belgium	DCE	808	Fairtrade	€ 0.19/ package	10% more compared with regular coffee
Loureiro and Lotad (2005)	Colorado, The U.S.A.	CVM	284	Organic	$16.2559 cents/lb.	2.5% more compared with regular coffee
				Fairtrade	$21.64 cents/lb.	3.33% more compared with regular coffee
				Shade coffee	$20.021 cents/lb.	3.08% more compared with regular coffee
Grebitus, Hartmann, & Langen (2009)	Germany	DCE	481	Organic	€0.79 /500g package	34.5% more compared with regular coffee
				Fairtrade	€1.32 /500g package	57.64% more compared with regular coffee
				Cause-related marketing (Menschen für Menschen)	€0.13/500g package	5.68% more compared with regular coffee
		A	47	Organic	€0.42/500g package	18.34% more compared with regular coffee
			55	Fairtrade	€0.80/500g package	34.93% more compared with regular coffee
			57	Cause-related marketing (Menschen für Menschen)	€0.58/500g package	25.33% more compared with regular coffee
	N/A	CVM	N/A.	Fairtrade	$1.40/lb.	16.85% more compared with regular coffee

Trudel and Cotte (2009)		CVM: Consumers with high ethical expectations			$3.28/lb.	39.47% more compared with regular coffee
Rotaris and Danielis (2011)	Italy	DCE	135	Fairtrade	€2.2/250g package	110% more compared with regular coffee (status quo)
Schollenberg (2012)	Sweden	HA	21,606	Fairtrade	1.381 SEK/kg.	38% more compared with regular coffee
Yang et al. (2012)	Wuhan in Hubei province of China	CVM	564	Fairtrade	¥ 4.5 /cup	22% more compared with regular coffee
Van Loo et al. (2015)	Northwest Arkansas, USA	DCE	81	USDA Organic	$1.16/ 12 oz package	27% more compared with the lowest price presented
				Rainforest Alliance	$0.84 / 12 oz package	19.5% more compared with the lowest price presented
				Fairtrade	$0.68 / 12 oz package	16% more compared with the lowest price presented
				Carbon Footprint	Non-significant	
Gallenti et al. (2016)	Friuli Venezia, Italy	DCE	420	Fairtrade	€-4.3/250g package.	48% less money compared to the highest price presented
				Organic	€2.8/250g package.	93% more compared with the lowest price presented
Klimas and Webb (2018)	DePaul University (Chicago, U.S.)	CVM: Stated preference	988	Shade coffee	Mean $128 cents/ cup, Truncated mean $178 cents/ cup.	8.5% and 11.9%, respectively.
		CVM: Realized preference	120		Mean $39 cents/ cup, Truncated mean $149 cents/ cup.	Increases were US$0.09 (4.9%) US$0.11 (5.2%) and US$0.14 (6%) for small, medium and large coffees, respectively.

Maaya et al. (2018)	Flanders, Belgium	DCE	262	Fairtrade	€2.1/ 250 g package	88% more compared with the lowest price presented
				Organic	€2.2/ 250 g package	92% more compared with the lowest price presented
				Fairtrade and Organic	€1.7/ 250 g package	72% more compared the lowest price presented
Liu, Chen, & Chen (2019)	Taiwan	DCE	568	Organic	In percentage	5.32%
				Eco-friendly		3.68%
				Grade		4,09%
				Traceability		6.48%

6.3 Material and method

6.3.1 Economic valuation methods

In order to elicit the consumers' WTP for an environmental certified coffee, we set up a hypothetical market in which consumers can choose between a 250-gram package of regular ground coffee -we denote it as z_0-, and an environmental certified coffee -we denote it as z_1-. In turn, the latter can have three alternative versions: CN coffee (z_1^1), Fairtrade coffee (z_1^2), and coffee produced by an ISO 14001 certified company (z_1^3). To estimate the price premium that consumers are willing to pay for these environmental certifications we designed a stepwise valuation application using two elicitation formats: OE-CVM and DCE.

The choice of the valuation method and the elicitation format represent an interesting academic debate (Carson, Flores, & Meade, 2001; Fisher, 1996; Soliño, Prada, & Vázquez, 2010). The *open-ended* format is simpler and avoids giving implicit clues to consumers. Nevertheless, one of its main drawbacks is that it potentially encourages strategic over or understating WTP (Crastes dit Sourd et al., 2018). But, in the last 20th Century, *DCE* emerged as an extension of the CVM. DCE incorporates multidimensionality in the sense that consumers are allowed to simultaneously choose between alternative products with different characteristics and prices like in a real market (Hanley, Mourato, & Wright, 2008).

6.3.2 Data collection

We used the OE-CVM as a first approximation to estimate the consumer's WTP and design the vector of bids for DCE. A stratified sampling approach was used in order to obtain a representative sample of the Costa Rican population over 18 years old, according to the population distribution by province and gender. 1,191 face-to-face surveys were completed between July 2017 and April 2018. We used a split sample to address each environmental certification separately (z_1^1, z_1^2 and z_1^3); 387 respondents were asked about their WTP for CN coffee, 383 for FT coffee and 421 for a coffee produced by a company certified as ISO14001.

We used the responses from the open-ended question to design a second survey incorporating a DCE. An invitation was sent to the respondents who provided a valid email address in the first round, 451 in total: 211 of them referred to ISO 14001, 130 to Fairtrade, and 110 to

Carbon Neutral (see Figure 6.1). This second questionnaire was conducted online using the TickStat® software. In the DCE, 220 respondents faced all three certifications and a non-certified coffee in the same exercise. In addition to reminding each consumer the characteristics of the certification that she had previously valued, the characteristics of the two certifications that she had not faced before were also explained.

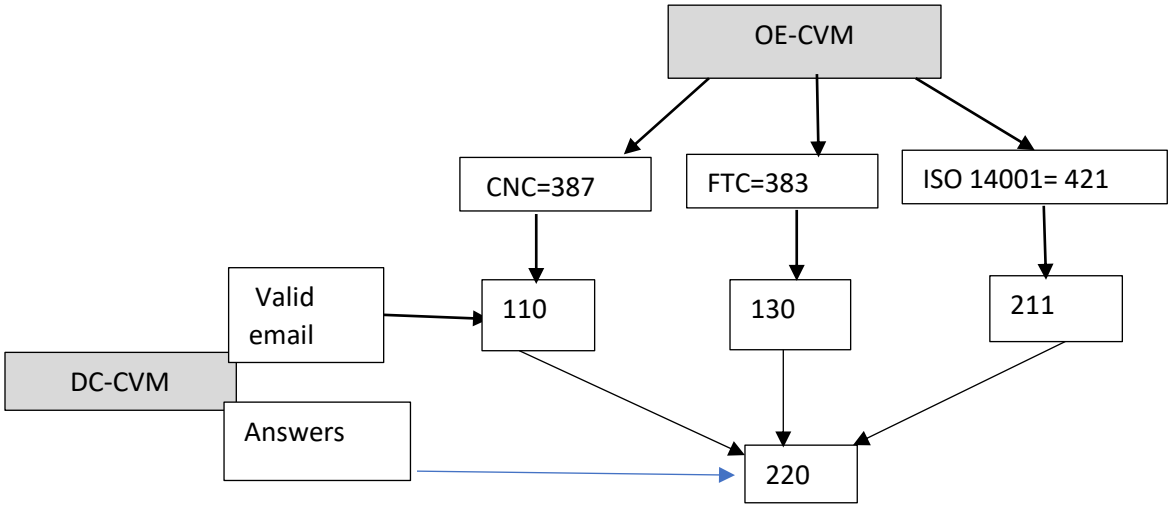


Figure 6.1 Stepwise application using two elicitation formats

6.3.2.1 Open ended CVM

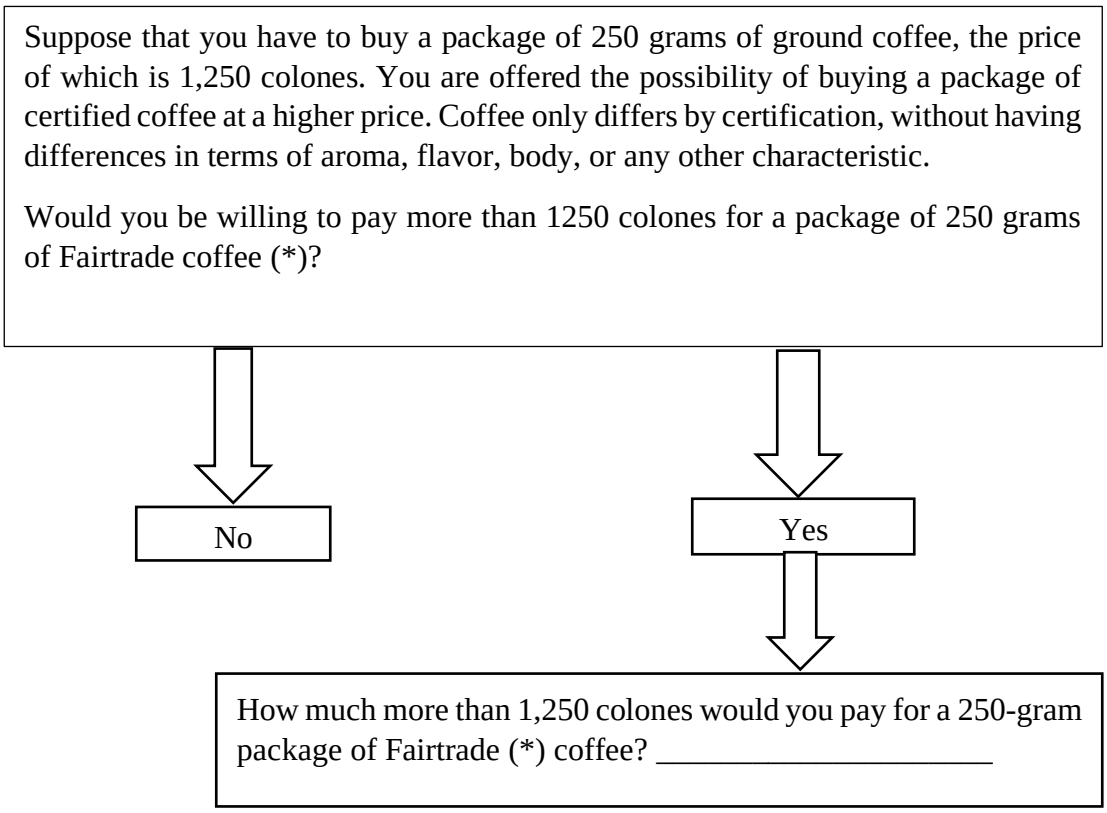
A split sample procedure was used in order to obtain independent estimations for each coffee certification (z_1^1, z_1^2, z_1^3). Each individual as randomly asked about one of the certifications. Before requesting the consumer's WTP, each respondent was informed about the characteristics of the corresponding certification as shown in Table 6.2.

Table 6.2 Characteristics of certifications shown to respondents

Certification	Characteristics
Carbon Neutral (z_1^1)	The companies that achieve the CARBON NEUTRAL certification must reduce or compensate their carbon footprint. Carbon gas emissions that cannot be reduced must be captured in the company's private sinks or offset through the purchase of carbon credits (the revenue of which will be used to pay landowners who maintain and recover forests).
Fairtrade (z_1^2)	FAIRTRADE companies must pay a fair price to the coffee producers, ensure good working conditions, gender equality and the absence of child labor. Also, Fairtrade coffee growers must use techniques that respect the environment and do not use agrochemicals categorized as very toxic.
ISO 14001 (z_1^3)	Companies that obtain ISO 14001 certification improve their environmental behavior in the following terms: Creating and putting into operation an environmental management system, with objectives, policies and assignment of those responsible to comply with them, generating some corrective and preventive actions in order to reduce the contamination generated by the company and complying with national environmental laws.

The price of a 250-gram package of regular ground coffee (z_0) was set as ₡1,250[5] (around U.S. $2.2), which was the average sale price of the best-known coffee brands in Costa Rican supermarkets in July 2017 (Automercado, 2019; Maxi Pali, 2019). Respondents were consulted about their WTP above this reference price for a certified coffee. Figure 6.2 shows an example of the valuation question presented to the participants.

[5] U.S $ 1 = 568 colones; based on the 2017 exchange rate of the Central Bank of Costa Rica (2019); colones=₡.



(*) Split sample. The other versions present CNC and a coffee produced by a company certified as ISO 14001.

Figure 6.2 Open-ended question used in the contingent valuation for Fairtrade coffee

6.3.2.2 Discrete choice experiment

The discrete choice experiment included 6 hypothetical choice cards containing different combinations of environmental coffee certifications and prices. The choice cards were designed following a *D-efficient criteria and* using the *ngene 1.2 software* (Choice Metrics, 2012). Each card required the respondent to choose between three hypothetical 250-gram coffee packages (two certified and one regular coffee, the latter being an opt-out option with zero price premium). After explaining to the respondent what each certification consists of (see Table 6.2), the choice cards were shown. The price premiums were the same as in the DC-CVM. An example of a choice card is presented in Figure 6.3.

Characteristics	Regular Coffee	Certified Coffee A	Certified Coffee B
Type of coffee	Non-certified coffee	Carbon Neutral Coffee	Fairtrade Coffee
Price premium (in colones)	0	400	250
Choose an option	○	○	○

Figure 6.3 Example of choice card

6.3.3 Econometric approaches

In order to estimate the WTP for the environmental certifications, we use different econometric specifications. In the OE-CVM exercise we compute the average WTP for each certification as follows:

$$\overline{WTP}_{z_1^j} = \sum_{i=1}^{n^j} \frac{WTP_i^j}{n^j} \qquad j = 1\ is\ CN, 2\ is\ FT, 3\ is\ ISO\ 14001 \qquad (1)$$

where $\overline{WTP}_{z_1^j}$ is the average WTP for a coffee with certification z_1^j, WTP_i^j is the willingness to pay of individual *i* for certification z_1^j and n^j is the size of the subsample related to that specific certification.

In addition, in order to determine the socioeconomic variables (see Appendix A1) that influence the individual WTP, we specified a linear model as follows:

$$\text{WTP} = \beta'\text{X} + \varepsilon \qquad (2)$$

where X is the vector of explanatory variables, β is a vector of unknown parameters to be estimated and ε is a random error term assumed to be normally distributed with zero mean and constant variance. We include all individuals in a single model and use dummy variables to measure the differential effect of each certification. The model is estimated by OLS.

In accordance with the Random Utility Theory (McFadden, 1974), DCEs are based on the assumption that consumers (*i = 1, ..., I*) maximize their utility when they have to choose among

several alternatives ($j = 1, ..., J$) in a choice set ($t = 1, 2..., T$). The utility function is represented as:

$$U_{ijt} = V_{ijt} + \varepsilon_{ijt} \tag{3}$$

where $V_{ijt} = \beta'_i X_{ijt}$ is the deterministic component, X_{ijt} is a vector of observed variables related to alternative j in choice set t by an individual i; β_i is a vector of structural taste parameters which characterize choices, and ε_{ijt} is the corresponding type-I extreme value distributed random component, which is assumed to be independent of β and X.

The probability that a respondent i chooses an alternative j in a choice set t depends on whether the utility from the chosen alternative exceeds the utility that would be gained from the other alternatives k, as follows:

$$p_{ijt} = Prob\left(V_{ijt} + \varepsilon_{ijt} \geq V_{ikt} + \varepsilon_{ikt}, \forall k \in A_i \,\&\, k \neq j\right) \tag{4}$$

where p_{ijt} is the probability of choosing alternative j, Ai is the choice set faced by respondent i. If ε_{ijt} and ε_{ikt} are *i.i.d.* type I extreme values of the random component of utility, the probability of choosing alternative j in the observed sequence of choices $[y_1, y_2, ..., y_T]$ is calculated by the integral:

$$P_i[y_1, y_2, ..., y_n] = \int ... \int \prod_{t=1}^{T} \left[\frac{e^{X_{ij}\beta_i}}{\sum_{k=1}^{J} e^{X_{ik}\beta_i}} \right] f(\beta \mid \Omega) d\beta \tag{5}$$

where, β_i is the vector of individual preference values, X_{ij} is the associated attribute vector. The *vector* of parameters, in in our case is β $\{\beta_{z_1^1}, \beta_{z_1^2}, \beta_{z_1^3}, \beta_{Price}\}$ varies in the population with density $f(\beta|\Omega)$, where Ω denotes the parameters of the density function. We used a Random Parameter Logit (RPL) model, which allows us to introduce unobserved preference heterogeneity (Train, 2009). We assume that the random parameters for the three coffee certifications under study are normally distributed, which is the most common assumption in discrete choice analysis because of

its relatively simple estimation and interpretation (Sagebiel, 2017). Model estimations were performed using the NLOGIT® 6.0 software. We can estimate the sample mean WTP for each certification (z_1^1, z_1^2, z_1^3) as well as the individual WTP using the formula:

$$\overline{WTP}_{z_1^j} = \frac{-\beta_{z_1^j}}{\beta_{Price}} \qquad j = 1\ is\ CN, 2\ is\ FT, 3\ is\ ISO\ 14001 \quad (6)$$

6.4 Results and discussion

6.4.1 Results of the open-ended CVM

We compute the WTP mean, first using the complete sample (n=1191) and then for each of the certifications under consideration (split sample). The joint mean shows that Costa Rican consumers are willing to pay an average price premium of ₡371.1 ($0.65) for an environmental certified coffee (z_1). In the split sample, consumers are willing to pay an average price premium of ₡383.57 ($0.68) for CN coffee, ₡361.71 ($0.64) for FT coffee and ₡368.16 ($0.65) for a coffee produced by a company certified as ISO 14001. Standard errors (in ₡) were 13.57, 24.56, 25.24 and 20.92, respectively.

The price premiums for all three certifications are around 30% with respect to the benchmark price. Other studies found similar percentage price premiums using other economic valuation methods in different geographical areas. For example, Maietta *et al*. (2003) estimated a price gap for FT coffee of 30% with respect to the average price of a regular coffee in Italy using hedonic prices. With the same method, Schollenberg (2012) estimated a price gap of 38% for FTC in Sweden. Using discrete choice experiments, Van Loo *et al*. (2015) estimated that American consumers were willing to pay a price gap of 27% for an organic coffee compared to regular coffee; for the same sustainability label Grebitus *et al*. (2009) estimated a price gap of 34.5% in Germany. Finally, using the contingent valuation method, Yang *et al*. (2012) estimated a price premium of 22% for FT coffee in China.

Table 6.3 shows the estimated parameters for the model (1). We find that household income (I) is positively related to consumers' WTP for coffee certifications as WTP tends to be higher in the highest income quintiles. Previously, Loureiro & Lotade (2005) concluded that female

respondents with higher income were more likely to pay a premium for FT, shade grown, and organic coffee in Colorado, the U.S. While Liu *et al*., (2019) found a positive and significant statistical relationship between income and the individuals' WTP for grade-certified coffee in Taiwan.

Table 6.3 Linear model for the open-ended data, willingness to pay (WTP) for certified coffee (in colones)

Variables		**Coefficient (Std.Err.)**
Cons		205.7777** (73.44773)
i.I	q_2	103.0505* (41.87771)
	q_3	110.7753* (44.62357)
	q_4	173.9481*** (47.62782)
	q_5	186.6827** (59.32321)
A		-2.216789 (1.179515)
G		-41.74362 (26.61261)
ye		10.64901** (3.44028)
PR		52.3979 (31.55014)
PG		-7.187456 (38.99116)
M		-111.2494*** (31.65528)
RECG		22.50754 (33.17365)
i. TC	CNC	29.62967 (35.17438)
	ISO14001	-40.89618 (34.19063)
n		1191
R^2		0.0910
Prob > F		0.0000

Legend: * p<0.05; ** p<0.01; *** p<0.001.

Individual education (in years) has a statistically significant effect on the consumers' WTP for an environmental certified coffee. Previous studies have also found a positive relationship between both variables (see, e.g., Loureiro & Lotade, 2005; Liu *et al*., 2019). In addition, we obtain the non-standard result that married people (M) are less willing to pay. One possible explanation

for this result might be linked to the financial burden associated with maintaining a family. We found no statistically significant effects of the rest of the variables. It merits to underline that Costa Rican consumers can differentiate between “certified” and “non-certified” coffee, but there are no statistical differences in the price premiums that consumers are willing to pay between subsamples, i.e. there is a similar valuation for all three certifications (see i. TC in Table 6.3).

6.4.2 Results of the DCE

In the choice experiment we assume that the consumers’ choices follow a panel data structure, i.e. the decision heuristics are the same for the 6 choices of the individual. Then, we estimated a RPL model and calculated the mean WTP for our sample. The results show that price premiums that consumers are willing to pay for a package of CN coffee is ₡2,102.56 ($3.70), ₡2,228.86 ($3.92) for FT coffee and ₡1762.81 ($3.10) for a coffee produced by an ISO14001 certified company (see Table 6.4). A first remark is that coffee ecolabels (FT and CN) received higher price premiums than the ISO 14001 company certification.

DCE studies usually consider different characteristics of certified coffee. When this is the case, marginal WTP for each of the characteristics should be estimated and, through aggregation rules (for example, linear additivity) the price premiums are estimated. In our case study, the DCE only consider the type of certification and the price premium, as our objective is to directly estimate the consumers' WTP for certification itself, and not for specific coffee characteristics.

Table 6.4 Random Model and the estimated price premium for coffee certifications (in colones)

Variables	**Mean Coeff.**	**Std. Dev. of RP**	**WTP**
CN coffee (z_1^1)	3.90982***	1.51083***	2,102.56***
	(0.28409)	(0.22764)	(330.3788)
FT coffee (z_1^2)	4.14469***	2.63221***	2,228.86***
	(0.31024)	(0.33296)	(405.0509)
ISO 14001 (z_1^3)	3.27804***	2.96782***	1,762.81***
	(0.40035)	(0.40336)	(245.3985)
Price	-0.00186***	Fixed	
	(0.00034)		
McFadden Pseudo R^2	0.4109497		
Log likelihood function	-854.22210		
Numbers of observations	1320		
[individuals]	[220]		

* p<0.05; ** p<0.01; *** p<0.001. Standard errors in parenthesis, RP= Random Parameters

The first impression is that the price premiums estimated through DCE are very high as compared to the OE-CVM. However, our estimated price premiums, especially for FT coffee using DCE are more in line with those found in Costa Rican market for different brands of certified coffees (see figure 6.4).

Non environmental certified coffees				
Mean price per gram: ₡4.79	250 grams ₡ 1,240	250 grams ₡ 1,360	250 grams ₡ 1,245	250 grams ₡ 950
Carbon Neutral coffees				
Mean price per gram: ₡8.05	460 grams ₡4,027	300 grams ₡ 2,665	300 grams ₡ 2,665	250 grams ₡ 1,419
Fairtrade coffees				
Mean price per gram: ₡13.80	340 grams ₡4,140	340 grams ₡4,340.00	340 grams ₡5,600.00	

Figure 6.4 Coffee prices in Costa Rica

Sources: Peridomicilio (2020), CoopeDota (2020), Automercado (2020), Coocafe (2018)

6.4.3 Comparation of results across methods

Previous studies, mainly in high-income countries, have shown that, to some extent, consumers attach higher values to environmentally certified coffee and, therefore, they are willing to pay a price premium for it (see Table 6.1). In the same way, our results show that Costa Rican consumers are willing to pay price premiums for any of the three coffee certifications considered.

However, we find differences in the estimated price premiums across the methods (inter-method). In the DCE, the WTP tends to be higher than OE-CVM. Specifically, we estimate a price gap between 141% for ISO14001 and 178% for FT coffee compared to a regular coffee. Our estimates from the DCE are in line with those shown in the real market, especially in the case of FT coffee brands compared to non-certified brands.

Other studies found price premiums around 100% using DCE, for example, Gallenti et al. (2016) estimated a price gap of 93% for an organic coffee in Italy; while Maaya (2018) found that Flanders inhabitants were willing to pay a price gap of 88% for an FT coffee and 92% for organic coffee. Finally, Rotaris and Danielis (2011) estimated that Italian consumers were willing to pay a price gap of 110% for FT coffee as compared to a regular coffee. Moreover, in a large survey (n=1199) of coffee consumers in Costa Rica, Aguirre (2016) showed that 50% of respondents are willing to pay approximately double for high-quality (not necessarily certified) coffee. Thus, our DCE adjusted results are in line with similar experiences in Costa Rica.

In addition, DCE results show that consumers value ecolabels (FT and CN) more than ISO 14001 company certification. This result could be explained because of the fact that a large proportion of the Costa Ricans are concerned about climate change and environmental sustainability (see e.g. Vignola et al., 2013). This broad knowledge and concern about this problem is due to several factors, including that during decades, domestic and international communication media has informed about the damage caused by greenhouse gases, as well as the irreversible consequences of climate change (Boykoff, 2009; Zamith, Pinto, & Villar, 2012), the belligerent policy of the Costa Rican government to combat climate change (Flagg, 2018; Vignola et al., 2013), the study of the environmental issues in the public education system (Blum, 2008), the active actions of companies in order to reduce their carbon footprint (Ministerio de Ambiente y Energía, 2018, Musmanni, 2014), among others.

6.5 Conclusions

Using different economic valuation methods, our research shows that Costa Rican consumers are willing to pay price premiums for all the certifications evaluated, namely ISO 14001, Fairtrade, and Carbon Neutral. Results from OE-CVM suggests that the current prices of certified coffees are aimed at a more educated and higher income segment of the Costa Rican population, as shown by our linear model. In addition, the DCE shows higher consumers' WTP for all three certifications than those obtained in the OE-CVM but, DCE better mimics observed price differences between certified and non-certified coffee brands.

Since coffee producers must comply with a series of environmental and social standards in order to get environmental certifications, we can argue that certified products and companies tend to have a better environmental performance than their regular counterparts. Our study shows that Costa Rican consumers are willing to pay a price premium for certified coffee, which points to the existence of a market channel for eco-labeled coffee that should be strengthened in order to guarantee the environmental improvements derived from these certifications. In order to strengthen this channel and foster the environmental improvements associated to the consumption of certified coffee, communication campaigns should be developed so that consumers can deepen their knowledge of each certification as well as its social and environmental implications.

Appendix A.1

Table. A.1. Variables and descriptive statistics

Dependent variable	Description	Mean	Std. Dev.
WTP	Willingness to pay for a 250-gram package of "certified" ground coffee (in colones)	371.1	468.14
Independent variables			
I	*Monthly household income quintile in colones (qi=1 if the respondent is in quintile i, 0 otherwise)*		
q1	Less than 300,000 (around $528)	0.1671	0.3732
q2	Between 300,001 and 600,000 (around $529 and $1056)	0.2569	0.4371
q3	Between 600,001 and 1,000,000 (around $1,057 and $1,761)	0.2469	0.4314
q4	Between 1,000,001 and 2,000,000 (around 1,762 and $3,521)	0.2124	0.4092
q5	More than 2,000,001 (more than $3,522)	0.1167	0.3212
A	Age of the respondent	35.03	13.50
G	Gender, 1 if the respondent is a man, 0 if the respondent is a woman	0.5264	0.4995
Ye	years of formal education, from early childhood education.	13.81	5.25
PR	Place of residence, 1 if the respondent lives in one of the central provinces, 0 if he/she lives in a coastal province	0.7573	0.4289
PG	1 if the consumer belongs to, at least, one environmentalist or community group, 0 otherwise	0.1385	0.3456
M	Marital status, 1 if the consumer is married or in a domestic partnership, 0 otherwise	0.3233	0.4679
RECG	1 if the respondent knew the certification that she/he valued, 0 otherwise	0,330	0,4704
TC	*Type of certification (it is used only to differentiate the certification valued by each respondent)*		
CNC	1 for the subgroup of respondents that valued Carbon Neutral coffee, 0 otherwise	0.3249	0.4685
FTC	1 for the subgroup of respondents that valued Fairtrade coffee, 0 otherwise	0.3216	0.4673
ISO14001	1 for the subgroup of respondents that valued ISO14001 certification, 0 otherwise	0.3535	0.4782

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Chapter 7: Differentiation strategies in coffee farms: Opportunities for Costa Rican growers

Abstract: Coffee prices are essential for the development opportunities of some countries and regions. Thus, in the early 2000s the reductions in coffee prices in the international markets led to an economic crisis in producing regions within developing countries. This study investigates the principal main driving forces behind coffee berry prices in Costa Rica. Using an unbalanced panel dataset and Prais–Winsten regression to correct for heteroskedasticity and serial correlation for the period 2008–2016 our study finds different groups of relevant variables. Some are external to the control of the coffee growers, such as the international price of green coffee or the power of multinationals; others, like the altitude where the coffee is harvested or the berries' yield, are related to coffee quality but difficult to modify by coffee growers. Finally, the third group refers to differentiation strategies by farmers. We find that organic production is a successful strategy to increase the price, but Fair-Trade (FT) certification is not so successful as FT mills report lower average prices than other non-certified buyers. We look into the factors that explain this apparently surprising result and we propose some strategies to face periods of low coffee prices.

Keywords: Coffee prices; panel data analysis; differentiation strategies; quality; Costa Rica; multinational bargaining.

7.1 Introduction

Around 7.5 billion kilograms of coffee were exported from producing countries in 2017 (International Coffee Organization, 2019), which makes coffee the most traded food commodity in the world (Girotto, et al., 2018). Coffee production is also one of the most important activities in the rural regions of many developing countries as around 20-25 million families in 51 nations depend on coffee production for their livelihoods (Castro et al., 2004; Lewin et al., 2004; Prasad, 2019). According to Castro et al. (2004), in Central America coffee production supports 291,000 farmers and provides around 1 million seasonal jobs.

In Costa Rica, coffee production is an economic activity of great importance for many rural cantons (Pelupessy and Díaz, 2008), where primary production is mostly carried out by families

with small farms. In fact, 92 percent of coffee farmers have plots that are less than 5 hectares in size and 6 percent have plots that are between 5 and 20 hectares (Dragusanu and Nunn, 2018; Instituto del Café de Costa Rica, 2017).

The coffee value chain is made up of coffee growers, coffee milling companies, exporting firms and roasting firms. According to the Costa Rican Coffee Institute (ICAFE, 2017), 43,035 coffee growers, 246 coffee milling companies, 76 exporting firms and 65 roasting firms were operating in Costa Rica in 2017. During the 2016-2017 harvest, 1.4 million 46-kg bags of green coffee were exported, representing US$ 288.3 million. In 2017 coffee production accounted roughly for 0.28% of Gross Domestic Product (GDP) and 8.17% of Agricultural GDP (ICAFE, 2017).

Coffee price is, on the one hand, one of the most price-volatile primary commodities in the world (Lukanima and Swaray, 2014), and on the other hand, one of the most important determinants of profitability for all actors in the coffee value chain, especially for growers. Price drops affect both short-term and long-term profitability for growers by discouraging investment in coffee plantations, making plots more vulnerable to pests and diseases (Avelino et al., 2015). As a result, the productivity of plantations falls, generating a double crisis for producers, as the effects of the price reductions are intensified by those of lower productivity (Eakin et al., 2013; Renard, 2010). Furthermore, Pelupessy and Díaz (2008), Prasad (2019), Rettberg (2017), and Sick (2008) have reported that low international coffee prices are also related to higher levels of unemployment, poverty, migration, violence and corruption in coffee-producing regions.

For these reasons, Costa Rica's Law 2762 has regulated coffee berry prices in the country since 1961. This law is intended to solve market failures due to the information gap between coffee mills and growers, and to establish equitable relationships between them. According to this law, the price that buyers pay for berries must be based on the prices they charge for green coffee in national and international markets. Specifically, it creates a consignment mechanism in which prices paid to farmers must be a function of the seasonal average price obtained by each coffee mill, its production costs and processing yields (Adams and Ghaly, 2007; Asamblea Legislativa de Costa Rica, 1961; Dragusanu and Nunn, 2018).

Despite this law, it has been observed that coffee mills report different annual average prices (see Figure 7.1). Given this variability and the importance of prices for coffee growers, it seems relevant to ask what factors matter most to determine coffee prices and, ultimately, the

profitability of this activity. Although some of these factors are determined externally (like international prices), others are strategic decisions that farmers can use to put them in a better position. The latter include product differentiation by using certain farming practices or adopting some environmental certifications. In this chapter, we are particularly interested in the effect of these strategic decisions on coffee prices, although we also consider external variables for the sake of completeness. Thus, we aim to answer the following questions: (i) What are the main drivers of coffee berry prices in Costa Rica? and, more specifically, (ii) What coffee producers' strategies are more successful to differentiate the product and obtain better prices?

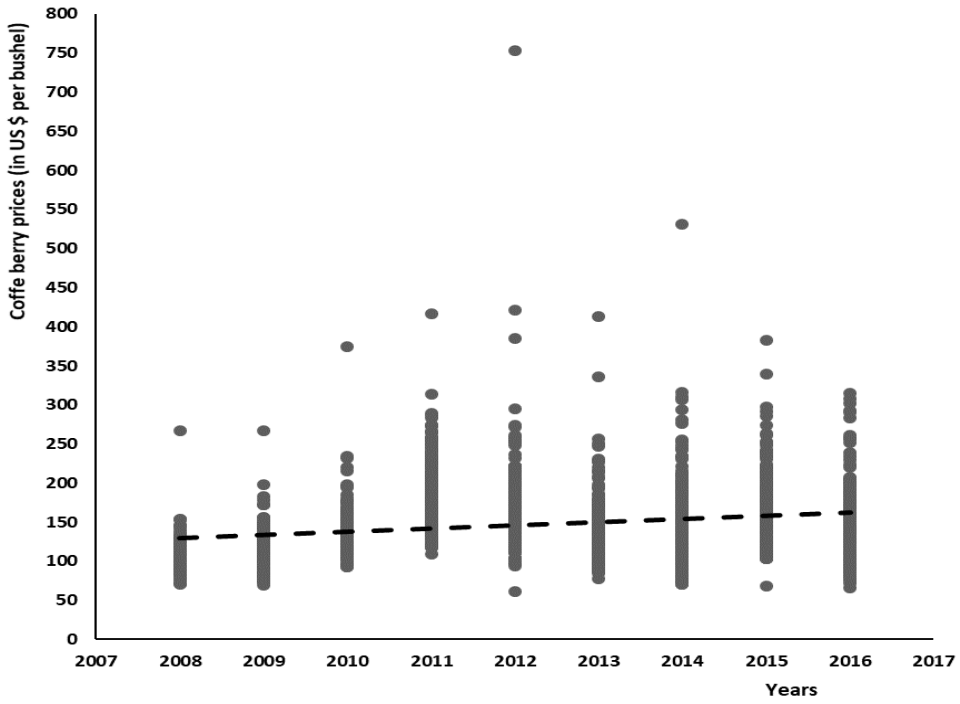

Figure 7.1 Costa Rica. Annual average prices of coffee berries reported by mills. In US dollars per bushel1. 2007-2008 to 2015-2016 coffee harvests.

Source: Authors' elaboration based on data from the Costa Rican Coffee Institute.

Among the researchers who have studied the determinants of coffee prices in Costa Rica, Donnet et al. (2008) estimated a hedonic pricing function using data from e-auctions in Central and South America, and found that market clearing prices are influenced by sensory characteristics and

reputation, including third-party quality rankings, country of origin, coffee variety, and quantity. They also found that e-auction coffee sales result in substantially higher prices than those obtained in conventional commodity markets.

Pelupessy and Díaz (2008) concluded that the highest-quality coffees harvested in the highlands of Central America obtain better prices in international markets than coffee harvested in lowland areas, which tend to be of lower quality. However, lowland producers can also increase their sale prices and survive in the coffee sector through market differentiation in terms of environmental and social attributes. Samper (2010) argued that quality and the use of organic production systems are positively related to better prices for coffee growers in Costa Rica. Likewise, Wollni and Zeller (2007) found that farmers participating in the specialty coffee segment in three coffee regions of Costa Rica received higher prices than those participating conventional channels. Dragusanu and Nunn (2018) found that the Fair-Trade (FT) certification is associated with a higher sale price and greater sales by coffee cooperatives.

As some previous studies, we focus on the prices that coffee growers receive, i.e., the first link in the coffee value chain (see e.g. Pelupessy and Díaz, 2008; Samper, 2010; Wollni and Zeller, 2007). However, previous analyses focus on the influence of individual variables such as quality, environmental certifications, or regional differences on the green coffee prices. The present chapter goes beyond these approaches by considering the effect of several groups of factors, including producers' strategic decisions, coffee characteristics and external elements such as the international price.

To the best of our knowledge, there is no study for the case of Costa Rica that addresses the joint effect of this set of variables on coffee prices through a panel data analysis. A panel data analysis has the advantage of allowing to control for the effect of omitted variables and to test more complicated behavioral hypotheses than is possible using data from a single cross-section or time series (see Hsiao 2007).

Our results suggest that coffee prices are influenced by three groups of variables. The first group includes purely external factors, that we take as control variables, such as international prices and the bargaining power of multinationals. Second, variables related to the quality of coffee, but not easily controlled by growers, such as altitude where the coffee is harvested and coffee berries yield. The third group relates to strategies that can be adopted by the farmers to differentiate their product and get better prices. Specifically, we focus on two of those strategies that are particularly

relevant in the coffee sector, such as organic farming practices and the adoption of the FT certification. Our conclusion is that not all differentiation strategies have to be equally effective. We find out that organic farming practices tend to result in higher coffee prices, but this is not necessarily the case for the FT coffee mills. Actually, we get the somewhat counterintuitive result that the average prices reported by FT coffee mills have been lower than non-FT ones.

The rest of the chapter has the following structure. Section 2 presents the conceptual framework of the analysis, Section 3 explains the methodological aspects, including the econometric approach, the variables considered and the data sources used, Section 4 presents and discusses and Section 5 gathers the main policy implications Finally, our conclusions are summarized in Section 6.

7.2 Theoretical framework and hypothesis development: The drivers of coffee berry prices

Although we are mainly concerned about the coffee attributes, and especially those that can be strategically decided by growers, in order to avoid estimation biases, we also include other elements that may have an influence on the coffee price, such as the international price and the power of multinationals.

7.2.1 Control variables: International price and multinationals bargaining power

7.2.1.1 International coffee prices

It is well established that international markets are crucial in determining the domestic prices of commodity products, especially in small countries with open economies (Igami, 2015). Like other commodities in developing countries, it has been shown that domestic coffee berry prices are strongly influenced by international prices (Mofya-Mukuka and Abdulai, 2013; Worako et al., 2008). As a consequence, the periods during which prices for green coffee are low in international markets tend to generate economic crises in coffee growing regions (see Avelino et al., 2015 and Prasad, 2019).

Currently, the main references for coffee prices in the world are the London International Financial Futures and Options Exchange, and especially the New York Stock Exchange (Jarvis, 2012; Lukanima and Swaray, 2014). Moreover, the International Coffee Organization (ICO) established a general price indicator system based on prices of the different types of green coffee that are marketed around the world; one specific price indicator calculated by the ICO is for "Other mild arabicas", which is how Costa Rican coffee is classified (International Coffee Organization, 2011; International Trade Centre, 2011).

Figure 7.2 shows that, in the period between 1990 and 2012, domestic coffee prices in Costa Rica have basically followed a very similar trend than that of international prices.

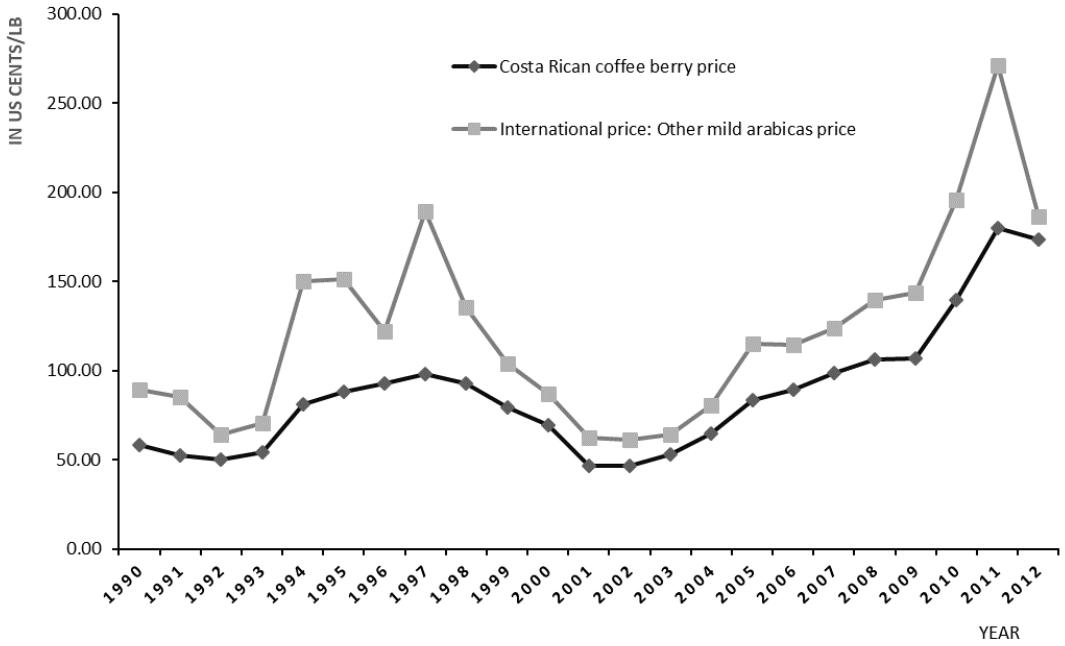

Figure 7.2 Nominal coffee prices. US Dollar Cents per pound.

Source: Authors' elaboration based on ICO statistics.

Based on previous theoretical and empirical studies, the first hypothesis of this study is stated as follows: *H_1: There is a direct relationship between prices of coffee berries in Costa Rica and international prices of green coffee.*

7.2.1.2 Multinational coffee companies

Multinational companies (MCs) control value-added activities in several countries (Dunning and Lundan, 2008). These companies are often vertically integrated, in the sense that different stages in the production process take place in a single firm, and/or are horizontally integrated, insofar as they establish the same or similar production processes in different locations, mainly to gain market access or because of tariffs and transportation costs (Borga and Zeile, 2004).

MCs will typically extract a "fee" to offset the risk of investing in specialized and real-estate assets in a host country. This fee might take the form of higher prices for goods sold and/or lower prices for the commodities they purchase (Teece 1985, 237). Similarly, Dunning and Lundan (2008) consider that MCs can use their dominant position to gain competitive advantages in the form of cheaper inputs in different countries (see also Markusen 1995).

In the coffee sector, multinational coffee companies (MCCs) tend to use a vertical integration strategy, integrating most of the value-added processes along the coffee production chain and also a horizontal integration strategy, because they carry out agroindustrial processes in different countries or different regions in the same country (Talbot 1997; Talbot 2002). We can expect that the following hypothesis holds true: *H_2: MCCs pay lower prices to coffee growers than those offered by other types of coffee mills.*

7.2.2 Intrinsic coffee quality properties

In this group we include those variables that are related to coffee quality, but are intrinsically given and not easily modified by growers.

7.2.2.1 Coffee berry yield

The agroindustrial process in the coffee chain basically consists of the separation of husks and pulp from coffee berries, after which the coffee beans must be completely dried. The resulting product is called green coffee or parchment coffee.

An increase in the yield of a bushel of coffee berries is expected to imply an increase in the prices paid to coffee growers (Instituto del Café de Costa Rica, 2014), since coffee berries with larger and heavier seeds are associated with higher quality, and mills therefore obtain higher yields from their inputs. Based on these arguments, the following hypothesis is proposed:

H_3: Berry yield is positively related to coffee berry price.

7.2.2.2 Altitude of coffee production regions

Altitude is an important determinant of coffee's sensorial qualities (body, acidity, and aroma). Pelupessy and Díaz (2008) argued that the optimal growing altitude in Central America appears to be between 1,200 and 2,100 meters above sea level (masl). Coffee harvested in these areas is classified as *hard bean* and *strictly hard bean*, which often command significant premiums in the market (Varangis, et al. 2003).

In the case of Costa Rica, it has been reported that coffee quality differs considerably across regions. Samper (2010) claims that while growers in highlands tend to produce higher-quality coffee and earn significant price premiums, those in lower areas offer lower quality and focus on output volume instead.

According to Castro et al. (2004) and Pelupessy and Díaz (2008), agricultural policies in Central America seek to promote coffee cultivation in areas of high altitude, given that the hard been and strictly hard been coffee types enjoy more prestige and have a better price in international markets.

According to ICAFE (2017) Costa Rica is divided into 8 coffee producing regions, which differ with respect to altitude, rainfall volume, and soil characteristics. Coffee farms located in the Tarrazú coffee region are found from 1,100 to 1,900 masl (Castro-Tanzi, et al. 2012). Avelino et al. (2009) concluded that Tarrazú is the highest coffee producing region, with a large proportion of coffee plots located at around 1,800 masl, which leads us to expect that coffee produced in Tarrazú is, on average, higher quality and thus is sold at higher prices, as we state in our next hypothesis: *H_4: Coffee growers located in the Tarrazú production region obtain higher average coffee berry prices than those obtained in other production regions.*

7.2.3 Strategic differentiation: Organic coffee and Fair Trade.

Traditionally, most growers and coffee mills follow a low-cost production strategy; however, an increasing number of them are pursuing strategies other than commodity pricing and cost reduction. These alternatives involve product differentiation in both agricultural and agroindustrial processes. Available channels for coffee differentiation include geographic indications of origin, as well as gourmet and specialty, organic, Fair-Trade (FT), Eco-friendly or shade grown, or other certifications (see, e.g. Lewin et al., 2004). We focus on organic coffee production and FT certification.

7.2.3.1 Organic certified coffee

Coffee growers who aim at being certified as organic must comply with a strict package of technological and environmental standards, including the following practices in their farms (Blackman and Naranjo 2012; Van der Vossen 2005):

(i) using composted organic matter rather than chemical fertilizer inputs,

(ii) implementing soil conservation practices such as planting shade trees, planting cover crops and mulching,

(iii) using natural substances for disease, pest, and weed control, rather than synthetic pesticides and herbicides,

(iv) minimizing use of fossil fuels in the production process, and

(v) minimizing pollution during postharvest handling.

In summary, organic coffee growers must reduce chemical inputs and adopt environmentally friendly management practices such as agroforestry techniques. These actions increase the level of biodiversity in farms (Inter-American Development Bank, USAID and The World Bank 2002).

Lewin et al. (2004) state that organic coffee growers obtain economic benefits, primarily because they can participate in a differentiated market and obtain better prices while safeguarding their natural resources. Varangis, et al. (2003) argued that roaster companies pay a premium for organic coffee because final coffee consumers are in turn willing to pay higher prices for it. For example, Mexican organic coffee growers received, on average, 34 cents more per kilogram than conventional growers in the period from 1995 to 2004 (Barham et al., 2011). In Nicaragua, the price obtained at the farm by organically certified farmers was 27% higher than that received by

FT certified and non-certified farmers (Jena et al., 2015). Based on this empirical evidence, our next hypothesis is that: *H_5: Organic coffee berries are more expensive than non-organic berries.*

7.2.3.2 Fair-Trade Producer certification

Coffee mills buy berries from growers and carry out the first industrial transformation of these berries. According to Pelupessy and Díaz (2008), FT Producers are mills, normally cooperatives, that buy coffee from growers who are in many cases partners of the cooperative itself and meet some of the production standards of FT Organizations.

To obtain this certification, FT producers must comply with several requirements, which include paying a fair price to farmers, transparency and accountability, commitment to non-discrimination, gender equity and freedom of association (labor unions), promotion of FT, ensuring good working conditions, facilitating capacity building, respect for the environment, ensuring the absence of child labor and forced labor, and creating opportunities for economically disadvantaged producers (Cordinadora de Comercio Justo para Costa Rica y Panamá n.d.; Ruben 2009). These efforts are expected to be rewarded by higher prices in the market.

Despite what one might expect, empirical results regarding the effect of FT on price are mixed. In Costa Rica, Dragusanu & Nunn (2018) found that cooperatives and grower associations that are FT certified receive higher prices and higher revenues when the minimum sale price guaranteed by FT is higher than the international price. They also show that FT is associated with higher incomes and better social indicators for coffee farmers' families. On the other hand, Jena et al. (2015), Sick (2008) show that FT certification does not necessarily imply better prices for coffee growers (see also Bacon, 2005; Haight, 2007; Omidvar and Giannakas, 2015; Weber, 2007).

Considering the FT objectives, as well as some of the empirical studies previously carried out in this area, the following hypothesis is posed: *H_6: FT-certified coffee mills pay better prices for organic and non-organic berries.*

7.3 Empirical application

7.3.1 Panel data set

An unbalanced panel data set was constructed using a database of annual average prices paid for coffee berries as reported by mills or buyers to ICAFE from 2008 to 2016. These prices are denoted as $DP\ i_{(rc)t}$, where the unit of analysis is the buyer "*i*" who bought a type of coffee "*c*" in a production region "*r*"; therefore, each group in the panel data is defined as "$i_{(rc)t}$". The subscript "*t*" refers to the years between 2008 and 2016. The same coffee mill could appear in several groups of the panel if it bought more than one type of coffee or from more than one region in the sample period.

In the panel data specification, some variables such as the coffee production region "*r*", type of coffee "*c*" and multinational coffee company "*mcc*" are time invariant variables, although they clearly vary between the groups of the panel. On the other hand, the international green coffee price variable, "*IP*" does not vary between the groups of the panel, therefore ($IP_{i(rc)t} = IP_t$).

Those groups in which the buyer "*i*" only reports purchases for one year during the sample period were not included in order to reduce the bias that could be introduced by companies that bought coffee in a speculative and non-systematic manner. After these adjustments, our effective panel consists of 426 groups ($i_{(rc)t}$=1,…,426) and 2,415 observations.

7.3.2 Data sources

We used data from several sources: data about annual average prices of coffee berries paid by each mill for each type of coffee and in each productive region, as well as coffee berry yields were taken from the ICAFE Web Site (Instituto del Café de Costa Rica, 2015). Prices, which were originally in the domestic currency (colones), were converted to dollars using the annual average exchange rate of the Banco Central de Costa Rica.

FT producers were identified using the Web Site of the Fair-Trade Coordinator for Costa Rica and Panama. This information was complemented with data from the Fairtrade Certification Mark Web Site (FLOCERT 2017) and the Web Site of The Consortium of Coffee Cooperatives of Guanacaste and Montes de Oro, R.L. (COCAFE 2019). During the sample period, twenty buyers were FT-certified at least in two years, 9 of which were grouped in the COCAFE consortium, while 11 were independent cooperatives or grower's associations. An email was then sent to the managers

of the cooperatives to confirm average sales in the FT market during the last 5 years. Complete answers were received from COCAFE and 4 other cooperatives.

Faure and Le Coq, 2009; García and Valenciano 2016 and Talbot (2002) identified MCCs. In addition, MCCs operating in Costa Rica were verified through MCCs' web pages. Finally, as a measure of the international green coffee prices (IP_t), we use the "other mild arabicas coffee" index, from ICO statistics.

7.3.3 Variables

We take the logarithm of annual average prices paid by a mill according to coffee type and production region ($logDP_{i(rc)t}$) as the dependent variable. Regarding the independent variables, some of them are qualitative and some quantitative; the former pertain to buyers and coffee characteristics, while the latter are coffee berries yields and international prices. Table 7.1 shows the definition and the statistical behavior of each variable.

Table 7.1 Summary statistics

Variables		Description	Mean	SD
$\boldsymbol{LogDP_{i(rc)t}}$		Dependent variable. Logarithm of annual average prices of coffee berries paid by a mill, (domestic price in dollars per bushel)	4.9429	0.2913
Quantitative explanatory variables				
$\boldsymbol{logIP_t}$		Logarithm of Other Mild Arabicas reference price of ICO (international price in US $ Cents per pound)	5.1676	0.2035
$\boldsymbol{logyb_{i(rc)t}}$		Logarithm of the yield of a bushel of coffee berries. This is the amount of green coffee that is obtained from a bushel of coffee berries (in kilograms).	3.7834	0.1164
Qualitative variables (assume a value of 1 if the relevant characteristic is true, 0 otherwise)				
Coffee Regions	$bpa_{i(rc)}$	Brunca	0.2472	0.4315
	$wvpa_{i(rc)}$	Western Valley	0.1975	0.3982
	$guapa_{i(rc)}$	Guanacaste	0.0605	0.2384
	$tuapa_{i(rc)}$	Turrialba and Orosí	0.0683	0.2524
	$tpa_{i(rc)}$	Tarrazú	0.2265	0.4187
	$cvtrpa_{i(rc)}$	Central Valley and Tres Ríos	0.2000	0.4001
Characteristics	$mcc_{i(rc)}$	Multinational coffee company	0.0675	0.2509
	$ftp_{i(rc)t}$	Fair-Trade Producer	0.1569	0.3638
	$ocof_{i(rc)}$	Organic coffee	0.0675	0.2509

	$Nocof_{i(rc)}$	Non-organic coffee (conventional)		
Cross effects	$ftpocof_{i(rc)t}$	Fair-Trade Producer that bought organic coffee	0.0141	0.1178
	$ftpNocof_{i(rc)t}$	Fair-Trade Producer that bought non-organic coffee	0.1416	0.3487
	$Nftpocof_{i(rc)t}$	Non-Fair-Trade Producer that bought organic coffee	0.0534	0.2249
	$NftpNocof_{i(rc)t}$	Non-Fair-Trade Producer that bought non-organic coffee	0.7909	0.4068

7.3.4 Econometric models

Two alternative lineal models were considered. The first seeks to identify individual effects of coffee type ($ocof_{i(rc)}$) and FT buyers ($ftp_{i(rc)t}$) separately, while the second model considers cross effects of both variables.

$$LogIP_{i(rc)t} = \alpha_{it} + \beta_1 logDP_t + \beta_2 logyb_{i(rc)t} + [\beta_3 bpa_{i(rc)} + \beta_4 wvpa_{i(rc)} + \beta_5 guapa_{i(rc)} + \beta_6 tuapa_{i(rc)} + \beta_7 tpa_{i(rc)}] + \beta_8 mcc_{i(rc)} + \beta_9 ftp_{i(rc)t} + \beta_{10} ocof_{i(rc)} + u_{it} \quad \textbf{[Equation 1]}$$

$$LogIPdol'_{i(rc)t} = \alpha'_{it} + \beta_1 logDP'_t + \beta_2 logyb'_{i(rc)t} + [\beta_3 bpa'_{i(rc)} + \beta_4 wvpa'_{i(rc)} + \beta_5 guapa'_{i(rc)} + \beta_6 tuapa'_{i(rc)} + \beta_7 tpa'_{i(rc)}] + \beta_8 mcc'_{i(rc)} + \beta_{11} ftpocof_{i(rc)t} + \beta_{12} ftpNocof_{i(rc)t} + \beta_{13} Nftpocof_{i(rc)t} + u'_{it} \quad \textbf{[Equation 2]}$$

where u_{it} is a random term and the rest of the variables are previously defined in Table 7.1.

To determine the most adequate approach, the Pooled, Fixed Effects (FE) and Random Effects (RE) versions of the two specifications (equations 1 and 2 above) were estimated. In all cases, the results of Hausman Tests and Breusch-Pagan Lagrange Multiplier Tests (LM) confirm that a General Least Square Estimator (GLS) with a Random Effects Regression (RE) is the most appropriate model for estimating these equations (see Appendix 1).

Additionally, the Random Effects (RE) model is most suitable when the regressors include variables that are constant over the observed time interval but vary between units or groups (Heij, et al. 2004). Since in our panel data set some variables, such as coffee type, multinational company

and production regions, are constant in the same group, this is an additional argument to prefer the RE model.

The Wooldridge test and the Wald test reveal the presence of autocorrelation and heteroscedasticity in our data. To address these problems we use the Panel Corrected Standard Errors (PCSE) and the Prais-Winsten regression, which permits correcting the problems of heteroscedasticity and autocorrelation following an autoregressive process of order 1, AR (1), even when the panel data is not balanced (Baltagi and Wu, 1999; Freybote, 2016), as is the case in this study. In addition, the standard errors of PCSE are more accurate than those of Feasible Generalized Least Squares in these circumstances (Beck and Katz, 1995).

7.4 Results and discussion

The results of our estimations are displayed in Table 7.2. We divide our discussion according to external variables (those that the growers cannot modify), and intrinsic quality variables and differentiation strategies available for growers.

Table 7.2 Regression results of some determinants of coffee berry price in Costa Rica.

		RE models		**Prais–Winsten models**	
Variables		**Eq.1**	**Eq.2**	**Eq.1**	**Eq.2**
cons (α_i)		0.9591***	0.9572***	1.2583***	1.2605***
		(0.1813)	(0.1814)	(0.2040)	(0.2040)
logIP (β_1)		0.6389***	0.6391***	0.5743***	0.5740***
		(0.0191)	(0.0191)	(0.0203)	(0.0203)
logyb (β_2)		0.1868***	0.1871***	0.1928***	0.1927***
		(0.0398)	(0.0398)	(0.0455)	(0.0455)
Production regions[b]	*bpa* (β_3)	-0.1426***	-0.1429***	-0.1399***	-0.1402***
		(0.0237)	(0.0237)	(0.01613)	(0.0162)
	wvpa (β_4)	0.0431	0.0434	0.0560***	0.0562***
		(0.0243)	(0.0243)	(0.0170)	(0.0171)
	guapa (β_5)	-0.0002	-0.0021	-0.0097	-0.0117
		(0.0355)	(0.0358)	(0.0249)	(0.0255)
	tuapa (β_6)	-0.1156***	-0.1157***	-0.1049***	-0.1051***
		(0.0334)	(0.0334)	(0.0238)	(0.0239)

	tpa (β_7)	0.1065***	0.1063***	0.1039***	0.1037***
		(0.0232)	(0.0232)	(0.0153)	(0.0153)
Characteristics	*mcc* (β_8)	-0.1659***	-0.1660***	-0.1680***	-0.1680***
		(0.0303)	(0.0303)	(0.0212)	(0.0213)
	ftp (β_9)	-0.1027***		-0.1117***	
		(0.0204)		(0.0147)	
	ocof (β_{10})	0.2751***		0.2945***	
		(0.0305)		(0.0206)	
Cross effects [c]	*ftpocof*(β_{11})		0.1895**		0.1995***
			(0.0617)		(0.0325)
	ftpNocof (β_{12})		-0.1033***		-0.1122***
			(0.0215)		(0.0155)
	Nftpocof(β_{13})		0.2707***		0.2900***
			(0.0338)		(0.0246)
i.t[d]		No	No	No	No
i.regions		Yes	Yes	Yes	Yes
Prob > χ^2		0.0000	0.0000	0.0000	0.0000
N		2,415	2,415	2,415	2,415
R^2 or overall R^2		0.4220	0.4216	0.8196	0.8217
Rho[e]		0.3258	0.3260	0.2708	0.2731

Legend: * p<0.05; ** p<0.01; *** p<0.001. Standard errors in parentheses.

NOTES: [a] Unbalanced Panel: years= 9, n= 2,415, Groups=426. Observations per group: average=5.7, minimum=2, maximum=9.

[b] The Central Valley and Tres Ríos Regions, variable $cvtrpa_{i(r)t}$ is omitted.

[c] The Non-Fair-Trade Producer that bought non-organic coffee (*NftpNocof*) is the point of comparison of cross effects.

[d] Given that "*logIP*" does not vary between the groups of the panel, controlling for temporal effects was not carried out because the international price ($logIP_t$) captures these effects.

[e] Rho is the fraction of total variance due to $u_{it.}$

7.4.1 Control variables

As expected, the international price of green coffee is relevant for domestic prices, or, in other words, domestic coffee berry prices have reacted directly to fluctuations in the international market. Our estimated parameter (β_1) shows that a 1% increase in the international price generated a short-term increase of about 0.58% in average prices paid to coffee growers in Costa Rica, *ceteris paribus*. This finding confirms our first hypothesis (H_1).

Our second hypothesis (H_2), regarding to the bargaining power of the multinationals, cannot be rejected either. Coefficient β_8 reveals that MCCs have reported, on average, 16.8% less than other types of coffee mills during the sample period. This is consistent with their vertical integration strategy (integrating the production, processing, and exporting links in the coffee value chain), and especially with their strategy of horizontal integration through purchasing and processing coffee berries in several producing countries. In the specific case of Costa Rica, MCCs are processing coffee in most of the producing regions.

7.4.2 Intrinsic quality variables

Berry yield (the amount of green coffee obtained from a bushel of coffee berries) is positively related to berry prices (coefficient β_2), as suggested in the third hypothesis (H_3). The interpretation is that coffee mills are willing to pay a higher price when berry yield is higher because they can save on inputs and production costs. The yield, referred in this case to the weight of the coffee seed, depends mainly on the conditions outside the farm, such as the climatic conditions and the altitude where the coffee is harvested. However, there are also intrinsic conditions of the farm, such as adequate fertilization of plantations that can increase the agroindustry yield of green coffee (weight of coffee seeds).

We also find that coffee growers located in the Tarrazú region (coefficient β_7), have received a higher average price for their berries than that paid in the rest of the regions, as stated in the fourth hypothesis (H_4). It is important to note that since Tarrazú is the highest region, this variable can be interpreted to some extent as a proxy for altitude. This is in keeping with the approach of Wollni and Zeller (2007), who used the altitude at which coffee is grown in Costa Rica as a proxy for quality, and showed that coffee berries harvested in higher areas are sold mainly in specialty coffee markets, where they obtain higher prices; see also Pelupessy and Díaz (2008), Samper (2010) and Varangis et al. (2003).

7.4.3 Strategic differentiation

We now pay attention to the variables that refer to grower's signaling and differentiation strategies: organic practices and FT certification. It turns out that they result in very different outcomes.

Coefficient β_{10} shows that, as expected (hypothesis H_5), higher prices have been paid for organic than for non-organic coffee. Specifically, the former has been sold for an average price 29% higher than non-organic coffee. This finding is similar to that of Jena et al. (2015) in Nicaragua. However, a fully-fledged profitability analysis should also account for the fact that organic production entails some reductions in productivity per hectare (see e.g., Lyngbæk et al., 2001).

Contrary to our hypothesis H_6, FT coffee mills do not appear to have paid a higher average price for coffee berries than that paid by non-certified mills. In fact, the reverse was true: on average, they paid around 11% less than non- certified mills, *ceteris paribus* (coefficient β_9). If we look at the second specification, coefficients β_{11}, β_{12} and β_{13} (see equation 2) reveal that FT mills have paid lower average prices for both organic and non-organic coffee berries than non-FT mills[2].

This apparently surprising result merits further discussion. Firstly, as established by Costa Rica's Coffee Law number 2762, the annual average price that coffee cooperatives or another buyer pay for berries is established mainly based on prices for green coffee obtained in the national and international markets (incomes) minus processing and exporting costs. Sick (2008) suggested that FT cooperatives or associations incur costs related to certification, processing, financing to buy coffee from its members, traceability, and the coordination of export logistics. Therefore, if FT mills operate inefficiently, these expenses can overcome the FT price premium before it reaches coffee growers. In addition, Snider et al. (2017) identified, for some certified cooperatives in Costa Rica, a low market demand for certified coffee, weak price incentives for certified coffee and a high auditing costs. For the Mexican coffee market, see also (Weber, 2011).

Secondly, Sick (2008, 201) argued that "although FT guarantees a minimum price above average world market prices, this is not necessarily the best price available. In today's competitive global coffee market, quality coffees are increasingly in demand". High quality coffee can receive better prices than FT certified coffee. For example, Ruben (2009) claimed that in the current

dynamic framework of quality upgrading and higher coffee prices, FT comparative advantage can become eroded in the Costa Rican coffee market (see also Sáenz and Zúñiga, 2009).

Additionally, Omidvar, and Giannakas (2015) and Weber (2007) showed that saturation of the FT coffee market can lead to a reduction in growers' welfare since cooperatives cannot obtain the FT price premium for all the coffee that they sell. Consistent with this insight, Haight (2007) and Sick (2008) claimed that most FT coffee mills in Costa Rica sell much of their coffee to roasters or brokers in conventional markets. They presented three cases; two cooperatives sold only 40% of their coffee at FT prices in Costa Rica, while another cooperative sold only 23% of its coffee in the FT market in Guatemala.

Complementary to our statistical study, we applied a survey to managers of certified cooperatives. That survey reveals that, in the sample used in this study, the proportion of coffee sold in the FT market varies widely between cooperatives, ranging from FT cooperatives that were not being able to sell anything in the FT market during the period covered in this study, to others that placed 67% of their production in that market.

To gain some additional insight into this result, we use the t-test to detect additional differences between FT mills and non-FT mills. The results can be found on Appendix 2. We find that FT mills show a lower agroindustry yield than non-FT ones. We also conclude that the price differences between FT buyers and non-FT buyers were lower or not statistically significative in coffee production regions with a greater proportion of plots located in lowlands (Brunca, Guanacaste, Turrialba and Orosi) instead of highlands, (Tarrazú, Western Valley, Central Valley and Tres Ríos), where quality plays a much more important role in the final price.

Despite these results, it is not necessarily the case the FT certification is not profitable for growers, as price is not the only channel through which FT cooperatives can reward growers. In fact, some part of the FT price premium is used to generate indirect benefits to producers and their relatives, such as technical assistance, credit facilities, or social projects in the communities, and these actions are not reflected in the final price of coffee berries; see, e.g., Dragusanu and Nunn (2008) and Sick (2008).

7.5 Policy implications

From our study, we can derive two kinds of policy implications. The first one has to do with policies to be developed by coffee growers and the second with public policy. Although our results are derived using data from Costa Rica, the parallelisms to previous studies suggest that these conclusions are also valid for other coffee production areas, especially in developing countries.

Regarding growers' policy, it is important that they become fully aware of prices' expected responses with respect to different factors and which of those factors are under their control or not. Our results reveal that coffee prices are clearly related to coffee attributes, some of which are intrinsic characteristics of the coffee itself and others are more easily managed by growers. Within the second group, organic production practices seem to have a more immediate and positive effect on the price, while Fairtrade certification is not so productive in terms of prices. It seems that, with some adaptations, similar conclusions would apply to other agricultural regions, especially in producing countries of high-quality coffee.

Given that MCCs and FT mills pay on average lower annual average coffee prices, to some extent, our findings inform about the success opportunities for coffee growers, who should generate value-added strategies such as the foundation of micro-mills and private family enterprises, producing quality coffee, and the search for more direct marketing channels in international markets (see e.g. Nuñez-Solis, 2019; Snider et al., 2017a).

The sensitivity of growers' profit to coffee prices and the fact that not all of the factors affecting prices are under their direct control suggest the necessity to adaptation strategies. One of such strategies consists in crop diversification. This is a way to ensure the family's food supply during periods of low prices and a source of income complementary to coffee production. Apart from farming, ecoturism and rural tourism are also new successful activities that can contribute to the diversification of growers' income (Heyne and Vargas-Camacho, 2018; Howitt and Mason, 2018).

We can also arrive at some conclusions regarding public policy. Since the coffee price is sensitive to some variables that are beyond the control of small growers, such as the fluctuations in the international prices, the intervention of public institutions can be crucial. Such institutions should undertake and improve strategies of market research and adaptation to low coffee prices

such as adequate price forecasting systems. A sound prediction strategy would involve continuous monitoring of international coffee prices, by studying the main stock exchanges and the use of statistical forecasting models. Making such information available to coffee producers would help them prepare for downward trends in prices. Currently, ICAFE has a web page where current coffee prices on the New York Stock Exchange are reported (see, e.g. ICAFE, 2015) but no price predictions are offered.

Public policy can also contribute to foster and guarantee the success of agricultural diversification. To this aim, public authorities should carry out agroecological studies to determine the products that best suit the climatic and soil conditions of each region. Hethcote et al., (2016) showed the implementation of a successful diversified system mixing coffee production with tomato and sweet pepper in a Turrialba coffee region of Costa Rica. Alternative activities such as ecotourism and rural tourism could also be encouraged and incentivized as they convene, not only as a complement to coffee production, but also as a means to promote the care of nature and local culture (Heyne and Vargas-Camacho, 2018; Howitt and Mason, 2018).

Coffee growers of higher altitude production regions, such as Tarrazu, have a comparative national and international advantage that allows them to obtain a higher quality of coffee, which ensures higher prices. In order to guarantee the positioning of quality coffee from Costa Rica in general, and from the regions with the highest altitude in particular, the regulatory entity (ICAFE) must promote the Protected Designation of Origin that will allow maintaining and widening the positioning of main brands of "Costa Rican coffee" in international markets. This strategy has been successfully carried out by producers of wine, meat, fruits, cheese, and other products in Europe (Hajdukiewicz, 2014; Marcoz et al., 2014; Sadílek, 2019).

7.6 Conclusions

Our study confirms that coffee prices, which are key for growers' profitability in developing regions depend, on the one hand, on a set of external variables that are beyond the control of farmers but, on the other hand, on their differentiation strategies.

We conclude that there is a direct relationship between international and domestic coffee prices, and multinationals tend to pay lower prices. We also conclude that prices are positively affected by variables directly related to the quality of coffee but not easily controlled by growers,

such as higher altitude (e.g. Tarrazú region) and larger yields. Regarding the specific environmental differentiation strategies that we have focused on, we find that organic production tends to be a successful strategy in terms of coffee price, while FT mills do not necessarily pay higher annual average prices.

Footnotes

[1]One bushel is equal to 4 hectoliters, and produces approximately 100 pounds of green coffee after processing (Samper 2010; Wollni and Zeller 2007).

[2] FT cooperatives have paid higher annual average prices for coffee berries than MCCs ($\beta_9 > \beta_8$) in the period covered in this study.

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APPENDIX A.1:

Table A.1. Specification and diagnosis tests

TEST	EQ 1	EQ 2
Hausman	$\chi2(3)=3.82$, Prob> $\chi2=0.2816$	$\chi2$ (4) = 8.94, Prob> $\chi2$ = 0.0626
LM	$\chi2$ (01)=422.62, Prob>$\chi2=0.0000$	$\chi2$ (01) = 423.16, Prob> $\chi2$ = 0.0000
Wooldridge	F(1, 337)=52.553, Prob >F=0.0000	F(1, 337) = 52.820, Prob > F = 0.0000
Wald	$\chi2$ (426)=6.7e+30, Prob>$\chi2$ =0.0000	$\chi2$ (426) = 3.0e+31, Prob>$\chi2$ = 0.0000

APPENDIX B.1.

Table B.1. T-test Fair-Trade versus non-Fair-Trade buyers

		Data reported by non-fair-trade mills			**Data reported by fair-trade mills**				
		n	Mean	S.D.	n	Mean	S.D.	Diff.	t test
Agroindustry Yield (kilograms of green coffee per bushel)		2,036	44.38	0.10	379	43.43	0.15	0.95	0.0000***
	Organic coffee	129	194.72	4.93	34	174.38	5.95	20.34	0.0101*
	Non-organic coffee	1,907	146.53	1.05	345	125.51	1.72	21.02	0.0000***
	Total	2,036	149.58	1.07	379	129.89	1.80	19.69	0.0000***
Annual average price reported by mills (In US $ per bushel)	Brunca region	468	130.49	1.74	129	116.92	2.36	13.57	0.0000***
	Guanacaste region	72	150.78	5.05	74	137.47	4.76	13.31	0.0570
	Turrialba and Orosi regions	151	128.30	2.80	14	133.36	9.36	-5.06	0.5993
	Western Valley region	413	162.16	2.93	64	138.55	4.55	23.61	0.0000***
	Tarrazú region	505	163.38	2.06	42	144.87	5.44	18.51	0.0024**
	Central Valley and Tres Ríos regions.	427	149.33	2.09	56	127.74	4.35	21.59	0.0000***

Chapter 8: Conclusions

8.1 Concluding remarks

Environmental voluntary approaches (EVAs) are non-coercive instruments to improve companies' environmental performance that are being increasingly used worldwide. After the environmental improvements carried out by firms have been verified by some external agency, they can get an environmental logo or certification. EVAs can take the form of a company certification, such as ISO 14001, Carbon Neutrality, or ISO 14064. They can also take the form of an ecolabel or product certification, such as Organic, Fairtrade or Rainforest Alliance. It has been documented in the literature that, despite the costs of certification, training and technological change entailed by the certification process, companies can have some incentives to adopt these approaches because they can also achieve significant economic benefits.

Most of the studies about voluntary environmental certifications that are present in the literature have been conducted in developed countries and very few in developing countries. Costa Rica is a particularly interesting case: while it has been traditionally considered as a developing country, it has been recently incorporated into the OECD and has a relatively high per capita income. Moreover, this country has traditionally adopted a very active role and leadership in terms of environmental policy. When it comes to our main research interests, voluntary environmental approaches are becoming more important and being increasingly used by a large number of companies in all economic sectors -agriculture, industry, and services- in Costa Rica. In this thesis, we have studied the effects of three specific environmental certifications, namely, CN, FT and ISO 14001. The CN certification is part of an environmental program promoted by the government of Costa Rica; the FT certification allows companies to produce more socially and ecologically efficient products. Finally, ISO 14001 is a company certification that guarantees the proper implementation and execution of an environmental management system (EMS).

Our analysis takes three different points of view corresponding to the three main parts of the dissertation: (i) the motivations and obstacles pointed out by Costa Rican businessmen regarding the adoption of an environmental certification, (ii) the consumers' knowledge of environmental certifications and the factors that determine such knowledge. In this part, we also care about the media impact of a specific certification, such as CN and wonder how this media

diffusion impacts on consumers' knowledge. Finally, (iii) we care about the impact of environmental certifications on the price of coffee, which is a particularly important commodity in Costa Rica. We do so in two different levels: first on the final consumers' willingness to pay for a certified coffee versus a regular one. Second, in a previous stage of the value chain, we perform an analysis of coffee berry prices in order to study whether coffee growers receive significant price premiums for environmental certifications. Summing up the results of our research, we can derive some general conclusions about the current situation and the prospects of voluntary environmental approaches in Costa Rica.

One important dimension of our study has to do with the knowledge and appreciation of VEAs by the main economic agents, companies and consumers, as well as the willingness of those agents to get involved in these approaches (by adopting them in the case of companies and appreciate and pay for them in the case of consumers).

On the companies' side, as expected, the adoption of environmental certifications and programs is partly driven by traditional economic motivations, such as the benefits perceived by firms as a result of such an adoption. In this respect, the most outstanding aspects are linked to the companies' green image improvements, the participation in green markets, getting price premiums, stakeholders' relation improvements and production efficiency improvements. On the other hand, the main barriers to adopt VEAs are linked to the high costs of certification and adoption of green technologies, as well as the difficulties in accessing and generating information linked to environmental sustainability processes.

Importantly, however, we conclude that, apart from purely economic drivers, those aspects related to ethical motives such as the environmental concern and environmental sustainability are increasingly considered in the firms' decision process. This conclusion is consistent with the recent theoretical stream of Micro-Foundations in strategy and corporate environmentalism. In this respect, the top management individual features, their beliefs and perceptions may be the key drivers of the companies' environmental commitment. In our studies the companies have reported that their certification decisions turn out to be motivated by aspects linked to the Sustainable Development Goals promoted by the government, which involve saving energy and materials, the reduction of emissions, materials and damage generated by the company. The consolidation of these motivations are fundamental factors when moving to a more sustainable development paradigm.

To some extent, this perception of entrepreneurs is aligned with our conclusions about consumers' in the sense that Costa Rican consumers appear to be gaining some knowledge of environmental certifications, at least partly understand their implication and be willing to reward them in their purchase decisions. However, this knowledge is not totally spread among the Costa Rican population. In fact, we conclude that the environmentally aware consumers present a well-defined socioeconomic profile with a relatively high household income and education. This knowledge is reinforced by participation in community and environmental committees, while age is a variable that is negatively related to consumers' knowledge of VECs. We have also concluded that the media are a channel for consumers to learn about the environmental actions of companies. In the case of the CN certification, we find that the companies that appear in online newspapers more frequently were also more recognized by consumers.

Given the different nature of the research exercises that we conducted for companies and consumers, the conclusions are not totally comparable. Nevertheless, we can tentatively conclude that the dynamics of learning, information dissemination and awareness-raising is different in both groups of agents. For example, while we conclude in chapter 3 that CN is better valued than ISO 14001 among firms, we get somewhat the opposite conclusion in chapter 5, as consumers seem more prone to be aware of ISO 14001 than CN or FT. This fact can be due to the different channels through which firms and consumers get the information and perceive their role.

A potential economic implication of VECs is that consumers may be willing to pay some price premiums for them. In fact, we conclude that Costa Rican consumers show a positive willingness to pay for sustainable coffee labels and such willingness to pay is determined basically by the same features as knowledge: household income and consumer education. In addition, unmarried consumers are willing to pay higher price premiums. An immediate policy implication of these findings is the necessity to provide mechanisms to inform the majority of the population about the environmental sustainability practices of companies. The companies' environmental volunteer campaigns must be more frequent and involve people with different levels of income and education. At the public policy level, environmental education programs can be designed to improve the knowledge of lagging groups, especially through environmental training at the basic education levels (primary and secondary). Encouraging participation in environmental and community groups is also an interesting way to promote knowledge. More information on voluntary environmental approaches is also needed through media information campaigns.

In our study of the prices paid by coffee mills to growers, we find mixed results that, to some extent, qualify our previous conclusions. On the one hand, organic certified coffee tends to receive significant price premiums but, on the other hand, fair trade certified mills pay lower average prices than non-certified ones. This may seem a contradiction in the sense that we find a (social and) environmental certification that may generate a negative rather than positive price premiums. Our analysis concludes that the price of coffee paid to farmers is not explained by environmental certifications, but also, to a large extent, by other variables such as coffee quality.

In addition, as we underline in Chapter 1, in economic terms the decision to use environmental certifications as a price differentiation mechanism must also consider the certification costs. Companies must compare certification costs with the possible associated income (price premiums and increased sales). The costs associated with certifications may outweigh the more direct economic benefits in the short term. Our model in Chapter 1 suggests that big firms are more prone to adopt VECs because a large volume of output will make it easier to recover the fixed costs associated to technological change regarding the certification. In addition, companies must have a long-term perspective of recovering profits since investments are usually high and recovery profit margins are usually slow.

These last considerations suggest a more active public policy to encourage the use of these voluntary environmental approaches. The government's policy can be focused on three levels: (i) to encourage technological change towards more environmentally sustainable production systems, applying policy instruments such as green credits at low interest rates, (ii) to guarantee market participation; for example the government can prioritize certified firms for their purchases (government purchases), (iii) and, finally, technical training and access to public information is essential to carry out research processes and to facilitate the design of environmental management systems in all companies.

8.2 Limitations

At the beginning of this research, we had the expectation of having the databases on the investments made by companies when adopting a public environmental program such as CN or other private certifications such as FT or ISO 14001. However, later on, we discovered that in Costa Rica, in many cases the information did not exist, and the companies' databases were not

available (even those of public institutions). This inconvenience led us to make direct inquiries to companies, in addition to incorporating the consumer's perspective.

Collecting primary data has a number of drawbacks, such as the high cost, the refusal of companies to provide information, especially when this information is related to environmental innovations, and the refusal of consumers to participate in surveys, among others.

Despite all these problems, we are grateful to many managers and consumers who were able to participate in surveys and provide us with relevant information, which is the cornerstone of this thesis.