THE POTENTIAL FOR SUSTAINABILITY POLICIES TO CREATE NEW MARKETS: A CASE STUDY OF EUROPEAN UNION SUSTAINABILITY POLICIES AND BRAZILIAN BIOENERGY

by

Aris James Morfopoulos
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Name:	**Aris James Morfopoulos**
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Title of Thesis:	**The potential for sustainability policies to create new markets: a case study of European Union sustainability policies and Brazilian bioenergy**
Examining Committee:	
Chair:	**Dr. Alec Dawson** Professor

_____

Dr. Anil Hira
Senior Supervisor
Professor

_____

Dr. Jeremy Hall
Supervisor
Associate Professor

_____

Mr. Henrique Pacini
External Examiner
Associate Economic Affairs Officer

Date Defended/Approved: April 20, 2011

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ABSTRACT

The sustainability policies in the European Union are potentially creating high value niche markets for developing and emerging economies. This thesis examines the feasibility of Brazil developing a sustainable biofuels industry targeted at niche markets created by European Union renewable energy and sustainability policies. Brazil is used as a case study of a developing country producer economy due to its high technological and agricultural capacity with regard to biofuels, its domestic biofuels market, its place as an innovator in developing biofuels, and its strong government support for its biofuels programs. Thus, the Brazilian market is uniquely poised to take advantage of value-added niche markets created by policies in the European Market. This study specifically addresses the feasibility for Brazil to target European niche markets for sustainable biofuel, in terms of fiscal, political, and sustainability factors, by analysing stakeholder relationships, capacity for innovation and adaptation, and regulatory change.

Keywords: biofuels; Brazil; European Union; sustainability; trade regulations;

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TABLE OF CONTENTS

LIST OF FIGURES

1: INTRODUCTION AND FRAMEWORK

1.1 Introduction to Sustainability

The 2009 United Nations Climate Change Conference in Copenhagen emphasized that sustainability policies are creating a growing gap between developed countries and developing countries, as a clear division of priorities have created an uncertain future for sustainability policies on a global scale (Bodansky 2010; Vidal, Allegra, and Suzanne 2009). The conference ended with developed and developing countries sorely divided on the ramifications of sustainability policies on the developing world. Indeed, most developing countries have rejected any attempts by the developed world to hold them to the same standards of environmental sustainability. As a result, a major rift has emerged between developed and developing countries on the issue of environmental sustainability, namely in terms of the disproportionate impact of climate change on certain developing countries, and developed and developing countries respective responsibilities in responding to these impacts. This work elaborates on the overarching theme of disparate impacts of issues of environmental sustainability on developed versus developing countries, but takes an economic perspective on the impact of such sustainability policies and regulations in the developed world on developing country economies.

Specifically, this study will explore the possible impact of sustainability policies in the developed world on developing country economies, taking the

example of the current and potential impacts of European Union (EU) sustainability policies on the Brazilian bioenergy industry. The discussion will be supported and informed by stakeholder and innovation theories in order to explain the impacts of EU sustainability policies and provide the foundation for a framework (Aerni 2002; Berchicci 2009; Freeman 1984; Hall and Vrendenburg 2005; Maloney 2002; OECD 2009). The focus of this discussion will be on understanding the externalities generated by the transformation of public sustainability discourse into policies and regulations in the EU, and their effect on Brazilian industrial innovation, utilizing a framework of stakeholder and innovation theory. The theoretical framework elaborated in this study would suggest the potential for large and lucrative economic benefits for developing countries that can successfully tap into sustainability niche markets in the developing world. Further, such markets could offer the developing world a unique opportunity to overcome a technological gap with the developed world and become lower cost producers for high value-added niche markets. Thus, further investigation into the potential economic benefits and risks associated with sustainability markets remains an important, though largely unstudied, issue.

Sustainability has become an increasingly popular policy focus, both academically and politically, as the increased demand for energy from industrializing countries, fluctuating energy prices, energy security, and increasing environmental concerns, have created an increased demand for alternative fuel sources such as biofuels and other types of bioenergy (Borghesi 2008; Cashore 2001; UNCTAD 2006). The seminal WCED definition of

sustainability as “meeting the needs of the present generation without compromising the ability of future generations to meet their own needs” (WCED 1987), has increasingly been applied, coupled with energy security concerns, to promote the development of sustainable fuels, namely biofuels. This trend towards biofuels has been further encouraged by recent technology breakthroughs in agriculture and in the refinement and utilization of biofuels themselves (Faaij 2006; Hira and de Oliveira 2009a; UNCTAD 2006).

The breakthroughs date back to the ‘Green Revolution’, that is, the increase in application of technology to agriculture, and the introduction of foreign and hybrid crops. The increased economic efficiency stemming from these developments led agricultural producers in the developing world to use new innovations and technologies to target the agriculturally-based biofuels market, both domestically and for export, in Brazil dating back to the Proalcool policy initiatives in the 1970s (Aerni 2002). Thus, based on increasing agricultural productivity coupled with fluctuating energy prices, the biofuels industry has prospered in Brazil, growing with the Green Revolution and expanding since the 1970s in response to various oil crises. The entry of external stakeholders into the Brazilian biofuels market is a relatively new phenomenon and thus this paper will examine how, specifically, sustainability policies abroad will affect the already strong domestic market. The impacts of such policies on the Brazilian market will be taken as a springboard from which implications for other developing countries may be drawn.

By creating markets for products labelled as sustainable, sustainability policies implemented in the European Union have several implications for countries exporting to the EU. Firstly, and perhaps most alarmingly for developing country producers, there is the possibility these new policies will favour domestic production due to higher costs, in turn decreasing available market share and reducing profitability. On the other hand, there is the possibility that these policies will create a new, potentially value-added niche market, to which developing countries can cater, allowing them to develop more technologically advanced or value-added products. In one way or another, sustainability policies *will* affect industries in developing countries, the unknown variables are the form and severity of their impacts. This paper will examine which of these impacts, or blend of impacts will result from the introduction of sustainability policies being implemented in the EU, and how they will affect the Brazilian bioenergy industry.

1.2 Research Question

The impacts of sustainability policies being implemented in the EU on the Brazilian bioenergy industry will be broken down into three research questions that correspond to the chapters in this work.

Do the European sustainability policies surrounding the European bioenergy industry present an opportunity for developing and emerging economies to target a new niche? (Chapter 2)

What is the state of the Brazilian biofuels industry and what is its capacity to target new sustainability-based niche markets? (Chapter 3)

What will be the outcome of these sustainability policies? What barriers will prevent access to these potential niche markets by developing and emerging economies? (Chapter 4)

Each of these questions will be addressed in a subsequent chapter using the framework for analysis laid out later in this introductory chapter.

Figure 1: Framework for Analysis

1.3 Agenda

This study will be broken down into an introduction and three chapters which will be laid out as follows.

1.3.1 Introduction - Chapter 1 (following)

The study will begin with the development of a conceptual and theoretical framework. The conceptual framework will break down the research questions in preparation for further discussion and lay out the variables and methodology that forms the basis of this study. A framework will be developed using stakeholder and innovation theories to understand and explain the potential implications of sustainability policies for developing and emerging economies producing for EU markets. Stakeholder ambiguity, as described by (Hall and Vrendenburg 2005), and the concept of primary and secondary stakeholders, as described by (Freeman 1984), will be used to explain the relationships, linkages, and difficulties involved in the addition of sustainability policies to an already complex trading relationship. Seminal innovation ideas, as described by Schumpeter (1962), and as well as Nelson and Winter's (1982) analysis of problems stemming from technological innovation will be used to determine the outcomes of sustainability policies on Brazilian industry.

1.3.2 European Sustainable Markets - Chapter 2

The study will then examine European sustainability policies and the rise of sustainability policies including trade between Brazil and the European Union surrounding biofuels. The growing sustainability discourse has, in the European Union, manifested itself in the form of sustainability policies, a specific set of policies and targets aimed at promoting domestic sustainable development, which have been laid out in European Commission directive 2009/28/EC (European Commission 2009). These new targets and policies, implemented

domestically within the EU, will also affect foreign producers, as it is likely that the EU will need to procure a portion of its sustainable energy from outside its borders (European Commission 2009). Among the industries targeted by EU sustainability policies, the energy sector has the most defined targets, with the European Commission outlining a plan for sustainable energy targets to be met by 2020. This target will put pressure on European countries to adapt new energy policies and continue to seek out alternative energy sources in the coming decade, creating new sustainable markets in the EU.

EU sustainability policies will be used as the basis for this study for two principal reasons. First, these policies have emerged from a growing global sustainability discourse that has not been translated into concrete policies in most countries, both developed and developing. The EU sustainability policies, although not yet fully implemented, are the most concrete policy options created in response to this discourse. Second, the EU is one of the largest international trading blocs and thus its regulatory decisions will have an influence both on global trade and on other sustainability policies. The EU today represents the largest single trading entity in the developed world, with a population of approximately 500 million people in 2010 (Marcu 2009), the world's largest economy with a GDP in excess of USD $17 trillion (Eurostat 2009), and accounts for approximately 20 percent of all global trade (Marius and Alan 2007). As a result, sustainability policies, which represent a refocusing of EU trade policy, have far-reaching ramifications on both developed and developing country economies (Marius and Alan 2007).

1.3.3 Brazilian Biofuel - Chapter 3

The third chapter will address the state of sustainable industry in developing countries and their potential to adapt and tap into developed country, and specifically EU, sustainability markets. Brazil, as one of the world's largest agricultural producers and a major agricultural exporter, has become a world leader in biofuel production and technology (Reid 2008; Rosillo-Calle and Cortez 1998). As a result Brazil has been chosen as a case study to examine the impacts of foreign sustainability policies on emerging and developing country producers. In addition to biofuels, Brazil supports a number of major industries, such as steel, agriculture, and energy technology sectors, and is continuing to innovate in biofuels production (Cavalcanti, Magalhães, and Tavares 2008; OECD 2007; Reid 2008;). Brazil has invested heavily in agriculture over the past several decades and has developed advanced technical capabilities (Hall et al. 2010e; Chaddad and Jank 2006; Queiroz de Monteiro Jales et al. 2006), positioning it well to innovate and adapt to new production methods required in catering to sustainability niche markets. This combination of a strong domestic market and high innovative capacity makes Brazil particularly well positioned to adapt to changes in biofuel markets. There are numerous factors that setup Brazil exceptionally well to successfully target sustainability-focused niche markets, including its highly developing and strong domestic economy and its decades of experience and knowledge in biofuels production. Given these conditions, Brazil appears to offer a 'best case scenario' in its ability to capitalize on the potential opportunities of targeting sustainability niche markets. Ultimately, if the obstacles Brazil faces in tapping into these niche markets are

too great, it would seem highly unlikely that other developing and emerging economies would be successful in doing so.

This chapter will review the Brazilian agricultural and bioenergy sectors including the development of the National Energy Sector, its history and structure, the position of Brazilian bioenergy within international markets, and the current and future trajectory of the industry. This literature and sectoral review will then be analysed through the theoretical framework to examine the effects of EU policies on the Brazilian biofuels industry through processes of both adaptation and innovation. The chapter will close with a summary of the key successes and remaining challenges for Brazil's bioenergy industry and a discussion of the potential for expansion into the EU market.

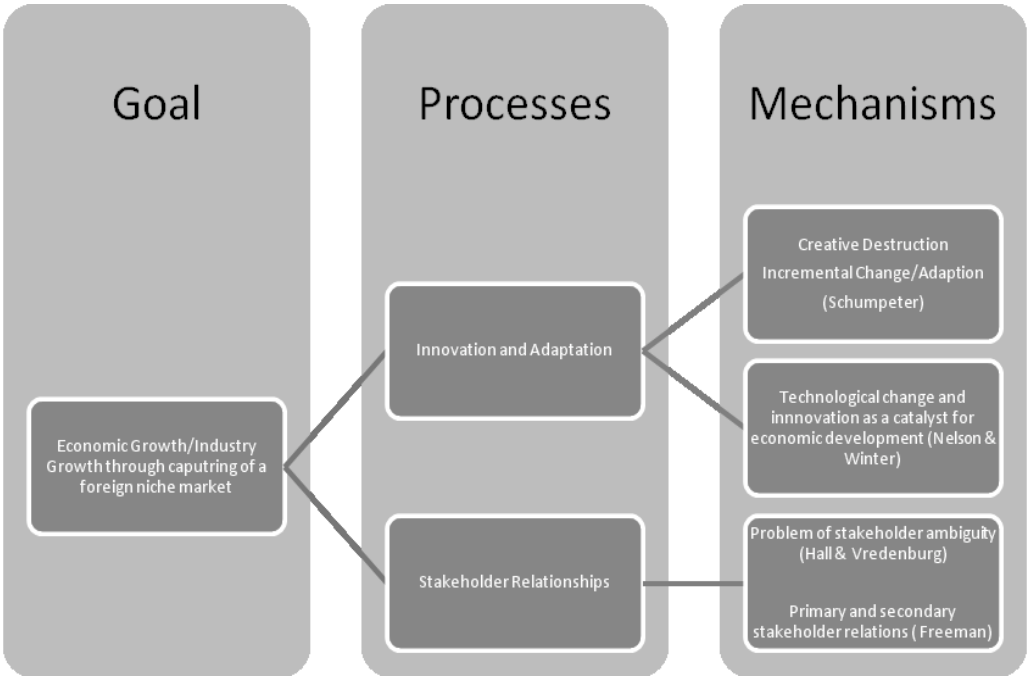
1.3.4 Research and Conclusions - Chapter 4

This chapter will assess the possibilities for the Brazilian biofuels industry to exploit a niche created by EU sustainability policies through adaptation and innovation. It will first examine whether some previously foreign production will shift back to Europe with domestic producers being more able to compete in their own markets due to a higher value-added industry, in turn shrinking the market for Brazilian biofuels. Secondly, it will examine whether these policies may provide a potential value-added niche which developing countries may have the opportunity to target as they are more able to bear the capital costs of their own domestic innovation and development. Sustainability policies will divide energy and agriculture products, which are imported, into those that are sustainable and those which are not, creating a two-tiered market. Thus, this chapter will explore

how Brazil, a strong but developing economy, will be affected by the adjustment in trade policies by a major developed trading partner, the EU, through sustainability policies implemented in the latter. The chapter will incorporate field research as a major component, which was carried out in support of this study in both the EU and Brazil in order to provide a robust picture of the case, and to determine the challenges and opportunities that Brazil faces in moving forward with the development of a highly successful industry.

1.4 Theoretical Framework

Figure 2: Theoretical Framework



The potential for Brazilian industry to transform EU sustainability regulations into new opportunities for niche markets that could add value to current Brazilian production and exports will likely depend on two key factors: (1)

Brazilian industry's ability to innovate through the creation of new products and markets; and (2) Brazilian industry's ability to adapt to a changing export market. This opportunity to target a sustainable market should allow Brazil to continue its economic success with Biofuels while pursuing balanced and sustainable growth, economically and socially. In the case of innovation, the necessary process of technological change within Brazilian industry can be understood within the theoretical framework of Schumpeter's Creative Destruction and Incremental Change, that is, that innovation as the invention and commercialization of new products, processes and methods of organization, leads to the discarding or re-combining of old methods for new ones, a process termed 'creative destruction' (Schumpeter 1962). The potential such innovation holds for economic development and industry growth can be understood within Nelson and Winter's (1982) framework of technological change as a catalyst for economic growth, examining the response of both firms and industries to changing market conditions through competition and innovation . At the same time, Brazilian industry's ability to capitalize on such innovation opportunities and to adapt to changing markets faces obstacles such as the considerable problem of Stakeholder Ambiguity, that is, the inability among major actors to identify key stakeholders and outcomes (Hall and Vrendenburg 2005) and problems in Primary and Secondary Stakeholder Relations (Freeman 1984), whereby those not directly engaged in transactions with the primary stakeholders but who can affect or be affected by the production process. All these obstacles will need to be overcome if Brazil is to secure a stake in EU sustainability niche markets.

1.4.1 Innovation and Adaptation Theory

Within firms' or industries' 'selection environment', described by Nelson and Winter (1982) as the setting in which a competitive process determines which firms' routines are better adapted to market conditions, there are factors external to domestic industries that influence the products, processes, and methods these industries use. In the case of this study, Brazilian industry is potentially subject to such external influences, which will be key to determining the industry's ability to access sustainability markets. Indeed, the industry's capacity to capitalize on the opportunities that such markets present, particularly in terms of high value-added production, will require industry innovation to ensure production conforms to EU standards and regulations.

Schumpeter's seminal definition of innovation as the commercialization of invention in the form of new consumer goods, methods of production, transportation, sources of raw materials and industrial organization, is the foundation of his concept of 'creative destruction'; that innovation is a difficult and painstaking processing in which old methods and products are discarded in order to take on new innovations (Schumpeter 1962; Schumpeter 1982; Schumpeter 2005). Creative destruction, however, as defined by Schumpeter, was the extreme form of invention and the majority of innovations are actually the product of the combination and integration of existing technologies and methods, what he called 'recombinations'. Sustainability regulations will require innovation and adaption in order to bring products and services up to the standards these regulations lay out. Indeed, the product must meet the sustainability standards to

qualify for the benefits. Specifically, they may require incremental innovation and adaptation, such as the alteration of planting techniques, the development of new methods and equipment, and other changes to the production process. This incremental innovation builds upon Schumpeter's definition, whereby using existing methods and technologies as well as more radical 'destructive' innovation, such as the transition of labour intensive to mechanized production and a shift to high-carbon and bio diverse land avoidance, leads to the development of a new product or industry (Henderson and Clark 1990; Schumpeter 1962).

A key factor in determining the outcome of such innovation will be the national learning capacity of the biofuels industry in Brazil, which could hinder the timely adaptation of products to EU standards (Maloney 2002), as developing countries frequently do not have the necessary pre-existing technical knowledge. Domestic innovation and adaptation will require state support and development, which the state may or, if historical trends hold true, may not be able to sufficiently fund to keep pace with their highly competitive developed country counterparts (Lazonick 2008). For others, innovation to meet EU standards may open new markets and opportunities by allowing industries to add value to their products, increasing profits and wages. As Nelson and Winter (1982) describe, these new technologies will create new industry practices and methods, which will adapt to the new regulatory framework that will be generated by sustainability regulations. The creation of sustainability regulations signals market demand and longevity, but also signals that innovation is needed to fulfil the requirements of

newly opened markets and develop new technologies. It is essential then to take a more in-depth look at the possible spillovers from these regulations and the rationale behind them, which will ultimately determine the effect of these new policies.

The work of economists such as Nelson and Winter (1982), Schumpeter (1962) and Vernon (1966) have given foundation to the link between technological innovation and regulation as catalysts for economic development, including new methods of production, access to new markets, and the utilization and discovery of new opportunities and sources of resources. Technological development is essential for economic development; thus, sustainability regulations, by forcing developing countries to innovate and increase their technological capacity, could enhance economic growth (UNEP 2011). As sustainability regulations present new niches, the barriers to entry from clusters and developed capitalized industries is lower than more established niches, providing developing countries with opportunities to innovate where they have at least a smaller disadvantage. This is an excellent model and one that is contingent on a plethora of factors, which will challenge the developing state and present significant risk. In the case of Brazil, potential access to value-added niches in sustainability markets in the EU could further help drive industry growth, already supported by a strong domestic market, as well as expand and solidify the country's technological leadership in biofuels on an international scale (Hira forthcoming).

On the other hand, the technological innovations required to bring an industry in line with the regulations implemented in foreign export markets may prove too arduous, leading to industry collapse if it lacks the capital and/or technical knowledge to innovate accordingly, or if other producers retain greater capacity to innovate. Thus, the link between greater technological innovation and economic growth is tenuous, and highly dependent on multiple factors.

1.4.2 Stakeholder Theory

In addition to issues of innovation and adaptation, an industry's ability to conform to new sustainability policies and regulations is contigent on its ability to identify key stakeholders and outcomes by major actors. Indeed, the issue of stakeholder ambiguity, or the *inability* to identify key stakeholders and outcomes by major actors, has the potential to be particularly prevalent in sustainable development policies due to the convoluted and multi-state nature of these policies. These stakeholder relationships, in the case of sustainable development, involve a variety of actors who are not directly involved in the production process, making their positions and direction ambiguous (Matos and Hall 2007g). These indirect stakeholders, defined by (Freeman 1984) as secondary stakeholders, are those not engaged in transactions with the organizations and corporations directly involved but can affect, or are affected by, the production process. A further level of difficulty is added with sustainability-regulated trade between two countries with entirely different, or at least ambiguous, definitions of sustainability. Thus, sustainability policies involve a wide range of stakeholders many of whom are not directly involved with

production (Hall and Vrendenburg 2005), and create ambiguous variables and probabilities, also known as Knightian uncertainty (Knight 1921), uncontrolled by the exporting country, in addition to any that might be created in normal trade relations. Sustainability regulations create an arbitrary set of standards, which the importing country may use to reject or accept trade, subject to ambiguous interpretation, making targeting sustainability-oriented niche markets inherently subject to Knightian uncertainty pending better definitions or a universal certification system.

In producing for a European niche market, Brazil must take into account the secondary stakeholder positions of actors within the EU (Freeman 1984). These stakeholders may be ambiguous, which may make it difficult to identify their specific agendas and their respective importance (Hall and Martin 2005). Thus, these secondary ambiguous stakeholders make it difficult for companies, in this case particularly difficult for companies abroad, to accurately predict market activity and trends (Hall and Vrendenburg 2005), leaving them exposed to sudden moves by secondary stakeholders they do not understand or of which they are unaware.

Establishing a reduction in Knightian uncertainty (Knight 1921) around the selection environment, in which Brazil is able to control for these external factors, will allow for the creation of an industry aimed at targeting a particular niche within the EU selection environment. Stakeholder behaviour, according to Hall and Martin, directly affects the ability of firms to appropriate benefits from their innovations (Hall and Martin 2005). Thus, the uncertainty associated with

ambiguous secondary stakeholder relationships may limit the ability of firms in developing countries to benefit from niche markets created by sustainability regulations by limiting the return on innovation and adding a high level of risk. As a result, EU sustainability regulations may prove to be a barrier to trade rather than a mechanism to transition towards sustainable energy, as intended, if secondary stakeholder relationships make investment in sustainability markets too risky for producer countries to warrant investment. On the other hand, the high risk generated by this ambiguity, capital barriers and organization barriers to sustainable production, likely mean a high-value niche market which will remain low in competition.

Throughout this study, the theoretical framework elaborated above will be used to analyse the impact of sustainability regulations on developing economy markets, specifically the biofuels sector in Brazil. Innovation theory, specifically, Schumpeter's concept of creative destruction as well as the linkages he establishes between technological and economic development, will be applied to the Brazilian biofuels sector to analyse the changes in industry-wide production and regulatory practices as a result of the emerging niche market in sustainable fuels in the EU. The concept of stakeholder ambiguity will be used to identify discrepancies in the definitions and interpretations of the concepts of sustainability and sustainable production between producer (in this case, Brazil) and purchasing markets (in this case, the European Union). Further, the concept of stakeholder ambiguity will be applied to the case study to illustrate the

challenges Brazil will face in adapting its production to meet EU sustainability regulations in order to capitalize on this potential niche market.

2: EU POLICIES AND MARKETS

2.1 Introduction

The emerging global discourse on sustainability has generated considerable policy interest and some, albeit limited, policy responses. The term "sustainability" has reached every form of media, influenced government policy, and been introduced as a condition for international trade. It has become a buzzword through which new technologies leverage funding, activists seek to further their causes, and governments strive to better their image. As sustainability considerations have become increasingly important to government and business practices, the introduction and expansion of new regulations, policies, business programs and academic research institutes have enhanced the focus on sustainability (Collins 2006).

The seminal Bruntland report of 1987 (WCED 1987) arguably launched sustainability rhetoric, much of which now revolves around the potential for regulation and implementation, such as the Kyoto Accords or the Copenhagen Agenda. The European Union (EU) in many ways led the path in promoting sustainability in policy-making. Indeed, the EU was swift to adopt sustainability rhetoric in its policies as, certainly in the case of agriculture, it was seen as a potential boon to EU farmers and a method of developing the alternative energy sources the EU lacks while supporting industries traditionally subsidized by the EU (Faaij 2006).

EU sustainability policies are the result of change in the political and social climate, as well as part of a drive for alternative energy sources. Despite considerable innovation and interest in sustainable products as a result of these initiatives, there has been doubt as to the feasibility of sustainability policies, in terms of monitoring, enforcement, and accountability mechanisms, as well as the economic viability of many sustainability initiatives (Borghesi 2008). This is the result of the two driving factors which have pushed sustainability policies through: (1) the social and political climate bending towards the environmental movement; and (2) a drive for alternative energy sources at least partially based on high oil prices and energy security. Sustainability policy, as an amalgamation of food security, energy security, and climate change policy, has become a prominent policy issue within the EU, with EU states such as Germany heavily focused on developing alternative fuel sources, largely as a result of their past experiences with fuel shortages[1]. The implementation of sustainability policies has begun, and these policies are creating a unique set of challenges due to their multifaceted nature, which will affect both developed and developing countries.

In the European Union, the rising interest in sustainability has translated into sustainability policies and regulations, which have been defined in Euopean Commission Directive 2009/28/EC. (European Commission 2009). They aim to promote domestic sustainable development by establishing specific targets to be met by EU countries. These new targets, though established on a domestic level, will also affect foreign producers, as countries within the European Union will

[1] For a comprehensive history of oil dependency see The Prize, by Daniel Yergin (1993)

have to acquire a percentage of their energy, agriculture, and more, from sustainable sources (European Commission 2009). Of these industries, energy has the most defined targets, with the European Commission outlining a plan for sustainable energy targets to be met by 2020. This target will put pressure on European countries to adapt new energy policies and continue to seek out alternative energy sources in the coming decade.

EU sustainability policies will be used as the basis for this study for two principal reasons. First, although not yet fully implemented, they are among the few concrete and large-scale policy responses to be established in response to increasing interest in the issue of sustainability. Second, the EU is one of the largest international trading blocs and its regulatory decisions will have an influence on trade throughout the globe, and thus most importantly on the sustainability policies of its trading partners. As the world's largest single trading entity, the EU has a population of approximately 500 million people in 2010 (Marcu 2009), is the world's largest economy with a GDP in excess of USD $17 trillion (Eurostat 2009), and accounts for approximately 20 percent of all global trade (Marius and Alan 2007). As a result, sustainability regulations, which represent a refocusing of EU trade policy, have far-reaching ramifications on both developed and developing country economies (Marius and Alan 2007).

This chapter will be guided by the following research questions: What are the EU sustainability policies, how do they affect biofuels, and do they potentially present opportunities for developing countries? Within the theoretical framework elaborated in the preceding chapter, it will be argued that EU sustainability

policies present opportunities for developing countries in terms of creating new value-added niche markets within the EU. At the same time, however, substantial obstacles remain to capitalizing on such opportunities. Namely, considerable stakeholder ambiguity implies considerable Knightian uncertainty (Knight 1921) and thus high risks upon entry into such markets, while the 'openness' of EU markets to foreign trading partners, as well as the extent of preferential access for domestic producers within the EU, remain unclear.

This chapter first provides a background in European agricultural and trade policy to set the context in which sustainability policies are being developed within the EU and in which such policies will be perceived and interpreted by developing countries. This will be followed by an overview of the development and current state of EU sustainability policies, with particular attention to what they may mean for developing countries. Finally, drawing on the innovation and adaptation framework laid out in the first chapter, it will be shown that EU sustainability policies present potential opportunities for developing countries to access new value-added niche markets within the EU. Nonetheless, viewed through the lens of Stakeholder Ambiguity Framework, given unclear policies and stakeholders within the EU, high and unknown risks for entry into EU sustainability markets present substantial obstacles to accessing such markets and will be a major consideration in the policy recommendations presented in the last chapter.

2.2 Literature Review

2.2.1 EU Agricultural and Trade Policy in Historical Perspective

When choosing to invest in sustainability-focused industries, developing countries must consider EU policy, as it will have both a direct effect on the markets available and may have spillover effects, leading to policy changes in other developed countries. Of particular concern to developing countries should be the EU's protection and support of its domestic industries, particularly in areas such as agriculture and the automotive industry, both through subsidies and tariffs (Marius and Alan 2007), which have often resulted in trade disputes. These domestic trade policies have given the EU at best a poor reputation as a trading partner in the developing world, deservedly or not, stemming most recently from the WTO Doha round and various other international agreements. As a result, for reasons of both protectionism and politics, developing countries are understandably leery of new EU policies, particularly around agriculture and energy.

EU trade policies are often criticized as unfair and protectionist, notably those related to agriculture, yet it is crucial for developing countries to understand the historical and political rationale behind EU policies in order to understand where there may be room to negotiate and where, whether for political or economic reasons, it is simply not an option. Sustainability policies are no different, and in order for developing countries to be able to respond appropriately to these policies, they must understand their underlying motivations, which pre-date issues such as energy and climate change.

The General Agreement on Trade and Tariffs (GATT) followed later by the WTO and paired with innumerable bilateral agreements, laid the foundation for many bitter disputes between developed and developing countries, particularly surrounding agriculture and energy[2], which may very well persist or worsen with the creation of sustainability policies. The failure of the Doha Round of WTO negotiations in particular has disappointed developing countries (Panagariya 2003), leaving many frustrated and suspicious of new policies and regulations, particularly those surrounding sustainability discourse. In discussing how developing countries can innovate and prosper through trade with the developed world, it is essential to preface with a brief look into the rationale behind agricultural and energy trade policies from an EU perspective. As the EU implements sustainability policies, by better understanding the EU rationale behind trade regulations, it will be possible to create better policy suggestions and solutions for developing countries trying to target the EU market.

Sustainability policies, while popularized through climate change discussion, have distinct underlying motivations. These motivations will have a distinct impact on what sustainability policies mean for developing economies as they showcase the domestic priorities within in the EU. The most prominent of these priorities are a) food security, and b) energy security, in addition to the proposed rationale solely around c) climate change. If assessing purely in the moment, it might seem that EU agricultural policies are simply meant to create

[2] For the dispute process see (Smith 2004); For Doha see (Panagariya 2003); for GATT examples see (Hudec 1992)

jobs on EU soil and keep an uncompetitive industry alive in the EU, yet the reality of European protectionism is far more complex.

2.2.2 Food Security

Sustainability policies play a significant role in agriculture as they are heavily involved in both bioenergy and different forms of agricultural production such as organics. Agriculture has long been a contentious issue in global trade talks between developed and developing countries (Marius and Alan 2007), and so sustainability regulation can hardly avoid the disputes in global agricultural trade. The protection of agriculture is not a new trade policy caveat and has continued to play a prominent role even as technology has allowed long distance transport and, more importantly, mobile refrigeration. Some would also argue that organic goods protect domestic agriculture even further as they encourage people to buy local and further disadvantage developing countries (Campbell and Coombes 1999). Food security, as defined by the United Nations Food and Agriculture Organization, *"exists when all people, at all times, have physical and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life. "* (Commodity Policy and Projections Service 2003).

Food security, which seems innocuous and inarguable initially, surrounds much of the debate between developed and developing countries as 'food security' is generally thought to refer to 'national food security' as opposed to 'world food security.' The result has been what has been seen as a near impenetrable wall of agricultural subsidies and tariffs in the developed world.

Putting this in stark perspective, the average European cow earns USD $2.20 per day in subsidies, amounting to more than what 1.2 billion of the world's population lives on per day (New York Times 2005). Such subsidies have been viewed negatively by developing countries; however, agricultural regulations have proven to be the most consistent issue in the long series of trade negotiations, agreements, and disputes since the end of the Second World War. The EU, comprised of so many individual states, has a long agricultural tradition, and, perhaps more importantly, has a long tradition of agriculture as the backbone of each individual state (Bogucki 2008). Sustainability policies, by requiring products imported to meet a new and more stringent set of standards, could easily be viewed among developing countries as a new form of trade barrier to accessing the EU market. Understanding the rationale behind European agricultural policy is fundamental to assessing sustainability policies, as they are by definition[3] tied to domestic production, garnering the support of domestic agricultural producers, who, in the EU, have a powerful influence over government policy. The motivations behind this stance should affect the decisions developing countries make about targeting EU market niches and assessing the feasibility of an industry.

The widespread popular support behind the agricultural components of sustainability policies has stemmed from recent memories of the food shortages of the World Wars and, farther back, of the famines that have plagued Europe throughout its history. With constant food shortages across much of Europe, and

[3] As it is often considered that 'local' is more sustainable.

for example the famine in the Netherlands which killed over 30,000 people during the Second World War deeply ingrained in the minds of Dutch citizens, it is easy to understand how what would become known as 'food security' would dominate the concerns of a generation of Europeans and be profoundly instilled in the post-war era they would craft (Roseboom, de Rooij, and Painter 2006). As a result of the EU's long and intricate history with agriculture and food, in combination with recent developments in international trade regulations at the WTO level, and an agenda of trade liberalization pursued by industrialized countries that has been poorly perceived in the developing world (Smith 2004; Panagariya 2003; Hudec 1992), agriculture has come to be a highly contentious issue on the international stage. Analysis of the impacts of trade, in this case sustainability policies, must always be made paying tribute to these historical influences or risk misrepresenting the political reality. Even sustainability policies, no matter how hard they are pushed or promoted in EU rhetoric, should be expected to come second to European domestic producers. Trade agreements or theories mean little as European states simply cannot politically be seen as abandoning their domestic producers.

2.2.3 Energy Security

Given that climate change discussion and policy have focused primarily on energy, it follows that energy would be the primary focus of sustainability policies. A shift away from oil, led by strife in oil producing regions, which has increased uncertainty in supply chains, has ignited a search for alternative energies and a focus on 'getting off oil'. These motivations have provided capital and

widespread political support for environmental ‘green’ policy initiatives, largely aimed at climate change, which have received considerable popular support. Europe has long been dependant on foreign oil and so the ability to justify seeking new sources of energy while promoting climate change has created considerable interest in alternative fuels. The EU has gone as far as to set renewable energy targets to reduce oil dependency while promoting climate change. Though new ‘sustainable’ sources of energy have not yet overtaken oil as a primary source of fuel, the funding poured into them has driven innovation and investment in sustainability-focused niche markets in a broad spectrum of industries. The EU is committed to developing new alternative fuel sources, not only for sustainability, but also for energy security, which has been an issue since before the Second World War (Yergin 1993). These new niches are where the opportunity lies for developing countries, however an obvious obstacle lies in their path: Europe will be conflicted about keeping production at home and maintaining energy security while attempting to gain enough alternative energy sources to meet its targets and offset the needs for Russian and Middle Eastern oil.

2.2.4 Climate Change

Regardless of underlying motivations, sustainability policies have arisen from green initiatives and are primarily concerned with issues of environmental sustainability. These initiatives, which have generally taken place at the international level (such as in Kyoto or Copenhagen), have principally proposed to fight climate change. Though the majority of sustainability rhetoric continues to

occur at the international level, the discussion of sustainability policies has been underway in the EU for over 5 years (European Commission 2009). These new regulations, many on the verge or in the process of implementation have been pushed through by the popularity of sustainability policies; yet, both the direct and collateral impacts they will create remain largely unstudied.

The creation of sustainability policies around specific industries within the EU has the potential to impact a myriad of industries in developing countries, as demand from the EU shifts. With a variety of new methods of renewable energy being examined, the most accessible to production in the developing world is the production of renewable biofuels through agriculture. As the new sustainability policies are targeted at agriculture more than any other industry through these renewable energy initiatives, in analysing the potential effects of sustainability policies on developing countries, it is essential to have a general perspective on EU trade, notably in agriculture.

2.3 EU Sustainability Policy

Trade policies have begun to shift to accommodate new sustainability priorities and concerns in the developed world, among which the European Union has been a consistent leader in transforming sustainability discourse into policy. EU sustainability regulations have been among the first efforts to translate this discourse into concrete policy measures. The EU has been at the forefront of sustainability policy development, implementing and developing standards through a variety of methods, with current sustainability regulations being the culmination of a blend of policy initiatives and political and public discourse

(Borghesi 2008; European Commission 2008; Faaij 2006; Olesen and Bindi 2002). These policies pertain to a variety of industries, a key component of which is a sustainable energy policy focused on 10 percent of energy used in European transportation being certified as sustainable by 2020, coupled with wider EU sustainability initiatives (European Commission 2008; European Commission 2009). European sustainability policies began to take a clear unified direction in 2008 with the creation of overarching legislation that laid out defined targets, if not a specific strategy for achieving them, in the form of sustainability regulations.

This transformation of sustainability discourse within the European Commission represents the first step for the EU in moving from discourse to action on sustainable development. The implementation of these policies within the EU remains to be seen, although some EU members, such as Sweden, are already pushing for the EU Commission to favour sustainable energy sources through tariff reductions (TheBioEnergySite News Desk 2009).

The sustainability policies that the EU has begun to implement will, if government rhetoric holds true, be part of an EU-wide sustainability agenda premised on, among other stipulations, the goal of making 20% of all EU energy renewable by 2020. This sample document provides a background of vocabulary and policy direction:

> *The Community's external energy policy should ensure the common voice of the EU in support of intensifying its relationship with its energy partners, with a view to further diversifying sources and routes, strengthening partnership and cooperation and focusing on the reduction of greenhouse gas emissions, the promotion of renewable, and the improvement of energy efficiency. Third countries should be able to benefit from the promotion of renewables in the EU through the supply of biofuels and*

> *other bioliquids which meet sustainability requirements, or the supply of renewable electricity from neighbouring countries. While in principle, no trade restrictions should apply to renewable energy imports or exports, the Community must ensure that a level playing field is afforded to all renewable energy producers, in and outside of the Community***.** (European Commission 2008)

The impacts of sustainability policies within the EU have been carefully planned and well capitalized as they have strong support from EU members both in terms of individual member support and popular support. However, with regard to developing countries, there are no such considerations. While the impacts of these policies within the EU will depend on member uptake and internal politics and policies, for external trading partners the primary impact will be the effect of regulation on specific industries, such as biofuels. Considerations for developing countries will be two-fold. First, the text above alludes to the potential for trade restrictions in order to provide a level playing field to bioenergy producers both inside and outside the EU. External producers must consider the inherent risk associated with the possibility of the EU applying trade restrictions in the sustainable biofuels sector in order to protect domestic producers. Second, as the text above suggests, the implementation of sustainability policies in the EU will have potential economic impacts for its trading partners in the developing world and afford new opportunities in EU markets. The industries subject to regulation will be forced to adapt and innovate to match that regulatory environment, the consequences and rationale of which are not clear (Nafziger 1996) and will be examined in the subsequent sections of this chapter. These regulations and policies will likely have differing impacts on various industries and sectors in developing countries; however, failure to address and innovate

with these impacts may result in developing economies stagnating as they strive to either meet the fixed regulations and cease innovating, or simply abandon innovation and produce for other markets (Lall 2003). Though these policies and regulations will not create a catalyst for development and innovation on the scale of the great oil booms, the transformation of trade, both in being bound by a new type of regulation and by the quest for new forms of energy, will have a considerable impact on developing countries. In doing so, these policies may present opportunities for developing countries, such as Brazil, to take initiative and innovate from these new policies providing a potential catalyst for development.

2.4 Applying the Theoretical Framework

2.4.1 Innovation and Adaptation Theories: Opportunities for Value-Added Niche Markets

As one of the world's largest bioenergy producers and exporters, Brazilian industry has the potential to feel the impact of sustainability policies, for better or worse, more than most other developing countries. Brazil's bioenergy industry, in particular ethanol, has become increasingly export focused (Hira and de Oliveira 2009a), and as a result, new sustainability policies in potential export markets may have a dramatic effect on Brazil's continued ability to expand their bioenergy exports. There has been a steady rise in Brazil's biofuels exports over the last decade, particularly to the EU and United States, and therefore policy trends in either of those nations may well determine the future of the industry. How Brazil

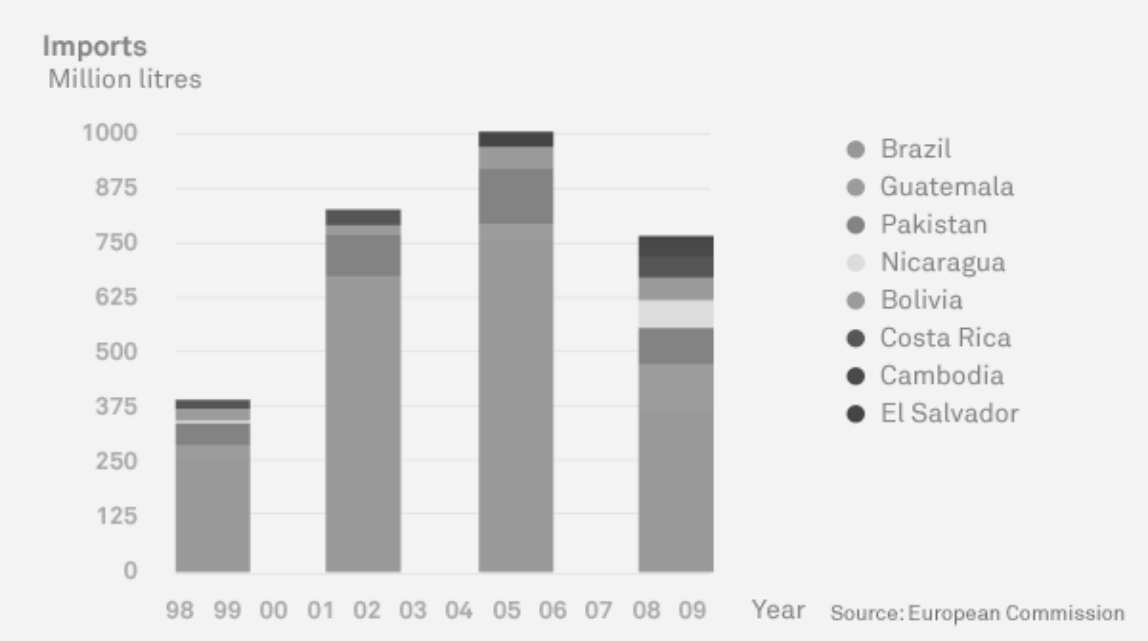
responds, adapts, and works with EU policy-makers will have a significant impact on the future of the Brazilian ethanol export industry.

Despite being the largest ethanol exporter globally, Brazil is subject to substantial import tariffs in both of its major export markets, the EU and the US (UNCTAD 2006). In the EU, the current tariffs are 0.102 euro per litre and 0.192 euro per litre on denatured and undernatured alcohol respectively. Although the US is the larger of the two markets at the moment, EU consumption is set to dramatically increase, especially if new renewable energy targets laid out by the European Commission are to be met (European Commission 2009). Therefore, Brazil's 30 percent share of the 250 million litre market of EU ethanol imports is likely to increase as the country has the capacity and experience to expand its domestic industry quickly to meet increasing EU demand. At the same time, the high tariffs within the EU are likely to remain, as the EU struggles with economic troubles and seeks to promote domestic industry to maximize energy security (Elbersen et al. 2008). Thus, EU policy, as Brazil's second largest ethanol trading partner, will have a direct impact on Brazilian industry.

In developing sustainability-focused industries, EU policy must be considered by Brazil, as it will have both a direct effect on the markets available and may have spillover effects, changing policy in other developed country markets. Brazil supplies the largest portion of European imported ethanol, and imports have continued to grow over the past decade with a significant increase in growth stemming from the EU's sustainable energy initiatives. Below in Figure 3, can been seen the largest suppliers of ethanol to the EU. It should be noted

that the drop in 2008-2009 is not indicative of EU policies but rather linked to the economic crisis during that same time period.

Figure 3: EU Ethanol Imports



Source: ePure.org 2010

However, there is an important distinction here: before the new sustainability policies were brought into place, the ethanol itself was not required to be sustainable, rather its use was part of an overarching sustainability policy. The EU has already begun to implement some of the proposed sustainability regulations and to reduce agricultural duties on Brazilian ethanol imports to the EU, upon EU companies verifying sustainable sources (European Commission 2008; European Commission 2009; TheBioEnergySite News Desk 2009). In addition, the EU has declared that “verified sustainable ethanol is a first step in a vital process towards new general sustainability criteria of the EU”. The

expansion and implementation of these regulations will offer Brazil unique opportunities to innovate for a new European market, meeting existing European demand and catering to demand spikes due to fluctuating domestic production. The implementation of these sustainability regulations could create a new higher-value niche market for more sustainably produced ethanol in the EU.

At the same time, Brazil will be particularly concerned with the EU's protection and support of its domestic industries, specifically in areas such as agriculture and the automotive industry, both through subsidies and tariffs (Marius and Alan 2007), which have often resulted in trade disputes. These domestic trade policies have given the EU a poor reputation as a trading partner in the developing world, deservedly or not, stemming most recently from the WTO Doha round. Criticism has surrounded the North-South aspects of the agricultural trade debate, with issues such as trade barriers, domestic support, and tariffs resulting in a fruitless Doha round (Subedi 2003). As a result, for reasons of size, protectionism and politics, developing countries are understandably leery of new EU policies, particularly around agriculture and energy.

On the other hand, classical competitive advantage claims that, through innovation, international market competition, and access to new markets, developing countries will be able to better utilize their competitive advantage through cheaper access to resources, low labor and land costs, etc. (Porter 1998). Through the development of, and adherence to a standard, Brazil might be able to be more competitive during the innovation cycle (Vernon 1966), as it

will have adhered to the same standards as the developed world, poising the country to innovate in tandem with other states. Policies requiring innovation may open new markets and opportunities by allowing industries to add value to their products, increasing profits and wages (Hall et al. 2009a) in domestic and international markets. Through sustainability policies, it will become possible to take advantage of new opportunities early in the product cycle. New access to niche markets will allow developing countries to add value to industries through domestic innovation in areas where they possess a competitive advantage. For example, Brazil possesses, largely through both intrinsic factor endowments and domestic innovation, a significant market advantage in producing ethanol (Ray 1998). Although sustainability policies could be viewed as encouraging EU domestic research and development, which is certainly one of the EU's main goals in funding sustainability initiatives, they may also provide incentives for developing countries, such as Brazil, to innovate and develop local technologies and human capital. Development in technology sectors will increase human capital among developing country populations by creating incentives to increase higher education in order to domestically innovate to take advantage of the new markets they create (Lall 2003). This will allow these countries to begin to support domestic research and development sectors. By utilizing increased education levels and human capital, developing countries will then be able to support high tech industry with wages low enough, relative to developed countries, to create a competitive advantage in technologies previously dominated by developed countries (Maloney 2002). The key to ensuring this

accumulation of human capital would be to break the vicious cycle in developing economies of low levels of knowledge, leading to low returns on human capital accumulation, resulting in little incentive to invest in human capital and a lack of capital investment, in turn reinforcing low levels of knowledge accumulation and low returns to human and physical capital investments (Ray 1998). Sustainability regulation may provide developing countries with new niche markets in which they can utilize a natural competitive advantage and thus create this human capital, breaking this vicious circle of low knowledge levels and low investment.

Sustainability-focused niche markets would present an opportunity for developing countries, unlike with highly developed products such as the microchip, to innovate in an industry in which they already possess a domestic advantage. This innovation and adaptation can occur through new industry specific technologies as well as through new general purpose technologies developed as externalities, creating greater efficiency and greater access to new markets. Thus, through the implementation of sustainability policies, developing countries are presented with an opportunity to enter new technology-based industries that have a high chance of being competitive, if they can capitalize on these uniquely suited windows of opportunity. Indeed, sustainability policies provide a window, which, if properly utilized, might allow a developing country to break free of a resource-based economy by increasing total factor productivity. Responding to sustainability policies through domestic policy will require decisive and focused capital investments allowing domestic industries to adapt to new markets rapidly and stay abreast of competition in developed countries (Ray

1998). In sum, sustainability policies have the potential to increase innovation, promote domestic research and development, further exploit competitive advantages, and develop human capital while providing increased total factor productivity from which developing countries might better diversify and hone their economies to compete and trade with the developed world; however, they will require a focused, capitalized and innovative response to take advantage of these opportunities.

The work of economists such as Nelson and Winter (1982), Schumpeter (1962) and Vernon (1966) has established strong links between technological innovation and regulation as catalysts for economic development, including new methods of production, and access to new markets. At the same time, the national learning capacity of the developing state may hinder the timely adaptation of products to EU standards (Maloney 2002), as developing countries frequently do not have the necessary pre-existing technical knowledge. Domestic innovation and adaptation will require considerable state support; yet, it remains unclear whether many developing countries could sustain the necessary financial support to launch such an industry, particularly when in competition with far wealthier industrialized states (Lazonick 2008). For other states, sustainability policies may open new markets for existing industries by providing opportunities to add value to their products, increasing profits and wages. As Nelson and Winter (1982) describe, these new technologies may create new industry practices and methods that will adapt to the new regulatory framework generated by sustainability policies.

Schumpeter's seminal definition of innovation, as the commercialization of invention in the form of new consumer goods, methods of production, transportation, and industrial organization, is the foundation of his concept of 'creative destruction'; that innovation is a difficult and painstaking processing in which old methods and products are discarded in order to take on new innovations (Schumpeter 1982). Creative destruction can be seen as the extreme form of invention, while the majority of innovations are actually the product of the adaptation of existing technologies and methods. Given that sustainability policies will require innovation and adjustment in order to bring a product up to the standards that these policies lay out, products may require incremental innovation and adaptation in order to qualify for the benefits of such policies. This may include, for example, the alteration of planting techniques, the development of new methods and equipment, and other changes to the production process. This incremental innovation builds upon Schumpeter's definition where using existing methods and technologies as well as more radical 'destructive' innovation, such as the transition of labour intensive to mechanized production, leads to the development of a new product or industry (Henderson and Clark 1990; Kuhn 1996; Schumpeter 1982).

The new methods of production required to meet sustainability policies may mean the demise and obsoletion of old methods, resources, products, and markets. Many industries will undoubtedly fail to become economically viable in the pursuit of sustainable practices, and the products generated, some as a direct result of sustainability policies, will not persist (Blewitt 2008). At the same

time, however, this should be offset by the opportunities such policies create, depending on what qualifies as a sustainable product and if developing countries are able to meet those standards. Either way, industries will continue to innovate and evolve, and the unique opportunities created by these regulations have the potential to create high value added goods and foster domestic innovation. These new regulations will inevitably lead to Schumpeter's creative destruction (Schumpeter 2005), whereby innovation and new technologies make older ones obsolete; the question is whether developing countries will be able (due to unreachable levels of sustainability for foreign producers), or even allowed (due to protectionism) to participate. In responding to these regulations, it is essential that developing countries capitalize on the opportunities or risk, as well as any domestic advantages that already exist. While these regulations have the ability to damage existing industries by reducing market demand for non-sustainable products (Reardon, Berdegue, and Timmer 2005), they more importantly create new product cycles through which developing countries might advance their relative economic positions.

Among developing and emerging economies, Brazil is among the best positioned to capitalize on the opportunities presented by sustainability policies. This stems largely from its relatively developed domestic market for biofuels as well as its considerable historical experience in biofuel innovation and production. In striving to cater to new market niches created by sustainability policies, Brazil must take care to regulate and focus capital expenditures (Lazonick 2008), directing them towards specific targets so that innovation aimed at capitalizing on

such policies does not create unsustainable levels of capital expenditure and subsidies (Cashore, Auld, and Newsom 2004). There must be a clear objective so that capital is not squandered on half-hearted objectives, but instead given the best realistic chance to succeed, and if unsuccessful, terminated. These opportunities could allow developing countries to break out of cycles of low levels of knowledge accumulation and capitalize on new technologies and innovations by targeting specific market niches. As sustainability policies present new niches, the barriers to entry from clusters and developed capitalized industries would be lower than in developed industries, providing developing countries with opportunities to innovate where they have at least a smaller disadvantage. In addition, the niche market must be larger than EU domestic production, or at least growing faster, in order to ensure that, regardless of EU protectionism, there will be a market to cater to. In conjunction, domestic demand must be created to generate a national stake in new industries and to prevent national market fluctuations from dictating new industries entirely (Blewitt 2008). This should aid in avoiding price spikes and retaining some domestic control (Smeets et al. 2008). Without this domestic market, developing countries have not historically been successful in expanding into new industries (Hira 2007).

Additionally, the amalgamation of forces (energy, environmental, and security) behind sustainability policies may give existing or new industries within the EU the opportunity to survive, despite high capital costs and slow progress. Developing countries may struggle to match this determined support of new policies, and risk falling still farther behind. Though taking advantage of the

opportunities offered by new niche markets may require government intervention as the initial costs of investment may be too high for the private sector, the developmental state has the opportunity to utilize these niche markets created by sustainability policies to enter these new markets in a favourable position, as opposed to entering after developed countries. This market entry is key to increasing long term rates (and growth rates) of total factor productivity, which will ensure future investment flows (Helpman 2004), and the ability to create a competitive advantage in a particular technology. Increased total factor productivity creates investment, which creates more physical capital for investment in human capital, which in turn increases the capacity to support further value-added industry.

If Brazil takes care to ensure it fully analyses the potential of these new policies and regulations as well as the risks, there is the potential to capitalize and develop a more sophisticated value-added industry that could support the growth of other domestic technology-based industries. By capitalizing on value-added niches provided by sustainability policies, new methods of production, access to new markets, and the utilization of new opportunities and resources could help drive Brazilian industry growth, supported by an already strong domestic market (Hira and de Oliveira 2009a).

The creation of a new niche market for sustainable bioenergy clearly recreates energy security issues for the EU; however, the ability to produce more energy domestically should outweigh this, as it is likely that, at least initially, only a small fraction of sustainable energy will need to be imported. The EU will

undoubtedly favour domestic producers with the creation of this market for the food and energy security reasons discussed above; however, their targets (20%) will likely require external sources if they are to be met. The question remains how tightly the EU will regulate imported bioenergy sources and favour domestic producers.

2.4.2 Stakeholder Ambiguity Theory: Potential Obstacles to Accessing EU Markets

Sustainability policies provide some niche opportunities, which developing countries may attempt to target. However, there are further challenges regarding the implementation and interpretation of these policies and regulations, such as the ambiguity of key stakeholders, the clarity of EU regulations, undefined institutional and administrative structure for sustainability regulation, and fluctuating and volatile niche markets.

Stakeholder ambiguity, defined as the inability to identify key stakeholders and outcomes by major actors, poses considerable obstacles to developing and emerging economies when targeting sustainable niche markets. Given the stakeholder relationships in sustainability markets, it may be difficult for producer countries to assess the potential risks and benefits of targeting EU sustainability niche markets. Indeed, sustainability policies in the EU involve numerous secondary stakeholders who, although not directly involved in the production process, could significantly impact the foreign producers' ability to access EU markets. For example, factors such as EU consumer pressures, regulatory structures and red tape, non-governmental organizations, and domestic EU

issues may directly affect Brazilian production and methods. In producing for a European niche, Brazil must take into account the secondary stakeholder positions of actors within the EU (Freeman 1984). These stakeholders may be ambiguous, which may make it difficult to identify their specific agendas and levels of importance (Hall and Martin 2005). Consequently, companies, in this case particularly companies abroad, may find it extremely difficult to accurately predict market activity and trends (Hall and Vrendenburg 2005), leaving them exposed to sudden moves by secondary stakeholders they do not understand or of which they are unaware. Sustainability policies involve a wide range of stakeholders many of whom are not directly involved with production (Hall and Vrendenburg 2005), and create an ambiguous variable uncontrolled by the exporting country, in addition to any that might be created in normal trade relations.

Establishing a reduction in uncertainty and ambiguity in which Brazil is able to control for these external factors will allow for the creation of an industry aimed at targeting a particular niche within the EU selection environment. Complex and ambiguous stakeholder relationships between the EU and Brazil have exacerbated efforts to create sustainability policies that go beyond national borders, as the creation of a certification scheme or universal definition simply involves too many actors. Stakeholder behaviour, according to Hall and Martin (2005), directly affects the ability of firms to appropriate benefits from their innovations (Hall and Martin 2005). Thus, these ambiguous secondary stakeholder relationships may limit the ability of firms in developing countries to

benefit from niche markets created by sustainability policies by limiting the return on innovation and adding a high level of risk in investing in such markets. On the other hand, the high risk generated by this ambiguity, capital barriers and organization barriers to sustainable production, likely mean a high-value niche market which will remain low in competition.

A further level of difficulty is added with sustainability-regulated trade between two countries with entirely different, or at least ambiguous, definitions of sustainability. In this case study, there is a clear disjuncture between the focus of sustainability policy in the EU and Brazil. In the EU, sustainability policies have maintained a clear emphasis on the environmental aspects of sustainable production, while in Brazil the emphasis has shifted to social sustainability. This difference in definition and policy could hamper Brazil's ability to capitalize on potential value-added niche markets provided by EU sustainability policies. Sustainability regulations create a somewhat arbitrary set of standards, which the importing country may use to reject or accept trade, subject to ambiguous interpretation, making targeting sustainability-oriented niche markets inherently high risk, pending better definitions or a universal certification system.

The EU must define sustainable production, both within its borders and in any country that it trades with, in the areas covered by sustainability policies and regulations. This presents a logical problem of how to translate broad goals into actual standards for a myriad of different industries. What exactly constitutes a sustainable product? Which factors will be taken into consideration? Are the policies and regulations looking for purely environmental sustainability, or will

they expand in all cases, or only some, to social and economic sustainability? While these questions are addressed in the European Commission 2009/28/EC it remains uncertainly how these policies will eventually play out. For example, with regard to social sustainability the directive has defined it as exporting countries being signatories to the ILO conventions. This not only shirks any responsibility from the EU to enforce social sustainability but leaves the door open for further stipulations in the future.

Although sustainability requirements are defined numerous times across dozens of pieces of EU legislation, there is not a clear detailed set of EU-wide standards. This lack of consistent definition, coupled with the European Community ensuring "that **a level playing field is afforded to all renewable energy producers**" raises the ever-present concerns of thinly veiled protectionism and additional red tape for imports. At the same time, the European Union has made some assurances to foreign ethanol producers that they will be treated equally to European producers (European Commission 2009). Whether this claim holds up will be crucial for developing countries catering to new EU niche markets. The demand within the sustainability niche market created by renewable energy policies should be greater than the supply possible from within the EU in order to ensure that the market is not entirely met by domestic supply. Developing countries cannot rely upon the EU to continue to provide market access, particularly in agriculture, if the market can be filled entirely by its own producers.

European Commission Directive 2009/28/EC lays out who will both enforce the policies and regulations and verify products as sustainable. The directive passes on the responsibility to each member state, in that each member state must guarantee the origins of the product. It is possible this will create numerous double standards as member states interpret European Commission documentation in their policy implementation. Thus it creates a large problem for foreign producers, as, while they can meet the standards of the EC Directive, their product will be subject to the discretion of the individual member states. Specifically regarding biofuels and sustainability the Directive states that they must not be produced from land with high biodiversity value or with high carbon stock, while using ILO membership to define social sustainability. To benefit from financial support aimed at supporting the EU renewal energy goals, imported biofuels will have to qualify as "sustainable". This Directive is the foundation of EU renewable energy policy and affirms the place of sustainable biofuels in EU policy and initiatives.

In sum, key obstacles to developing country trading partners accessing new sustainability markets in the EU remain. In particular, many unknowns from key stakeholders, to definitions of sustainability, to administrative processes for sustainability certification present significant risks for developing countries seeking to gain access to EU markets. Such risks, despite their potential payoffs, may be too high to allow such economies to enter or expand sustainable industries and products that would otherwise allow them to capitalize on an emerging value-added niche market.

2.5 Conclusions

Sustainability discourse within the EU has, over the past few years, led to increased political attention to issues of environmental sustainability, culminating in the implementation of specific environmental sustainability targets and regulations. Much of these policies have focused on renewable fuels, namely biofuels, as alternative energy sources, with the obvious appeal of not only addressing the issue of climate change but also offering greater energy security as well as new opportunities for EU agriculture.

As the EU seeks to increase renewable energy use to its target of 20 percent by 2020, it is unlikely that increased demand in biofuels (along with other renewables) will be able to be fulfilled entirely from within the EU market. This, in turn, potentially presents a unique opportunity for developing countries to make up this deficit, ensuring access to coveted EU markets, and within a high value-added niche market. Indeed, sustainability policies present both opportunities and risks to developing countries. Brazilian, and other developing country, producers, will have to adapt or potentially risk losing a high value market. Though such policies are in their infancy, it will be essential for Brazil to act quickly in order to capitalize on the opportunities they present. This process has already begun as Brazil tries to re-orient towards new markets abroad; indeed, the country has already begun to develop sustainability mechanisms within its bioenergy production.

At the same time, despite the increased political interest in sustainability policies through renewable energy, the policies are still subject to interpretation

and it remains to be seen how effective their implementation will be. This Knightian uncertainty (Knight 1921) presents considerable risk to Brazil and other developing trading partners as they attempt to assess opportunities for access to EU markets. The level of risk associated with targeting EU sustainability markets will thus largely depend on the extent to which it lays out the standards for products to conform to EU sustainability regulations, and the process through which developing countries can obtain sustainability certification, and in turn access to lucrative EU sustainability markets. Under current practices, whereby accountability is largely offloaded onto EY member states, developing country exporters will have a variety of standards to meet EU requirements due to different interpretations of Directive 2009/28/EC and thus fewer incentives to invest in such markets as they are made doubly high risk by not only fluctuating trade policy, but stakeholder ambiguity. At the same time, the risk associated with targeting such markets makes them less competitive and all the more lucrative.

The impacts these regulations will have on Brazilian industry and innovation are largely dependent on the nature of the Brazilian economy and industry and its ability to respond and adapt to EU policy. The next chapter will outline the nature of the Brazilian bioenergy industries and the aspects that will be affected by sustainability policies, and examine the efforts that have already been implemented to prepare Brazilian bioenergy products for sustainability driven markets.

3: BRAZILIAN BIOFUELS INDUSTRY

3.1 Introduction

The previous chapter elaborated the potential that sustainability policies hold for developing countries in terms of accessing high value-added niche markets in the EU. At the same time, there are obvious obstacles to capitalizing on such niche markets, not least of which include historically protectionist trade policy within the EU, especially in relation to agriculture and energy, and vaguely defined sustainability standards. This chapter will seek to assess the impact of EU sustainability policy on developing country economies, taking Brazil as a case study.

This chapter will explore the conditions that appear to position Brazil well to be able to take advantage of EU sustainability niche markets. The sectoral analysis that follows will show that Brazil has developed major competencies in biofuels through an extensive biofuels program initiated in the 1970s in response to the oil crises. In tandem with the development of this biofuels program, Brazilian sustainability policies have also evolved towards a relatively comprehensive understanding of the concept of “sustainability”. Further, the country’s well-established public and private R&D and innovation capacities and systems that stem from its pioneering experience in producing alternative fuels, its considerable infrastructure already adapted to produce various products under the new EU sustainability requirements, and its relatively well-developed

domestic market, all appear to put Brazil in an optimal position vis-à-vis other developing countries in confronting changing trade patterns based on issues of sustainability (Hira and de Oliveira 2009a). Given this historical experience with both the concept of sustainable development and the creation of a biofuels industry, Brazil is among the best-positioned developing and emerging economies to capitalize on the niche market opportunities presented by EU sustainability policies. Put differently, Brazil provides one of the most receptive economic environments for sustainability regulations in the developing world. Thus, the economic impacts of foreign-determined sustainability regulation on Brazil will provide a 'best case scenario' test case for developing countries as a whole.

This chapter will be guided by several key questions, namely, what is the present state of the Brazilian biofuels industry, and to what extent has it incorporated issues of sustainability? How might the industry respond to the implementation of sustainability policies within the EU? It will be argued that sustainability policies are a potentially valuable opportunity for developing country trading partners with the EU, especially for Brazil, to increase their market access within sustainability to EU markets. Sustainability policies can be understood as providing niche markets for developing country industries to secure. Thus, if Brazil (and other developing countries) are able to innovate and adapt within its existing bioenergy industry to changing market conditions and demand, it could secure a valuable niche market for its products. At the same

time, however, high levels of Knightian uncertainty (Knight 1921) could prevent Brazilian industry from capitalizing on this opportunity.

This chapter will first provide an overview of the role of the agricultural sector within the Brazilian national economy, followed by an historical perspective on the development of the national energy sector, with particular focus on the bioenergy industry. It will then examine the Brazilian biofuels sector in international markets, its incorporation of issues of sustainability, and industry prospects for expansion. The chapter will conclude with an analysis of the opportunities for innovation and adaptation within the Brazilian bioenergy sector in order to assess the possibilities of catering to EU niche markets, as well as the potential problems of stakeholder ambiguity that may prevent Brazil from capitalizing on such opportunities in order to suggest how they may be overcome.

3.2 Literature Review

3.2.1 The Brazilian Agricultural Sector within the National Economy

As the Brazilian biofuels industry has by and large focused on the production of biofuel from agricultural crops, an overview of the Brazilian agricultural sector, with specific reference to its innovation capacity, is key to understanding the country's ability to successfully target EU niche markets. Brazil has one of the largest land areas in the world at approximately 8,456,510 square kilometres with a large availability of rain-fed farmland and, as a result, agriculture and agribusiness is a key sector in its emerging economy, accounting

for fully one quarter of the country's GDP in 2007 (CEPEA 2007). (Hall et al. 2009d) note that, with the implementation of Green Revolution techniques, including mechanization, and the use of chemical fertilizers and hybrid plant varieties in the 1960s and 70s, followed later by the introduction of transgenic technologies, Brazilian agriculture saw vast improvements in output and exports. These capital and chemical intensive techniques, combined with the introduction of foreign crops such as coffee and soybeans have increased production efficiency in Brazilian agriculture and made the country one of the world's largest agricultural producers and exporters (Hall and Matos 2009; Reid 2008). Despite being a global leader in agricultural production, more than half of Brazil's arable land remains uncultivated, excluding, protected areas such as rainforest. Thus, the country holds immense potential for increasing crop production; this, coupled with the climatic advantages of spanning tropical and sub-tropical zones, which allow for longer and multiple growing seasons, give Brazil a considerable comparative advantage in agricultural production (Hall et. al. forthcoming). This considerable untapped potential for increased agricultural production opens the door to a considerable expansion of crop production for the biofuels industry, which would be an important consideration in targeting EU niche markets.

At the same time, the agricultural sector has been the target of much criticism, both on environmental and social grounds. Bioenergy crop expansion has contributed to the destruction of the rainforest, reduced biodiversity due to monocropping, deteriorating water quality, waste disposal issues, soil erosion, increased demands for energy, among other environmental problems (Rajagopal

and Zilberman 2007). Such environmental problems, notably the issue of deforestation has in turn led to much social conflict, including violent confrontations between landowners and indigenous and environmental groups, which have on occasion led to the murder of several environmental activists. In response to criticisms of the environmental sustainability of agricultural practices, the Brazilian government has enacted strict environmental protection laws (Hall et. al. forthcoming) and has adopted a rather comprehensive understanding of sustainability, at least in policy.

In addition to environmental concerns, there have been major concerns over the inequitable wealth distribution within the agricultural sector in Brazil. Hall et al. (2009) argue that, while Green Revolution techniques and biotechnology have been instrumental in increasing production and efficiency within the agricultural sector, they were not designed to meet the needs of small and subsistence farmers, leading to the dislocation of these groups towards urban areas and in turn the growth of favelas, or slums, in Brazil's urban metropolises. In response to the social marginalization of small and subsistence farmers, Latin America's largest protest group, the Landless Rural Workers' Movement, or MST, emerged in the 1980s to protest the concentration of land ownership and the migration of poor farmers from rural to urban areas as a consequence of agricultural modernization. While concerns remain over social exclusion both within society at large (Behrman et. al. 2009; Buvinic et. al. 2004) and within agriculture in Brazil, President Lula da Silva has attempted to speed up the process of land reform and address social exclusion through large-scale

expansion of social policy programs targeted at low-income groups. Moreover, (Hall and Matos (forthcoming) note that the creation of the Ministry of Social Development and Fight Against Hunger as well as the expansion of the mandate of the Ministry of Agriculture Development have aimed to address concerns of social exclusion and problems specific to small producer and subsistence farming. In addition to greater attention to broader issues of social exclusion, under President Lula, the concept of sustainability as implemented in policy has been expanded to incorporate issues of social sustainability, notably through the Social Fuel Stamp program that seeks to better incorporate small and low-income producers.

3.2.2 The Development of the National Energy Sector in Historical Perspective

As in the agricultural sector, the energy sector in Brazil has also seen major improvements in technology and production since the 1960s and 70s, which have made the sector and the state oil company, Petrobras, global leaders in this field. From large-scale hydroelectricity production, to the development of deep and ultra-deep offshore oil and gas, to the development of a world-class biofuels industry, Brazil's state oil company, Petrobras, has become a global leader in the energy sector. Indeed, Petrobras has become the world's seventh largest publically traded oil company and has been recognized for its attention to issues of sustainability and corporate social responsibility (Magrini and Lins 2007). Indeed, in addition to its agricultural sector, Brazil's energy sector is also well experienced with issues of sustainability and retains considerable capacity

for the innovation and adaptation necessary to successfully target EU sustainability niche markets.

While Brazil has been a pioneer in various industries within the energy sector, the national biofuels program was among the first major innovation that would put the country at the forefront of global energy innovations. Spanning both the energy and agriculture sectors, biofuels hold the potential to provide a more sustainable energy alternative to petroleum, as a renewable resource and with lower greenhouse gas emissions (D'Agosto and Ribeiro 2009; Laser et al. 2009; UNCTAD 2006). In terms of social sustainability, the biofuels industry has been seen as potentially holding the opportunity for incorporation of small subsistence farmers into the production model; at the same time, this potential has yet to be realized and much criticism of the Brazilian ethanol programs has been targeted at the failure to incorporate small-scale farming (Hall et al. 2009; Pacini et al. 2010.). Indeed, as Abramovay and Magalhães (2007) note, recent policies surrounding the country's biodiesel program have attempted to address such social inequities by providing for tax exemptions for refiners and distributors that source from small-scale farmers, particularly those in the North and Northeast regions.

In 2006, President Lula, in office at the time this study was conducted, announced the country was self-sufficient in energy, yet this has come as a result of a long history of investment in the energy sector. Indeed, an explicit policy for national energy self-sufficiency can be traced back at least as far as the development of the biofuels industry in the 1970s.

As the world's second largest ethanol producer, Brazil was a pioneer in biofuels technology, use and production, with an active government program for over 30 years now. The Brazilian government launched the ProAlcool program in response to the oil crises of the 1970s and collapsing global sugarcane prices (Rosillo-Calle and Cortez 1998). The program involved stakeholders from a range of government ministries, the military, the ethanol industry, researchers, media, and sugarcane producers to create a market for ethanol fuel (de Oliveira 2002b). Despite Petrobras' key role in much of the development of the Brazilian energy sector, the company was initially not involved in the ProAlcool program as the organization both believed ethanol production to be commercially unviable as an energy source and perceived it as a threat to petroleum production given considerable subsidies to the ProAlcool program (de Oliveira 2002b).

Nevertheless, Hall et. al. (forthcoming) highlight that considerable technological innovations in combination with increased oil prices have made ethanol production commercially viable which therefore no longer requires or receives government subsidization. The program initially aimed to produce an anhydrous ethanol mixed with 80% gasoline, as there would be no need for engine modifications or distribution infrastructure (de Oliveira 1991). As a direct result of the ProAlcool program, ethanol production saw substantial increases from 625 million litres per year in 1975 to 3,389 million litres per year in 1980, while sugarcane cultivation for ethanol increased by nearly 30% (Niemeyer 2009).

The Brazilian government's agricultural research corporation, known by its Portuguese acronym EMBRAPA (Empresa Brasileira de Pesquisa Agropecuária) has contributed to innovations to improve sugarcane cultivation and yields that have made it an efficient crop for the production of ethanol, considerably more efficient than alternative crops for ethanol production such as corn or sugarbeets. For example, according to the International Energy Agency (2009), a hectare of Brazilian sugarcane produces approximately 7,000 litres of ethanol, compared to only 3,800 litres from a hectare of US corn, or 5,400 litres from a hectare of European sugarbeets. Various authors note (Kamimura and Sauer 2008; UNCTAD 2006) that the high level of efficiency of Brazilian sugarcane in ethanol production, combined with the extended growing season in Brazil between tropical and sub-tropical regions have made Brazil one of the top global producers and exporters not only of fuel ethanolbut of flex-fuel cars, powered by combinations of ethanol and gasoline.

Government regulation of the sugarcane industry dates back to at least the 1930s with the introduction of the Instituto do Acucar e do Alcool (IAA) under President Vargas' administration, which aimed to set prices, regulate and act as a buyer of last resort in the wake of the Great Depression and the collapse of world trade. Though the Northeast had traditionally dominated sugarcane production, by 1951 Sao Paulo and the Southeast had overtaken the Northeast as the largest producing region in Brazil (Hira and de Oliveira 2009a). Following the Cuban Revolution in 1960, Brazilian sugar producers gained new market opportunities for exports, with sugar exports increasing by 250% between 1965

and 1974 (Hira and de Oliveira 2009a). The expansion of the sugarcane industry led to the creation of COPERSUCAR, a cooperative that united farmers with mills and refiners, as well as providing financing and marketing for products (Numberg 1986).

When the OPEC oil shocks of the 1970s hit, Brazil was importing over three quarters of its petroleum, inevitably leading to financial crisis (Hira and de Oliveira 2009a). At the same time, global sugar prices collapsed, leaving the sugarcane industry in crisis as well. In response, the government of then President Ernesto Geisel established a national ethanol program, ProAlcool, with the goal of saving foreign exchange from petroleum imports while also bailing out the sugarcane industry by providing new sources of growth and stability. This would mark the emergence of a large scale bioethanol industry in Brazil that, over the next decades, would gain the experience and technical knowledge to position it as a world leader in biofuels technology and production. As a secondary goal, the program hoped to improve agricultural incomes in the poor Northeast region where much of the sugarcane industry was located (Hira and de Oliveira 2009a). A National Alcohol Commission (CNAL) was introduced with the mandate of providing a favourable credit program to stimulate and guarantee a market for production of ethanol. By 1979, production had reached 790 million gallons (Sperling 1988). Though production improved in line with the ProAlcool program goals, the social objectives of the program, namely increased rural incomes and decreased regional disparities, did not.

There were political coalitions that both advocated and opposed the ProAlcool program. The IAA, which regulated the sugarcane industry and represented sugarcane producers' interests, lobbied the government to make sugarcane the exclusive feedstock for the ProAlcool program, while COOPERSUCAR lobbied for government subsidies (Numberg 1986; Sperling 1988). According to Hira and de Oliveira (2009a), the auto industry first quietly, then more publically, strongly supported the program in the hopes of procuring valuable subsidies. The Ministry of Industry and Commerce as well as numerous entrepreneurs who quickly secured rights to new distilleries also supported the program. On the other hand, the Ministry of Mines and Energy, Petrobras, the Minister of Finance, the Central Bank, and the Banco do Brasil all opposed the project and viewed it as commercially unviable. Despite fragmented support for the program, Hira and de Oliveira (2009a) further suggest that ProAlcool saw considerable success in its initial stages. The low level of ethanol blend (20%) required no engine modifications or infrastructural changes, while considerable underutilization of mills and infrastructure within the sugar sector all contributed to the smooth implementation of the ProAlcool program. Heavy government subsidies to a total of US$7 billion throughout the initial stages of the ProAlcool program reduced fuel costs by at least one quarter (Calabi 1983).

During the 1970s, much of ethanol production was linked to sugarcane production. Thus, few autonomous distilleries were built and the majority remained annexed to existing sugar mills (Sperling 1988). By the end of the

decade, the excess capacity within the sugar sector was largely used up, while the 20% ethanol blend target had almost been reached (Demetrius 1990).

The government began the next step of replacing gasoline with pure ethanol, requiring the construction of new infrastructure and new automobiles adapted to pure ethanol. This would mark a clear shift towards the widespread adoption of ethanol as an alternative fuel and be instrumental in putting the Brazilian biofuels industry at the forefront of international biofuel technology and know-how in the coming decades. With the second oil crisis in 1979, the government took measures to expand the ProAlcool program to deal with the financial and energy crises that ensued. Then President Figuerido raised annual ethanol production targets from 790 million gallons in 1979 to 2.8 billion gallons by 1985 (Hira and de Oliveira 2009a). Such commitments to ethanol production encouraged the automobile industry to begin manufacturing vehicles that could run on 100% ethanol (Rosillo-Calle and Cortez 1998; Sperling 1988).

State support policies to the ethanol sector, including higher minimum ethanol blends, guaranteed lower prices for ethanol versus gasoline (capped at 65%), guaranteed minimum prices for ethanol to producers, increased availability of credit for expansion of capacity within the sugar sector, lower registration taxes on ethanol-powered cars, increased availability of credit for the purchase of ethanol-powered vehicles, and the required availability of ethanol at gas stations all made the purchase of ethanol-powered vehicles highly attractive by the 1980s; and indeed, Hira and de Oliveira (2009a) highlight that sales of ethanol-powered vehicles boomed from 1% of total car sales in January 1980 to nearly

three quarters by December of the same year. By the mid-1980s, more than 90% of vehicles produced in Brazil were ethanol-powered (Niemeyer 2007).

Nevertheless, despite the government's expectation that the ProAlcool program could be a boost to regional development in the poorer North and Northeast regions of the country, by the mid-80s the productivity gap had widened between the Northeast and Southeast, with the wealthier Southeast region producing over 70% of ethanol and therefore receiving the majority of government subsidies (Silva and Sakatsume 2001). While the ethanol program saw success and widespread adoption of ethanol fuel among consumers in the 1980s, by the end of the decade several factors would contribute to the decline of the ProAlcool Program. Declining international oil prices and rising international sugar prices simultaneously made gasoline more affordable and ethanol more expensive. Ironically, the rise in world sugar prices, which encouraged the Brazilian government to liberalize sugar exports, resulted in severe ethanol shortages, leading to Brazil becoming the world's largest importer of ethanol between 1989 and 1996 (Hira and de Oliveira 2009a). Domestically, the discovery of major oil reserves both offshore and in the Amazon, as well as high inflation and foreign debt, a reduction in taxes on gasoline-powered vehicles (Kojima and Johnson 2005; Van den Wall Bake 2006), and major cutbacks in government spending with the transition from military dictatorship to democracy, all contributed to the reduction in subsidies for ethanol production and thus its increasing price. As a result, by 1989, the production of ethanol-powered vehicles dropped from 90% in 1985 to just over 50% (Neimeyer 2007). With

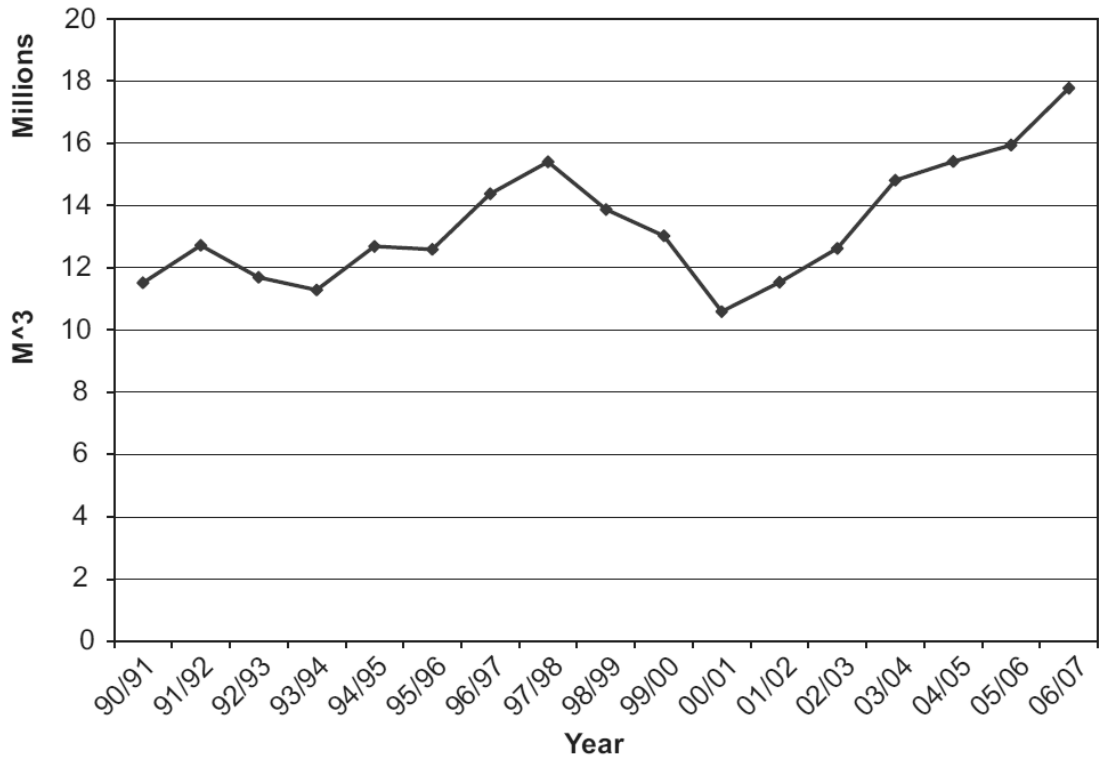
declining world oil prices and a major financial crisis reigning throughout the country, there remained little political will to continue the ProAlcool program and the subsidies it received. In 1991, the ProAlcool program was officially ended and its regulatory bodies were shut down, while subsidies and regulation of the sector were gradually removed (Hira and de Oliveira 2009a). By 1997, tariff quotas for sugar exports were eliminated and market-based prices for anhydrous ethanol were put in place, and a mere 1000 pure ethanol vehicles were sold (Hira and de Oliveira 2009a).

The ethanol industry would, however, be revitalized in the early 2000s, with the introduction of flex-fuel technology, allowing consumers to react to different prices in both the ethanol and gasoline markets (Pacini & Silveira 2010). The renewed large-scale production and use of bioethanol, benefiting from the previous years of experience, would make Brazil a global leader in biofuels production and technology. The government made flex-fuel vehicles (FFV) eligible for the same tax breaks as ethanol-powered vehicles in August 2002, spurring on the market in FFVs (Kojima and Johnson 2005). Within three years, sales of FFVs surpassed those of gasoline-powered vehicles, accounting for 57% of sales in 2005 (Amado, Dolzan, and Piacente 2006). With the taxation structure still favouring ethanol over gasoline, in January 2006, Hira and de Oliveira (2009a) note that taxes on gasoline were 58% higher than on pure hydrated ethanol, while anhydrous ethanol (mixed with gasoline) remains untaxed. There is, once again, a substantial domestic market for Brazilian biofuel, particularly for ethanol, which has historically and continues to be crucial

for industry development and expansion. This large domestic market is in turn key to Brazil's potential ability to successfully target EU sustainability niche markets, and cushion against external shocks generated by high levels of Knightian uncertainty in stakeholder relationships.

Goldemberg (2007) notes that the revitalization of ethanol as an alternative fuel has seen the industry mature, with increases in economies of scale among mills and distillation plants, so that it is no longer a side-venture among sugar producers, but rather an industry in and of itself. Key to the expansion of the ethanol industry has been government investment in research and development in such areas as genetics and breeding in sugarcane production, leading to consistent and marked increases in productivity (Hira and de Oliveira 2009a). In terms of the current study, these are both major contributing factors to the Brazilian biofuels industry being well positioned to tap into EU sustainability niche markets in biofuels. In this sense, both the scale of production and infrastructure, and the extensive development of research and technologies specifically tailored for the biofuels industry puts Brazil ahead of any competition among developing and emerging economies. Moreover, as shown in the figure 4 below, there has been a consistent and marked growth in ethanol production since the early 2000s.

Figure 4: Ethanol Exports

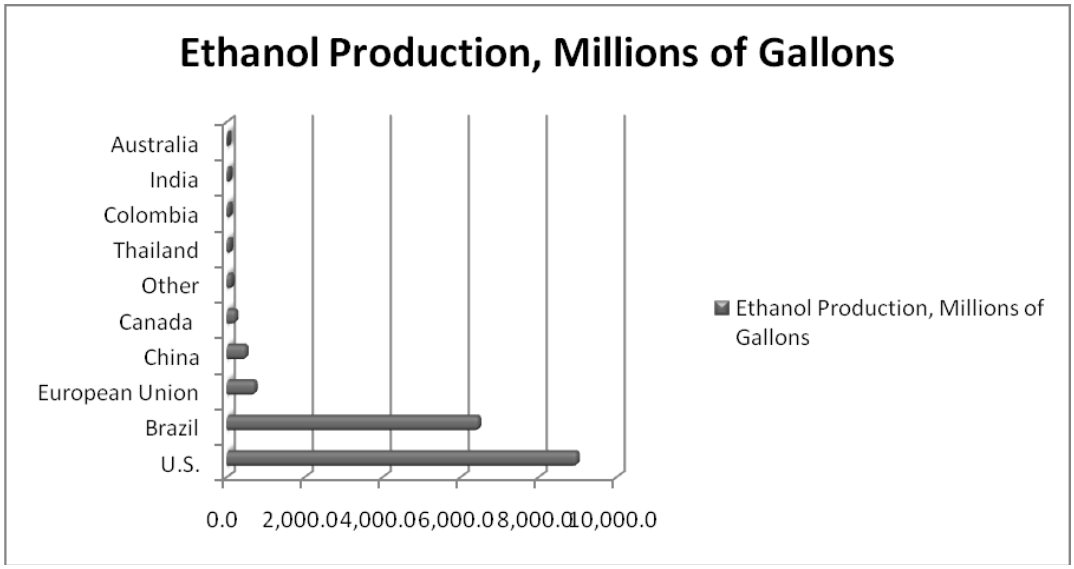


Source: Hira & Oliveira 2009 p. 2455

Aiding this growth has been increased foreign interest in investment and exports of Brazilian ethanol. Indeed, Japan has signed an agreement with Brazil for the construction of a pipeline for ethanol export, while a variety of foreign investors and companies have launched joint ventures and mergers with their counterparts in the Brazilian ethanol sector, including Goldman Sachs, Meryll Lynch, Cargill, and British Petroleum, among others (BNDES & CGEE 2008). The implications of such developments in the biofuel sector are immense, given both Brazilian expertise in the industry as well as increasing international interest in alternative fuel technology for both environmental and energy security reasons. Consistently rising ethanol production and exports, as well as foreign investment in the industry, suggest considerable capacity to meet increased

demand generated by new renewable energy targets abroad. As an industry leader, the Brazilian biofuel sector has the opportunity to capitalize on its thirty-plus years of experience, technological innovation and research and development capacity to provide a high value-added product in foreign markets, underwritten by a strong domestic market and an internationally competitive volume of production (see Figure 5).

Figure 5: Global Ethanol Production



Source: http://cta.ornl.gov/bedb/biofuels.shtml

3.2.3 Issues of Sustainability in the Brazil and the Brazilian Biofuels Industry

Brazil has considerable experience in integrating the concept of sustainability into policy and industry practices. This section will provide an overview of the evolution of the definitions of sustainability as used in Brazilian policy and industry in order to ascertain both the Brazilian biofuels industry's ability to accommodate sustainability concerns in export markets, as well as

potential problems of ambiguity that could arise from differing definitions or emphasis in the concept of sustainability between domestic and foreign industries.

Issues of sustainability have, over time, come to feature prominently in the development path of the biofuels industry in Brazil. Petrobras has established itself as a global energy industry leader, both in terms of technological innovation as well as corporate social responsibility. Since 2006, the company has been listed on the Dow Jones Sustainability Index. Hall and Matos (forthcoming b) note that a 2008 Management and Excellence survey named Petrobras the world's most sustainable oil company, while a 2007 Goldman Sachs study identified the company among four global leaders in the energy industry, and the only one from a developing country.

As the world's second largest ethanol producer (UNCTAD 2006), with a large domestic market, the Agencia Nacional do Petroleo (2010) estimated that in 2010 over 85% of new vehicles registered in Brazil were flex-fuel vehicles, while ethanol supplying nearly 50% of light vehicle fuel. Despite recent interest in featuring issues of sustainability more prominently within the biofuels sector, the sector did not traditionally aim to address such concerns. In the initial stages of industry development through the 1970s, the Brazilian biofuels industry focused heavily on economic development, and thus had no comprehensive environmental sustainability policies in place. Prior to the early 1970s, Bredariol (2001) notes that Brazil relied on a series of guidelines on water, forests, fishing, hunting and resources, with the focus remaining on single issues rather than the

impact of each on the entire system. Matos et. al. (2010) argue that, during this time period, economic development policies focused largely on resource-based industries as a means to reduce imports, while environmental issues were largely ignored. As a result, despite the improvements in air quality in large metropolises, largely as a result of decreased automobile emissions, air quality deteriorated in sugarcane producing regions due to the burning of sugarcane residuals (Souza 2005; Neimeyer 2009). Moreover, the unregulated discharge of vinasse, an ethanol by-product, into waterways resulted in serious environmental problems, while the displacement of pastures and cropland for sugarcane cultivation reduced biodiversity (Smeets et al. 2008). On a social level, concern arose around the substitution of food for fuel crops and was identified as the primary cause of increased food prices near the end of the 1970s (Brown 1980). Indeed, Redclift (1989) estimated that between 1974 and 1979, over 360,000 hectares of sugarcane replaced other food crops such as rice and corn, resulting in a decrease in food cultivation by more than one third.

By the 1980s, Matos et. al. (2010) argue that, with increasing international attention to problems of environmental pollution, biofuels policies began to shift to a more preventative approach whereby sustainability was equated with environmental protection. The 1987 publication of Our Common Future propelled the concept of sustainable development on to the international stage. Similarly, the World Conference on the Environment in Rio de Janeiro in 1992 led to a concrete policy agenda to address sustainable development, and the Kyoto Protocol and the UN Framework Convention of Climate Change in 1997 all

moved policy towards reducing the human impact on the environment. These trends in preventative action for environmental protection were formalized in the Brazilian Constitution of 1988 which stated that economic development policies may not be undertaken at the expense of the environment; however, Viola (1998) maintains that implementation was weak due to budget cuts. During this phase, the government's biofuels policy shifted from ethanol production for an anhydrous-gasoline mixture to the production of hydrous alcohol as a replacement for oil. A distribution network would thus be required as well as automobiles adapted to take 100% ethanol (Moreira and Goldemberg 1999). Prior to the mid-1980s, Calabi (1983) notes that the Brazilian government had subsidized ethanol production to a total of US$7 billion, implying a 26% reduction in costs for ethanol users (Rosillo-Calle and Cortez 1998). Consequently, by 1985, over 90% of new cars bought and produced in Brazil were fueled by ethanol (Neimeyer 2007).

Finally, by the early 2000s, sustainability policies in the biofuels sector began to integrate economic, social and environmental concerns into new policies initiatives under a more comprehensive approach to sustainability. Though the increased global concern for the interrelationships between global poverty, the environment and economic development drew attention to the Brazilian biofuels industry, it also highlighted existing tensions within the industry, such as reigniting the 'food for fuel' debate and bringing attention to the poor working conditions in the sugarcane industry in Brazil (Hall et al. 2009d). The Brazilian biofuels industry has, nevertheless, made considerable progress in

integrating issues of sustainability since the launching of the ProAlcool program in the 1970s, putting it ahead of many developing and emerging economies in being able to cater to foreign sustainability markets.

Between 1975 and 2006, sugarcane cultivation rose by over 500%, while productivity increased by nearly 60% (MAPA 2007); in many areas of the country, notably the Southeast, the increase in productivity was largely due to improvements in genetics and cultivation technologies (Satolo & Bacchi 2009). In addition to such vast improvements in ethanol production, the new millennium saw several developments that would make the ethanol sector once again an economically viable alternative fuel source. First, the increase in international oil prices once again made ethanol more economically cost-effective as a fuel. Second, the development of flex-fuel technology was instrumental in re-creating a large domestic market for Brazilian fuel ethanol, allowing consumers to easily respond to market changes in the price of oil or ethanol; by 2010, all new passenger vehicles produced in the country were flex-fuel vehicles (MME 2010). The development of such technologies, particularly flex-fuel vehicles, places the Brazilian biofuel sector particularly well to be a global leader in the implementation of sustainability policies currently in the process of or recently ratified, key among them, newly adopted EU policies that set explicit targets for increased ethanol use over the next decade.

Though ethanol production in Brazil has seen vast technological improvements, which have made it a viable alternative to gasoline, it remains under considerable scrutiny for its environmental and social impacts. Indeed,

many life cycle analysis (LCA) studies have put into question the environmental efficiency of ethanol production. While LCA studies on corn ethanol produced in the US have shown the amount of energy required to produce a litre of ethanol to be nearly the same as the energy content, LCA studies of Brazilian sugarcane ethanol have found both a better energy conversion rate, but also numerous negative impacts on global warming, ozone formation, acidification among other problems (Ometto, Hauschild, and Roma 2009; Searchinger et al. 2008). Social concerns over the production of ethanol largely revolve around the inability of small and subsistence farmers to compete in the biofuels supply chain (Hall and Matos forthcoming b). Though President Lula has made considerable efforts to address social exclusion, and despite pressure on the industry to better incorporate small farmers, there has been little change in the structure of the national biofuels industry.

In response to such environmental and social concerns, the government and various industry organizations have attempted to implement various policies and programs. For example, the association of Sao Paulo sugarcane producers has developed a protocol of economic, environmental and social practices for the promotion of sustainable development in biofuels production, including better practices in resource management and conservation, and use of agro-chemicals, as well as an agreement to eliminate burning by 2017 in favour of mechanization of production (UNICA). In addition, Coopersucar, a national cooperative that coordinates sugarcane cultivation, processing and distribution has also adopted more sustainable practices (Coopersucar). At the same time, expansion of

ethanol production is not projected to include biomes such as the Amazon or cerrado (savannah), although the industry continues to be criticized for the displacement of cattle ranching and other agricultural activities towards the Amazon (Goes & Marra 2008). In spite of progress on environmental concerns, social concerns over ethanol production remain. Much criticism has been directed at the poor working conditions of migrant workers in the sugarcane industry as well as the industry's failure to provide opportunities for the incorporation of small farmers into the production process (Martinelli and Filoso 2008). Mendonca (2006) notes that poor wages and working conditions in the industry persist and instances of child and slave labour have yet to be eliminated, largely as a result of weak monitoring and enforcement.

In an attempt to address this social deficit in the biofuels industry, the federal government, sugarcane producers and Petrobras have initiated social responsibility programs that now invest in worker health and education programs, and, in the case of biodiesel provide financial incentives to distributors who source from small farmers, particularly those in poorer regions of the country. The Social Fuel Stamp, which provides tax rebates for firms that source from small producers in the North and Northeast in exchange for long-term contracts and technical assistance, attempts to address the problems of social exclusion in the ethanol industry; however, Hall et al. (2009d) note that, to date, there remain considerable problems in the honouring of contracts on the part of the farmers, as well as the feasibility of providing technical assistance to small farmers who are dispersed over large areas and who may not be willing to accept such

advice. Moreover, Matos et. al. (2010) argue that, thus far, the wealthier regions of the country have benefited from government subsidies to the production of biodiesel, essentially mirroring the pattern of industry development seen 40 years earlier in the ethanol industry. Thus, despite a notable shift within the industry and policymakers to acknowledge the various dimensions of sustainability, it is far from clear that both environmental and social concerns over biofuel production have been put to rest. Even so, the industry has done much to integrate sustainability concerns, particularly in regards to environmental sustainability, and increasingly social sustainability, and remains well poised to become a global leader in sustainably-produced biofuels.

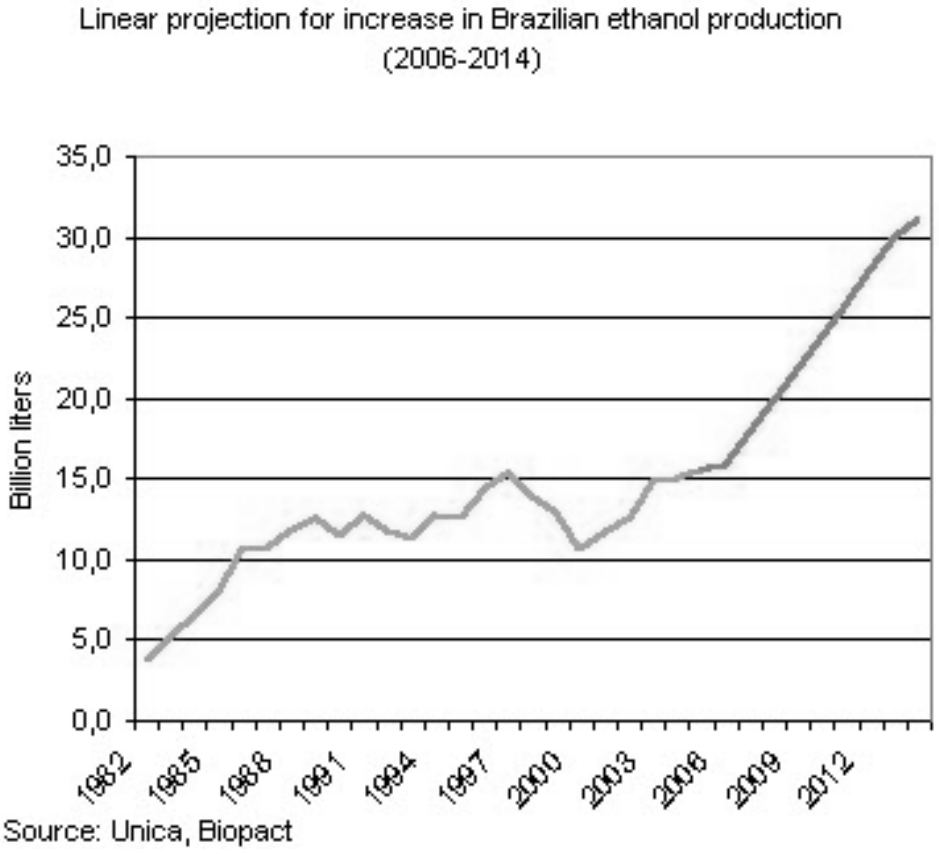
Indeed, internationally the Brazilian biofuels industry has been at the forefront of efforts to address issues of sustainability and thus is likely among the best positioned developing economies to benefit from sustainability regulations implemented across the developed world, and in the EU in particular.

3.2.4 The Future of Brazilian Biofuels

With ever-growing international concern for issues of sustainability, notably in regards to climate change, the biofuel industry is poised to make considerable gains over the coming years, particularly as developed countries implement specific targets and goals with regards to fuel efficiency and consumption. The recently implemented EU sustainability regulations are a prime example, establishing a target of 20% renewable energy by 2020, and one of considerable interest for biofuel exporters as it remains unclear that the increased demand for biofuels, principally projected to be caused by the EU

target of 10% of transportation fuel coming from renewable sources, will be met by domestic production. As the second largest ethanol producer and a leader in biofuel production, EU sustainability targets provide an enormous opportunity for Brazilian biofuel exports. Indeed, the Brazilian industry is well poised to meet such increased export demand, with considerable capacity and plans for industry expansion.

Figure 6: Projection of Future Brazilian Ethanol Production



3.3 Innovation and Adaptation

The many years of experience in biofuel innovation and production laid out in this chapter mean that Brazil has the technology and the research and

development capacity to innovate and adapt to new and changing biofuel markets. In particular the ethanol industry, originally set up as a side-arm of the sugarcane industry, has matured into a globally competitive industry in its own right. Mills and distilleries have been set up for the sole purpose of supporting the biofuel industry, they no longer shift between sugarcane and ethanol production and continue to innovate and adapt to new ethanol demands and production methods. R&D capacity has already led to the pioneering of key technologies such as the flex-fuel vehicle that has increased the appeal and accessibility of biofuels as alternative fuels and created a strong domestic demand. This advanced research and development capacity means the industry is well placed to make further innovations and adaptations to accommodate the new sustainability focus of international 'green' fuels.

Brazil has made serious attempts at integrating sustainability concerns into concrete policy measures and industry standards and practices. Though the Brazilian biofuel program was initiated primarily based on economic concerns surrounding oil, it soon evolved to integrate concerns over pollution and, over the last ten years,climate change. Most recently it has pioneered the need to address social issues related to biofuel production, notably with the country's biodiesel program and the Social Fuel Stamp. Brazilian industry's ability to not only integrate issues of sustainability, but to be a global leader in addressing such issues and implementing innovative programs that attempt to address the needs of both industry and the poor suggest that the sector could easily adapt to

accommodate sustainability concerns and standards in foreign markets such as the EU.

At the same time, Brazilian sustainability focused policies may also lead to problems, as suggested by Nelson and Winter, in that technical change and innovation, while leading to progress, generates new problems as well as new solutions (Nelson and Winter 1982). Thus, Brazil has the opportunity to cater to a value-added niche market in which they must contend with ambiguous stakeholders, uncertain innovation outcomes and returns, and unclear definitions. The latter is highlighted by the differences in the evolution of the concept of sustainability in Brazil versus the European Union. In the former, sustainability has evolved a comprehensive understanding of sustainability, which incorporates economic, environmental and social sustainability.. This could potentially lead to problems of ambiguity in the definitions of sustainability by the respective industries and thus pose obstacles to Brazil's ability to successfully target EU niche markets. Moreover, there are numerous factors shaping the implementation of EU sustainability policies that are ambiguous and unknown to Brazilian producers. Nevertheless, these barriers to entry may serve to keep competition out in an area in which Brazil already possess technological and capacity advantages. Though sustainability regulations may exacerbate stakeholder ambiguity and demand more innovation from producers, these barriers may aid Brazil in catering to a high-value niche market in which it already possess significant advantages. While Brazil trades with the EU in a number of commodities subject to sustainability regulation, it also has the capital,

technological capabilities (Hira 2007), and economies of scale to allow for adaptation to and implementation of sustainability regulations (Porter 1998). Thus, tapping into this EU niche market will not be difficult in theory for Brazil, and if sustainability regulations continue to propagate, may be very lucrative.

3.4 Conclusions and implications

The Brazilian state has a long and extensive experience in sectoral development and technological innovation in the biofuels industry. As a global leader in biofuels production and technology, Brazil has developed considerable research and development capacity, as well as industry-specific pioneering technologies, such as the flex-fuel vehicle, which have in turn expanded the market for biofuels on an international scale. The country's strong domestic market initially driven and currently supported by guaranteed demand created through government policy in support of ethanol has been key in developing this strong R&D capacity as well as providing long-term incentives for investment in biofuels. Strong state support for the industry resulted in an extensive infrastructure, which led to the entrenchment of biofuels as an alternative mainstream fuel and in turn resulted in considerably reduced barriers to entry. Most importantly, the country's experience over the past three decades in developing a world-class biofuels industry has made it a global leader and endowed it with a competitive advantage both in competing on an international scale, and in adapting to a changing global market. In sum, Brazil appears to have many, if not all, the necessary pre-existing conditions to successfully target a European niche market in sustainable biofuels. The following chapter will

explore the extent to which this conclusion, based on the theoretical framework and sectoral reviews provided in preceding chapters, may hold up in light of primary research conducted with various stakeholder groups in both Brazil and the European Union.

4: FINDINGS, IMPLICATIONS AND CONCLUSIONS

4.1 Introduction

The previous sections have discussed European sustainability regulations and the theoretical opportunities they present as well as the Brazilian biofuels industry and its theoretical ability to take advantage of those opportunities. This chapter will incorporate primary research done in support of this study in order to analyse the real opportunities presented by these EU regulations for Brazilian industry and conclude on where Brazil should focus its polices and efforts in biofuels. In the European Union, research focused on interviews with European officials and sought to address Brazilian concerns of European protectionism and domestic favouritism. As discussed in chapter 2, it is a serious concern for Brazilian policy makers that EU protectionism will cut off access to that market by making Brazilian products uncompetitive. The Brazilian component focused on interviewing small, medium, and large Brazilian producers, principally farmers, to determine their knowledge of EU sustainable markets, their impressions of opportunities presented by those markets, and the barriers to entry into the sustainable market.

In general, the research methodology was multi-faceted, including the use of semi-structured interviews obtained through snow-ball techiniques, within the framework of a case study analysis. All of the interviews done in support of this study were conducted anonymously in order to gather authentic data, protect the

individuals involved, and to maximize the number of participants by avoiding privacy concerns. This format was chosen for several important reasons, notably the lack of previous research and available data on the subject, thus precluding a quantitative analysis; the importance of the role of producer perceptions of the viability of targeting sustainability markets and thus their inclination to do so; and the importance of underlying EU motivations and goals in shaping sustainability regulations.

A case study format was chosen for several reasons, including the lack of quantitative data and the multi-faceted nature of the research question at hand. Indeed, a quantitative analysis alone would have arguably missed a large piece of the puzzle by ignoring the importance of producer and policymaker perceptions in determining the possibilities to access EU niche markets. Moreover, as the previous chapter showed, as a global leader in both biofuel production and technology and issues of sustainability, Brazil provides a 'best-case' scenario among other developing and emerging economies wishing to access EU niche markets.

Case studies seek to explain complex social phenomena by allowing a holistic and meaningful analysis of events such as organizational processes, international relations, and group behaviour (Yin 2009). (Yin 2009) also argues that a case study methodology is preferable where there are more variables of interest than data points, where the research must rely on multiple sources of evidence, and where prior theoretical propositions can guide data collection and analysis. Gerring (2004) argues that a case study can be understood as an

intensive study of a single unit with the goal to generalize across a broader set of units. Yin (1994) also maintains that single case studies are ideal in unique or exceptional cases, or where the research concerns a previously inaccessible phenomenon. In the present study, a case study was chosen to assess possibilities for developing and emerging economies to tap into EU sustainability niche markets as a result of the lack of previous research, the likelihood that Brazil would pose a 'best-case' scenario among other developing and emerging economies, as well as the multiple factors, both quantitative and qualitative, that would impact producers' abilities to tap into EU niche markets.

Case study research is not limited to qualitative research but can also incorporate elements of quantitative research. Indeed, case study research is strengthened by the use of multiple data sources to enhance credibility (Yin 2009). This study has attempted to do so through the document and data analyses that guided the sectoral reviews in previous chapters.

The primary field research for the present study was structured largely around what Rubin and Rubin (2005) term elaborated case study interviewing, where the goal of interviews is not only to establish the 'what', the 'how', and the 'why', but also the broader implications of these for the research topic as a whole. The use of semi-structured interviews, whereby respondents were encouraged to elaborate their views, interpretations and opinions with respect to the research topic were thus crucial in establishing these broader implications. Given the lack of previous research and of quantitative data on the research topic at hand, as well as the importance of individuals' (both Brazilian producers and

EU policymakers) perceptions, whether supported by quantitative data or not, in shaping the predicted outcomes of the study, individual interpretation was a key factor in the present analysis.

At the same time, it is important to note the limitations to the methodology used in this study. While multiple sources of evidence, from documentation to quantitative data, to stakeholder interviews, were employed, triangulation among various data sources to ensure validity and corroborate data and evidence (Breitmayer, Ayres, and Knafl 1993; Campbell 1956; Tellis 1997) was not (due to time and resource constraints). Moreover, given the snow-ball techniques employed to obtain interview participants, there is a potential inherent bias in the selection process. Finally, the relatively small sample size used in the interview process, again a necessity of time and resource constraints, could limit the applicability of the results presented here. Nevertheless, the present study provides some important preliminary findings in an area that remains, thus far, relatively understudied and provides a stepping stone to larger scale studies.

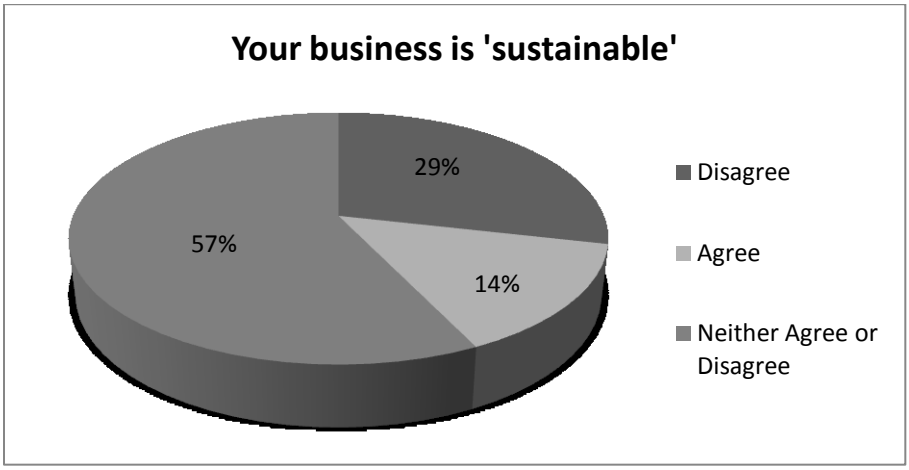
4.2 Principle Findings - Brazil

4.2.1 Brazilian Producers– Scepticism

Among seventeen interviews conducted with Brazilian biofuel producers and farmers, there was a high degree of scepticism expressed at the mention of the concept of “sustainability”. The consensus appeared to be that the concept was likely another overly complex scheme, offered by a government that, in the producers’ opinions, has little understanding of the production process, and that

would ultimately be poorly executed and result in few if any benefits to producers. This, producers believed, was consistent with a history of poorly executed government programs that were perceived to have provided little support or help to producers. In addition, there was a widespread perception among producers that the goal of sustainability was both unrealistic and unattainable and therefore should not be pursued, highlighted in the figure below.

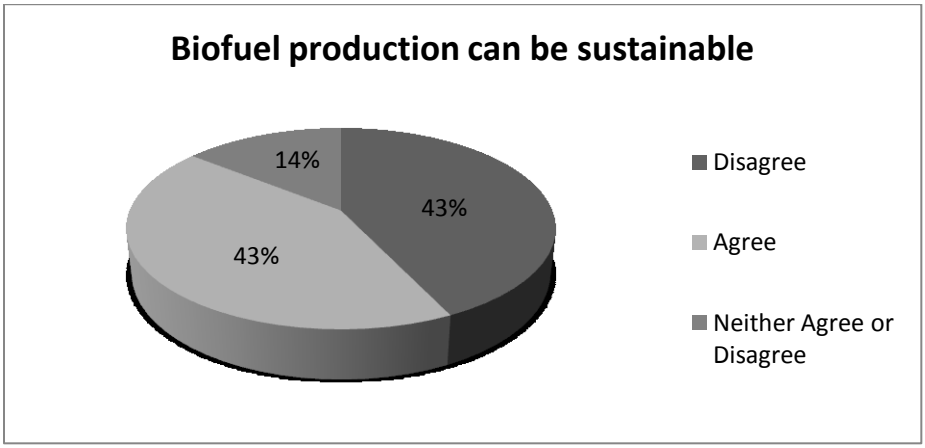
Figure 7: Sustainability in Biofuels Production



At the same time, and likely a contributing factor in their lack of faith in the concept of sustainability, the interviews conducted with a variety of small to medium sized producers revealed a general lack of understanding of the 'Green Movement' or 'Green Initiatives', both in terms of value and purpose. Although explicit environmental sustainability programs have been largely absent in the biofuels sector, likely another contributing factor to producers' lack of importance placed on environmental sustainability, the social sustainability programs implemented in biodiesel production seems to have garnered little understanding or value placed on social sustainability as an important component of the

production process. Given the general lack of support for the notion of environmental sustainability, as well as a high degree of scepticism of the economic feasibility of implementing such standards, it appears it would be quite difficult to convince Brazilian producers to adopt sustainable production methods. Only 23 percent of producers interviewed for this study believed that biofuels could be produced sustainably.

Figure 8: Sustainability in Biofuels Production

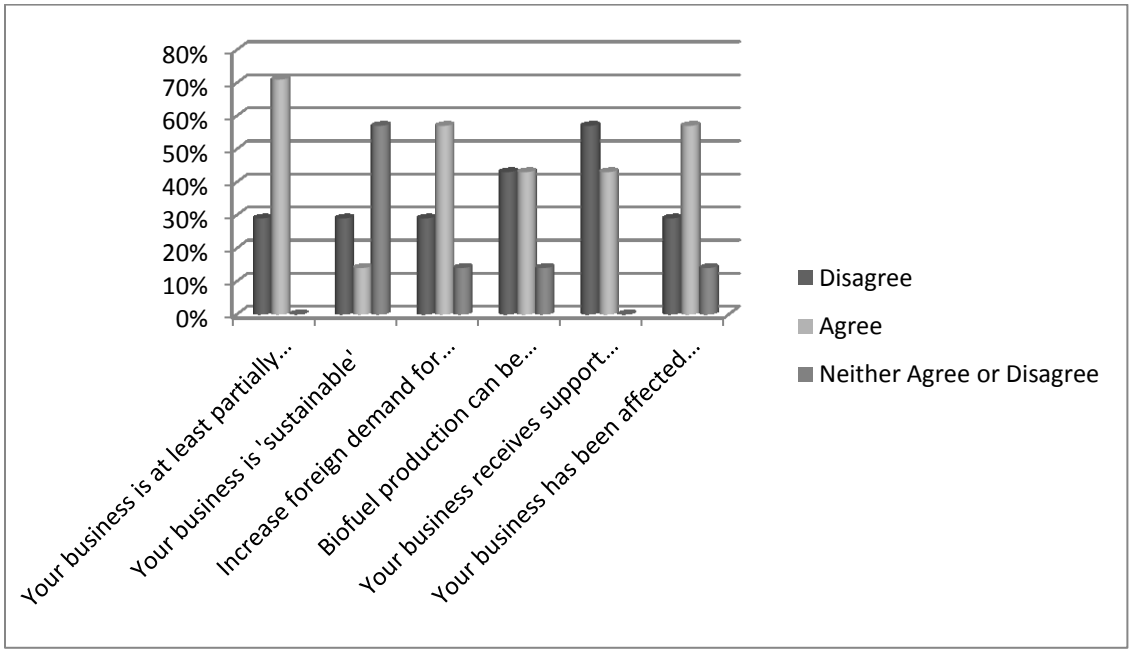


Thus, substantial barriers exist to Brazilian production making the necessary adaptations within the biofuels sector to successfully target EU sustainability niche markets. Indeed, the scepticism of Brazilian producers and farmers may be the largest element unaccounted for in making Brazilian biofuel sustainable, and convincing them otherwise may be an extremely difficult task. Ultimately, substantial government and sectoral outreach and dialogue with producers would be a necessary pre-condition to them favourably perceiving the opportunity to target such markets.

Figure 9: Medium and Large Ethanol Producers

	Disagree	Agree	Neither Agree or Disagree
Your business is at least partially export focused	2	5	0
Your business is 'sustainable'	2	1	4
Increase foreign demand for biofuels would benefit you	2	4	1
Biofuel production can be sustainable	3	3	1
Your business receives support from the Brazilian government	4	3	0
Your business has been affected by tariffs/trade regulations	2	4	1

Figure 10: Medium and Large Ethanol Producers (Graph)



4.2.2 Brazilian producers – Disparate Knowledge

The most surprising result of the study conducted in Brazil was the level of knowledge producers had with regard to international markets. Indeed, many producers interviewed had very little understanding of the impact of international markets on their businesses, the general functioning of international markets, and the sectoral linkages within the industry itself and to international markets. Certainly, there were exceptions, with selected interviewees being remarkably well-informed on these issues; yet, they were the exception rather than the rule. Rather, most maintained that international markets had no bearing on their business, and therefore most took no consideration of international markets or commodity trends in their business-related decisions. Most had very little understanding of where their products went after selling to them to a middle-man. This was true despite the fact that a majority of producers acknowledged that their production was at least partially export focused, that their business was affected by foreign trade and tariffs, and that their business would benefit from increased foreign demand for biofuels.

Figure 11: Production for Export

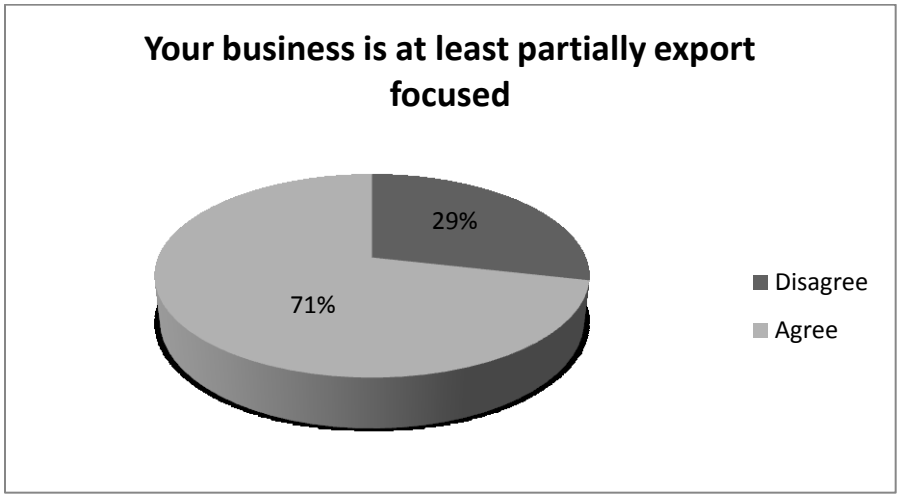


Figure 12: Impact of Foreign Trade and Tariffs on Biofuels

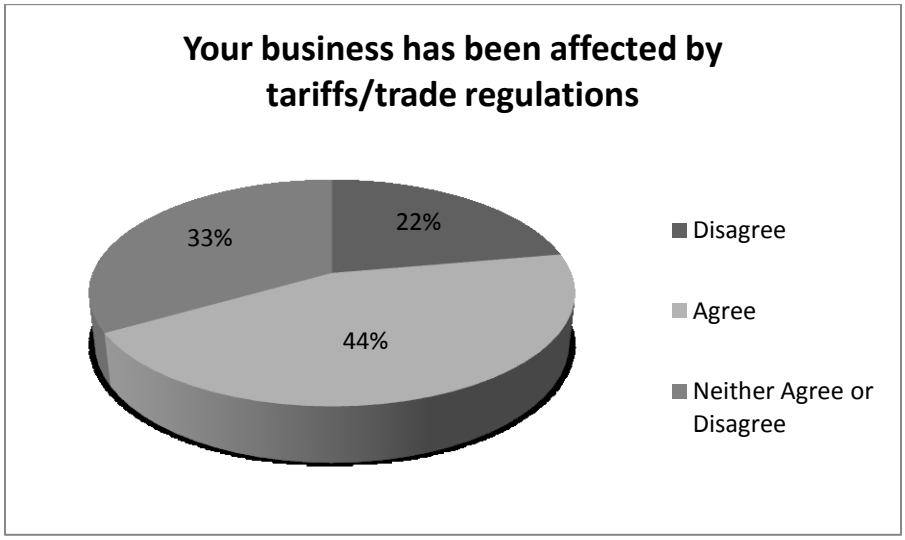
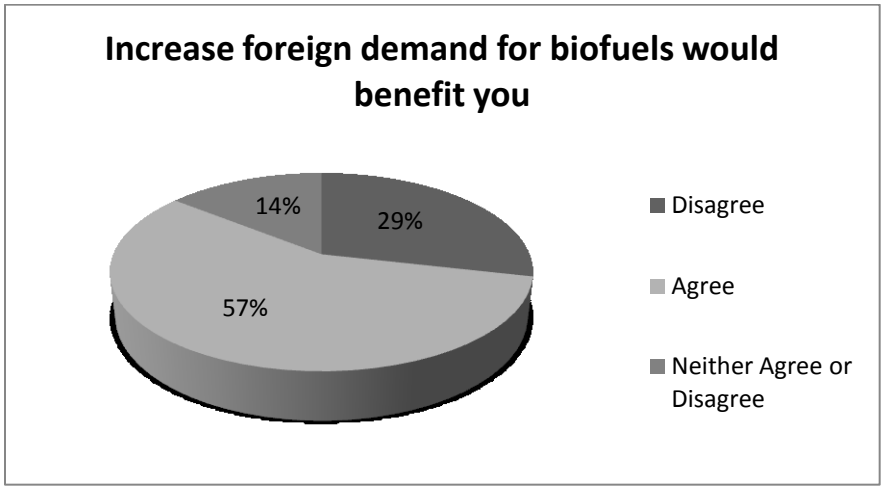


Figure 13: Foreign Demand for Biofuels



Some even maintained that international commodity prices had no impact on their product prices; rather, the domestic market was the only relevant factor in determining their product prices and ability to sell. On the other hand, one interviewee, clearly the exception to this trend, had the Chicago Board of Trade reports delivered to him daily and based much of his decision-making with respect to his business on fluctuations in international markets. These disparate levels of knowledge of their industry will reflect on producers' willingness and ability to adapt to production methods aimed at meeting international standards in sustainability markets. Lack of understanding of international markets was particularly evident among small producers of which only twenty percent interviewed in this study agreed that international trade and markets had some impact on their business.

Given these varying levels of knowledge of government programs, resources, policies, and international markets, implementing an overarching strategy to target EU sustainability niche markets will be difficult. The Brazilian

government will need to overcome such barriers to create an industry-wide strategy that aims to target EU biofuels markets. Again, government and sectoral outreach and dialogue would seem to be necessary to bridge the gaps in knowledge and understanding of international markets that would be a pre-requisite for targeting EU sustainability markets.

4.2.3 Brazilian Producers – Barriers to entry, Cash Flow

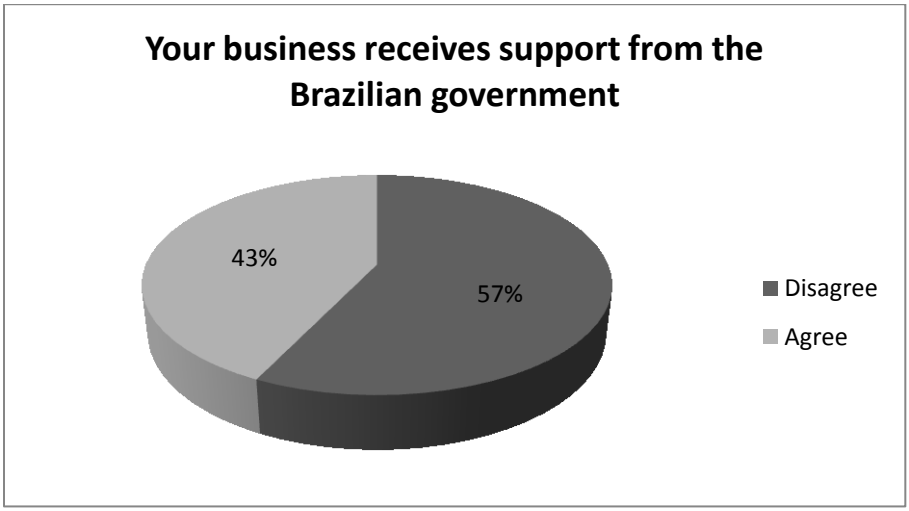
Another major concern for most producers, especially small to mid-size farmers, was the required capital inputs to convert production methods to sustainable ones that would meet EU sustainability requirements. The producer interviewees expressed the need for government support if the shift to sustainable production methods was to be made, but then immediately expressed a high degree of scepticism as to whether the government retained the capacity and the willingness to provide adequate technical and capital support to make the shift viable. Moreover, the long history, particularly among small and medium sized producers, of producing primarily, if not exclusively, for the domestic market, led to a perception of high risk associated with targeting any foreign market. This, in combination with the high degree of capital and time investments required to make the switch to sustainable production methods, contributed to a perception that targeting sustainability niche markets in the EU would be simply too risky. Thus, the required adaptation to meet the sustainability requirements to access EU niche markets appears to meet considerable resistance among producers. In order to allay producers' concerns over high degrees of risk associated with targeting sustainable foreign markets,

and ensure the strategy's success, the government would likely need to provide clear and decisive support for producers, with a long-term commitment to provide the necessary capital inputs to make the switch to sustainable production methods.

4.2.4 Brazilian Producers - Government Communication

The most consistent theme seen in interviewing Brazilian producers was scepticism of the government and the rejection of the idea that the government is capable of providing meaningful support to the biofuel or agriculture industries, reflected in the figure below.

Figure 14: Government Support to Biofuels



Indeed, regardless of whether they agreed that they received support from the Brazilian government, all producers expressed distrust for the government, at all levels, and a lack of faith in the government's ability to effectively execute its promises and programs. Furthermore, all producers expressed particular distrust and scepticism of the Partido dos Trabalhadores (PT) administrations and

programs. Though it must be noted that this was the perception of producers, and may or may not have reflected the government's role in the industry, this indicates a lack of trust and communication between the government and producers. Once again, this high level of distrust and lack of communication presents a significant barrier to successful adaptation to targeting EU sustainability markets. There is thus an apparent need for the government to establish better linkages and outlets for communication with producers if a successful sustainable production strategy is to be implemented in the biofuels sector.

This lack of communication with the government centred around two key points. Firstly, the interviews showed a lack of trust for the government which most attributed to the government providing little in terms of services in return for taxes paid. Secondly, the majority of interviewees saw no reason to approach the government and no government body had every reached out to them, suggesting a lack of awareness of available government services and a government failure to raise awareness about programs and initiatives. On the most basic level there is clearly a disconnect between the initiatives proposed in government and the reach of those policies on the ground. The Brazilian government may need to take significant outreach steps to raise awareness and build links between government and private bodies if it is to establish better communication with producers.

Figure 15: Small and Medium Producers

	Disagree	Agree	Neither Agree or Disagree
Your business is at least partially export focused	8	2	0
Your business is 'sustainable'	3	2	5
Increase foreign demand for biofuels would benefit you	6	2	2
Biofuel production can be sustainable	7	1	2
Your business receives support from the Brazilian government	9	1	0
Your business has been affected by tariffs/trade regulations	2	2	6

4.3 Principal Findings - EU

Targeting sustainability markets in the EU offers the opportunity for Brazil to tap into a potentially lucrative value-added niche market and research conducted within the EU suggests that these markets will be inherently high risk, for a number of reasons elaborated below.

4.3.1 Politics

First, the political environment in the European Union makes sustainability niche markets inherently high risk. Given that sustainability regulations and policies are relatively new, and that they are largely absent outside the EU, Brazil would be producing a product to a standard only relevant within one market, the EU. The viability of catering to such a market, given that Brazil is 'putting all of its eggs in one basket', is then inherently risky in that it is subject to the maintenance of a particular policy climate. There is always the possibility that the EU renewable energy initiatives which are intrinsically tied to sustainability will

inspire other developed countries to enact similar legislation, but these potential spillovers cannot be relied upon as markets to support a fleding sustainable biofuels industry. If the political environment in the target market (that is, the EU), were to change, for example, leading to greater restrictions in access to EU markets, to changes in support of industry competitors such as domestic producers, or to changes in the definitions of sustainability requirements, composition of the target market could change unexpectedly. Given that the EU has yet to clearly define the requirements and systems implicated in its sustainability policies, there are many unknowns for producers outside the EU, leading to decreased incentives to target such a market.

4.3.2 Tariffs

Equally vague are the current tariffs on imports under sustainability regulations in the EU. As of yet, there is no formal agreement on tariff rates to be applied to biofuels imported to the EU under its sustainability policies. Thus, not only are the tariff rates unknown, but are also subject to change at any time, inherently increasing the risk of producing for EU sustainability markets. Furthermore, given the EU's reputation of disregard for formal agreements that do establish tariff rates, especially in the agricultural sector, there would be no guarantees that any formal agreement on tariffs would be implemented and adhered to, further increasing Brazilian producers' risk.

4.3.3 Favouritism of Domestic Producers

The clearest theme that emerged from interviews with EU officials was that domestic producers within the EU would be favoured whenever possible. Though such support, primarily through subsidies, was not claimed to favour domestic producers within the EU so much as to ensure their competitiveness, it became clear over the course of the interviews that, whatever the rationale, the end result would effectively provide domestic producers with favoured market conditions in EU sustainability markets. Although this is largely unsurprising and entirely consistent with the EU history of support to domestic agriculture and energy, it is disappointing for foreign producers aiming to target EU sustainability markets. Given that it appears that the EU will maintain limited access for foreign/Brazilian producers to such key sectors as agriculture and energy in the future, and is not willing to make concessions to developing country producers, the EU market will remain an unstable and unreliable target market for Brazilian biofuels, and thus will be inherently high risk.

4.4 Concluding Remarks

Figure 16: Assessment

This study was intended to generate a clear picture of the viability of Brazil tapping into an emerging European sustainable biofuels market. The theoretical foundations offered by Nelson and Winter (1982), Schumpeter (1962) and Vernon (1966) lend credence to the links between technological change and innovation and economic growth. In terms of this case study, sustainability regulations in the EU present a potential catalyst for this change among relevant industries in producer countries. Thus, sustainability regulations could be understood as presenting opportunities for developing and emerging economies

to increase levels of technological innovation in their efforts to tap into potentially lucrative EU sustainability niche markets. The required technological innovations to access such markets could provide opportunities for developing and emerging economies to innovate where they have a smaller disadvantage than in pre-existing niche markets. Alternatively, the required innovations could prove to be too difficult or extensive, given available capital and technological inputs, and thus lead to industry contraction or collapse as other producers in other countries are able to fill the gap.

The market analysis of EU sustainability markets presented in Chapter 2 shows that EU renewable energy policies have gone farther than in nearly any other country in establishing concrete targets and goals and there appears to be considerable political commitment to the concept of sustainability more broadly. Moreover, the analysis also suggests that to meet the targets set out in EU sustainability policies the EU will need to import at least some of its ethanol to meet its sustainability pledges and its renewable energy targets. All this would suggest an opportunity for developing and emerging economies to gain access to lucrative EU markets by catering to sustainability niche markets.

Given these potential sustainability niche markets in the EU, the sectoral analysis developed in Chapter 3 suggests that Brazil, and more specifically its biofuels industry, is well positioned to cater to such niche markets. Indeed, Brazil's extensive history in producing and innovating in both the agricultural and biofuels sectors, its position as a global leader in the former, and its considerable experience in integrating issues of sustainability, whether economic,

environmental or social, into policy all appear to provide the necessary conditions to allow the biofuels industry to adapt and innovate to cater to EU sustainability niche markets. Indeed, among developing and emerging economies, Brazil arguably provides one of the most receptive environments for the necessary innovation and adaptation in producing for such markets.

Based on the theoretical framework and market and sectoral reviews outlined in Chapters 1 through 3, there appear to be strong opportunities for Brazil with the emergence of a high value-added EU market for biofuels. Even so, in practice, there appear to be significant obstacles to capitalizing on such opportunities. Namely, issues of Knightian uncertainty (Knight 1921) appear to feature prominently among the obstacles Brazil faces in producing for EU niche markets. High levels of stakeholder ambiguity, as a result of numerous secondary stakeholder who are not directly involved in the production or transaction process, pose considerable obstacles to Brazil's ability to assess likely risks and outcomes associated with targeting EU niche markets. Furthermore, ambiguous definitions of sustainability and of EU sustainability regulations leave both the requirements to meet EU sustainability standards and the process for accessing EU sustainability markets unclear. Given EU historical precedent in protectionist measures in the agriculture and energy sectors, such ambiguity seems to pose high risks to Brazilian producers, as they may be unable to accurately predict market activity and trends. Thus, these high levels of uncertainty associated with stakeholder ambiguity may well prevent Brazilian biofuel firms and producers from targeting EU sustainability niche markets.

Despite a strong domestic market, high production capacity, and world class biofuel technology well suited to innovating and adapting to new markets, Brazil should have serious stakeholder concerns which may make the European biofuels market unappealing.

If Brazil were to seriously target the European biofuels market and harness its R&D capacity to develop a strong sustainable biofuels production base, it would be putting itself almost entirely at the whim of the EU market. The financial crisis of 2008 severely curtailed interest in sustainable markets, focusing international attention on fiscal security and cutting government programs. The EU is one of the few remaining markets with clear sustainable targets, many other countries have made pledges and signed agreements but currently the EU is the only market of any size where it appears likely a strong sustainability push will continue. As a result, developing a sustainable biofuels industry would be solely dependent on the EU market.

Despite the single market, it might initially still seem attractive to target the EU market as the EU is the world's largest trading bloc and Brazil's biggest ethanol trading partner there remains the problem of stakeholder ambiguity. Not only would targeting the EU market leave very little potential for expansion, but it would involve dealing with the highly protectionist and sheltered EU economy. As described in the previous chapter, it became clear through both research into EU policy statement and interviews with EU officials that, there would be no guarantees for the Brazilian market and that domestic producers would be heavily favoured whenever possible. Official documents and interviews both see

European officials inviting countries to produce sustainable resources for Brazil, while at the same time pledging to keep domestic producers competitive.

In addition to problems with EU policy and protectionism, there also appear to be additional obstacles domestically that Brazil would need to address in order to successfully target EU niche markets. A lack of technical knowledge of sustainable production, high capital barriers to entry, considerable distrust of the government among producers, and a generally low level of understanding of foreign markets all pose problems to targeting EU niche markets, at least in the short-term. If Brazil wishes to pursue such a policy, an overarching strategy that encompasses both negotiating clearer terms of trade at the EU level as well as establishing better communication and coordination between the government and producers will likely be necessary. As it stands, there appear to be significant obstacles to a strategy targeting EU niche markets that currently outweigh the potential benefits of accessing such markets.

Brazil's foray into establishing energy self-sufficiency in oil and gas presented difficult and high risk challenges similar to those presented by EU sustainability niche markets, the addition of potentially volatile EU markets into the equation creates a situation where the determinants of success are simply too far out of Brazilian control to make pursuing this strategy an advisable course at the time of writing, although this is certainly subject to market conditions around oil and ethanol as well as the manifestation of EU sustainability policies. Moreover, though the issues of social sustainability that currently feature prominently in Brazil's national biofuel strategy could arguably serve to legitimize

pursuing EU sustainability niche markets, the consistent history of protectionism in EU trade policy suggest that it has consistently placed domestic priorities, particularly with respect to agriculture and energy above any concerns, social or otherwise, in countries with which it trades.

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