

Sustainable Systems of Innovation?

A study of globalization, FDI and sustainable performance
in the Costa Rican electronics sector led by Intel

David Christensen, Group 10
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Project Members:

David Andreas Mana-Ay Christensen

Supervisor: Ole Busck

Examiner: Ulrik Jørgensen

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1. Introduction

Approaching a problem focus sometimes calls for first establishing an overall context in which to understand it, which is provided by this introductory chapter. Here, this study's main overarching themes of globalization and sustainable development are presented, and includes a discussion of the various challenges faced in pursuing both today. Because of the nature of this question, the discussion is inevitably non-exhaustive and therefore done with a specific focus on the role of transnationals driving development in the third world. This provides the link with the main problem focus addressed in this study, which centers on Costa Rica.

Globalization – Beyond the End of History

Francis Fukuyama (1989) famously heralded the 'end of history' in his celebrated essay written at the time of the fall of the Berlin Wall and the subsequent collapse of the Soviet Union. By this, Fukuyama meant that with the cessation of the ideological struggle which marked the Cold War era, its victors would achieve complete hegemony. This implied that the ideology of the West would continue to dominate, and that the world would see the propagation of Western-style democracy and the opening up of economies to market reforms and trade in line with this ideology (Hellinger 1999, 49). While the proposition of the spread of democracy might be contested to have occurred in retrospect, it has been apparent that the tying together of international trade linkages has indeed happened on a hitherto unseen scale. This phenomenon in the international political economy goes by the name of globalization, its existence so much beyond refute that for many, it has attained status as a truism without need for empirical substantiation (Gwynne and Kay 2004, 5).

Globalization is an all-pervasive phenomenon and an underlying factor that is having far-reaching repercussions the world over, including and significantly, the development of third world countries. Developing countries are the problem focus of this study, which recognizes that globalization and the liberalization of trade is having a major impact on their development trajectories. This is seen in principle to at first encompass both favorable and undesirable effects.



Figure 1 – Anti-globalization protests: The 27th G8 Summit in Genoa, Italy (Left) and the WTO Ministerial Conference of 1999 in Seattle, United States (Gordon 2004; Bardhan 2003)

Indicative of the negative aspects of globalization, opposition is at times clearly made visible during organized protest actions during meeting by key international organizations such as the WTO, see Figure 1. However, there are also those who take on a much more favorable view, and in between lies a position that does not view globalization as the inherent cause of either positive or

undesirable effects, but that a variety of outcomes are possible depending on how globalization is handled as a transformative force (Gwynne and Kay 2004, 6-7). Briefly, these discourses as presented by Held et al. (1999) are labeled the hyperglobalist, skeptical and transformationalist theses. This study rests on belief of the last discourse, the transformationalist discourse that recognizes the problems of global divergence, i.e. increasing inequalities between and within countries, but that the issue of globalization remains dynamic and open-ended, with the possibility of a change for the better if given the right conditions.

In order to grasp the implications of globalization fully for developing countries, the question ought to be considered as more than a matter of economics, and thus more than a matter of international production systems, division of labor and liberalization of markets. The pervasiveness of globalization means that the phenomenon is making deep inroads into for instance the political and cultural spheres, which one would do well to take into consideration. In the developing world, these aspects of globalization are at times seen in exceptionally negative light. This is illustrated by James H. Mittelman (2000, 6) who offers a conceptualization of globalization closely aligned with the skeptical thesis:

Globalization means a historical transformation: in the economy, in livelihoods and modes of existence; in politics, a loss in the degree of control exercised locally... and in culture, a devaluation of a collectivity's achievements or perceptions of them. This structure, in turn, may engender either accommodation or resistance.

Mittelman's conceptualization is useful for pointing to the schisms involved in the globalization process. In basic terms, globalization as understood by Mittelman involves increased economic, social and political interaction between countries and the reduction of barriers between them. It is also understood as the shrinking of time-space relations and their social implications for daily lives, a perspective drawn from contemporary postmodernist theory¹ (Mittelman 2000, 4-6). What Mittelman then adds to this is a view on globalization that places great emphasis on power relations and how this leads to conflicts across the globe that play out on all levels, both overtly and covertly. Globalization is seen as a transformative process involving politics and culture, with impacts upon livelihoods and entire ways of living. This transformative process fosters both support and resistance, the conflicting parties divided between its contents and discontents (Mittelman 2000, 223). Examples by Mittelman range from the macro to the micro; In Mozambique, structural adjustment programs advocated by the IMF Fund and the World Bank have led to a relinquishing of autonomous policy-making, lowered health and education spending and increased marginalization of vulnerable groups; In the Philippines, a woman working in one of the country's export processing zone will likely be living on less than the legal minimum wage, in poor living and working conditions and with the overhanging menace of sexual harassment by work supervisors (Mittelman 2000, 102-104; Mittelman and Tambe 2000, 86-87).

Mittelman's studies focus on cases of resistance, and are by self-admission intended to give voice to the discontents: the trade unions, the marginalized and the poor in different corners of the globe. These discontents are often found in the developing world, where conditions of poverty only exacerbate the problem, or where blame is sometimes placed on globalization as creating or maintaining these conditions in the first place. Consequently, Mittelman's conceptualization serves to underline why globalization is a particularly important in a third world developmental context, and will be used as one important point of departure. To be sure, however, this study largely remains focused within the domain of economic globalization, though it recognizes the other aspects presented thus far. Still, economic globalization covers a very wide range of phenomena, including

¹ Mittelman acknowledges building his understanding of globalization on the ideas of leading postmodernists Anthony Giddens, David Harvey and Roland Robertson.

trade, foreign direct investment, short term capital flows, workforce migration flows and flows of technology (Bhagwati 2004, 3).

Trade regimes and capital market liberalization are problems unto themselves, relating mostly to the bigger scale. Jeffrey Sachs (2005) and Joseph Stiglitz (2003; 2006) are among those influential economists today who have presented scathing critiques of the international systems and institutions that govern these issues. Their examples are legion; Matters such as distorting agricultural subsidies and intellectual property rights, unresolved since the launch of the latest Doha Trade Round in 2001; The role of the IMF in worsening the 1997-1998 East Asian financial crisis; erroneous 'shock therapy' privatization policies that only served to bring Russia further to its knees during its transition from communism. While important aspects of economic globalization, these issues are too overarching to be the main focus of this study, which is not about macroeconomics, but rather where individual countries are perceived to have a potential for harnessing, or transforming, globalization forces. This is where foreign direct investment, or FDI, comes into the picture.

If any singular entity could be said to have been most empowered with the onset of globalization, it is the transnationals (Fortanier and Maher 2001; Herkenrath and Bornschier 2003). These market actors go by many names (i.e. multinational enterprises and transnational corporations, or variations thereof) and have been among those who have, literally, profited most by the opening up of market economies worldwide. As the global framework governing the activities of transnationals has become more conducive to them, their scale has naturally increased as a result. This can be quantified in stark terms.

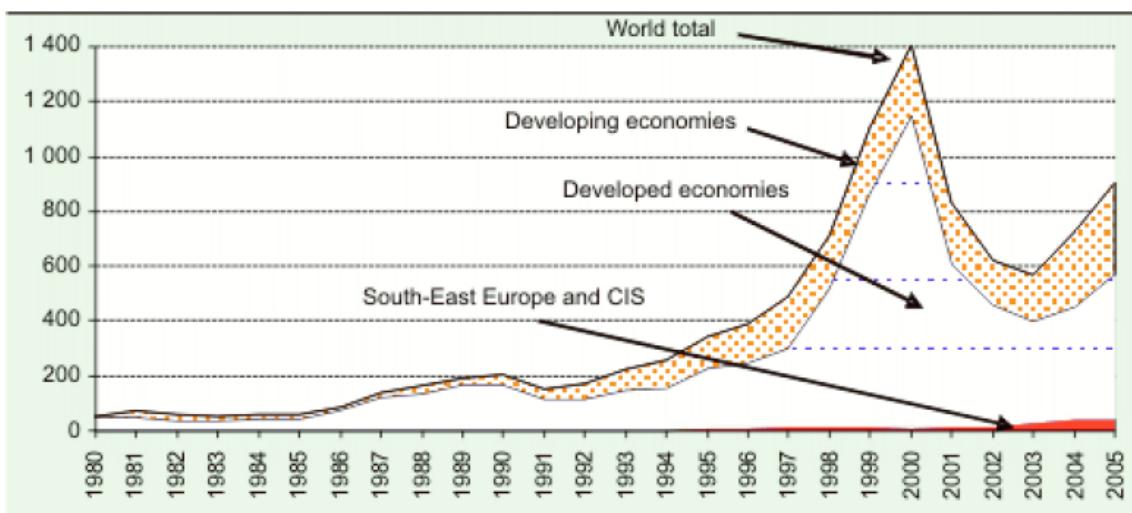


Figure 2 – FDI Inflows (billions of dollars) 1980-2005, global and by group of economies (UNCTAD 2006a).

Figure 2 illustrates the extent to which global FDI for both developed and developing countries has increased as globalization has matured, keeping historically to moderate growth rates until picking up speed following Fukuyama's 'End of History' and resulting in a massive increase in economic activity. To date, FDI inflows are below the historical peak of the early 2000's, when a list of factors such as the East Asian crisis, the IT 'Dot Com Bubble', various accounting scandals and 9/11 appear to have had a significant impact on the world economy. The global economic slowdown that followed however, and FDI is still significant. The point of the matter is this: because of increasing FDI flows globally and for the developing world, individual market actors, especially transnational companies, are growing increasingly more important as drivers for

development (UNCTAD 2006b, 111). For developing countries, this poses serious implications for the field of public policy-making dealing with the management of their activities.

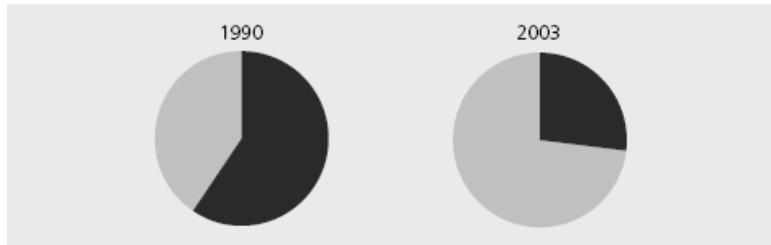


Figure 3 - Overseas development assistance (black) measured against foreign direct investment in 1990 and 2003, based on World Bank data (Danielsen 2005).

The same point can be illustrated even more clearly by viewing FDI in relative terms compared with perhaps a more traditional economic measure of inflows directed toward third world development – overseas development assistance, or foreign aid. This is shown in Figure 3, where it is evident that the sheer volume of FDI has eclipsed foreign aid in a period of little more than a decade. To be fair, this simple illustration does not cover other cash flows that have a bearing for development such as trading in capital markets or migrants' remittances from abroad, which are so vital to countries such as Ghana and Somalia that they too have surpassed foreign aid levels (Strudsholm 2006, 70;156-157). Also, the figures for FDI cover a number of things. FDI can take the form of 'greenfield' investments (the set-up new facilities abroad) or mergers and acquisitions, by either the transnationals themselves or private equity and hedge funds (UNCTAD 2006a). Developmental impacts of FDI also vary according to sector. Clearly, FDI and the harnessing of it is a complex issue. It is just as clear that blindly subscribing to the idea of FDI and economic prosperity automatically bringing with it desired development on all fronts would be an obvious mistake. This may not always be, and isn't always the case. This is true especially in light of a parallel discourse to globalization's effects that has gained prominence as globalization's negative social and environmental impacts are increasingly felt – that of sustainable development.

Sustainable Development – Beyond Economics

More than a catchphrase, the concept of sustainable development has become a dominant set of ideas in many circles, from academics to policy-makers, the first thoughts dating to when problems related to unchecked economic development first were made clear with *Limits to Growth* in 1972. This study was based on a simulated model of future prospects for human survival, and addressed the challenge of dwindling and finite natural resources coupled with continued exponential population growth (Meadows et al. 1972). *Limits to Growth* could be argued to have been the first high-profile instance where the assumptions in classical economics, the ideas of which fuel exclusively market-driven growth, were fundamentally challenged. It also touched upon environmental and social aspects of development that were later to be made explicit in the definition of sustainable development. The term itself was coined later, with the publication of the influential *Our Common Future* in 1987 by the Brundtland Commission convened by the United Nations in response to increasingly visible worldwide environmental problems that had formally entered its policy agenda in 1972 (Murray and Silva 2004, 117). This same year that *Limits to Growth* was published, the UN held its first conference on the environment in Stockholm. The Stockholm summit was joined by several follow-up summits, among them the important 1992 summit in Rio de Janeiro. By this time, the conference theme was no longer restricted to the environment as such; it became common understanding that environment and development on all fronts were inexorably linked issues, a main tenet of sustainability.

This is important, for it is here that the field of third world economic development, as outlined in the previous discussion on globalization, converges with environmental studies and it highlights the research problem in this study. Sustainable development places equal emphasis on ecological/environmental, economic and social sustainability (Murray and Silva 2004, 117). In a third world developmental context today, the premise of this study is that globalization, driving forward increased FDI inflows, has been the main factor in a skewed developmental path that has overridden environmental and social concerns in favor of economic winnings that are oftentimes in the short term. This is not a schism that has only shown itself recently, but has been visible since sustainable development was first debated in the 1992 Earth Summit. Developing nations here maintained a right to development (read: economic development) to assist in quelling poverty, their main concern, understandably indignant that developed countries sought to restrain their development while enjoying considerably better standards of living. Unfortunately, such faith in market-driven development is fraught with several problems when it comes to sustainability. The specific problems will be shown in the next section, and relate to a fundamental paradox between the twin discourses - between globalization's increasingly felt impacts and sustainability's inherent goals.

Challenges to Sustainable Development

Notwithstanding the notorious ambiguity of the sustainable development concept, the transformationalist thesis believes that the conditions governing the impacts of globalization may be controlled in a direction that could be said to be sustainable. As the focus of this study is the primary market actors behind the increasing levels of FDI, this entails the position that the activities of transnational corporations in developing countries may be managed sustainably. However what does evidence suggest? What are the problems, and is there reason to believe this hypothesis?

The points of criticism expressed by anti-globalization protest movements, mentioned previously, touch upon all manner of the social, ethical and environmental behavior of market actors, asserting that transnationals do not act in accordance with sustainability. In many cases these points of contention are extremely valid. A critical but nuanced view is offered by Wolfgang Sachs (1999), research fellow at Germany's Wuppertal Institute for Climate, Environment and Energy. In writing about globalization and sustainability, Sachs recognizes market actors as being inherently rational agents of efficiency who have made it possible to use economic globalization to satisfy more and more people around the world, reducing the use of resources as they have expanded more and more into previously closed markets. Many of these markets, from Nigeria to Mexico to Indonesia, had earlier been run bureaucratically and inefficiently, with globalization serving to 'raze down strongholds of mismanagement' on the basis of economic rationality. Key to this has been the use of more resource-efficient technologies which transnational corporations excel at standardizing between countries. On the demand side as well, globalization has promise, namely because produced commodities are subject to consumer preferences in the post-industrial countries, which include for instance greater environmental awareness.

However, Sachs points to an Achilles heel for several reasons, focusing primarily on environmental issues. Firstly, the sheer increase of economic activity worldwide is offsetting the efficiency gains. Then there is the criticism of specific FDI sectors that have enjoyed significant growth and are intrinsically harmful, such as extraction industries where environmental externalities are not taken into account. The question of culture and lifestyles becomes relevant also, because globalization has fostered a welcoming environment for copying post-industrial consumption patterns, leading to increased CO₂ emissions as more people buy cars, and deforestation because of land clearing to meet increasing demands for meat from fast-food chains. On the social side of sustainable development, Mittelman (2000, 25-26) claims globalization encourages developing countries to take on a client relationship toward the wealthy, forsaking local social and cultural safeguards in

favor of global market forces. States become submissive in their policies and trade off social welfare for cash flows. Illustrating this by using perhaps the most polite word possible, Mittelman uses the term 'courtesan role' to describe the behavior of these states. This criticism is well known, much media attention given in the past to individual transnationals such as Nike who have been alleged to set up sweatshop working conditions in developing countries at the tacit consent of their governments.

Taken together, the proponents of globalization and FDI, on the other hand, hold the view that transnationals carry numerous benefits with their presence in developing countries, first and foremost resulting from their obvious impacts on macroeconomic performance, with spillover effects to social equity and environmental performance (Fortanier and Maher 2001). Transnationals are argued to facilitate technological development, affecting environmental performance positively, specifically with the adoption of cleaner technologies or formalized norms and standards such as those manifested in voluntary measures like ISO 14001 environmental management system certificates, see for instance Sonnenfeld and Mol (2002). Transnationals contribute to job creation, and contrary to what critics believe, are said to offer high quality jobs that address poverty and social equity issues faced by many developing countries. Jeffrey Sachs (2006) and the pro-market economist Jagdish Bhagwati (2004) in particular run claims counter to the critics, saying that while wages offered might be low, it is often overlooked that transnationals offer wage levels that in relative terms are higher than the norm, and empower marginalized groups such as women in Bangladesh who would otherwise be confined to domestic household roles. The question of social and environmental problems is not one rooted in trade liberalization, according to this view, but on market and intervention failures.

One important point of criticism directed at transnationals that deserves special mention is the assertion that competition among developing countries to attract FDI is leading to a 'race to the bottom' with the lowering of legislative standards to accommodate big businesses. This is termed the 'pollution havens' hypothesis, and consists of two elements (Mabey, McNally and Zarsky 2003, 5). First, being the rational agents they are, firms will relocate their operations to developing countries to take advantage of less stringent environmental regulations. Secondly, because of non-enforced legislation, environmental performance will be lower than in developed countries. There has been little evidence of this hypothesis so obviously taking place, however, Wolfgang Sachs among those who would prefer to accurately call what is happening as being 'stuck in the mud' (Sachs 1999, 140). This means that, instead of a downward spiral of environmental standards, developing countries are reluctant to take unilateral action to improve their standards, leaving it up to the market to promote incremental advances (Mabey, McNally and Zarsky 2003, 38). This is seen as a sub-optimal. Yet another metaphor is used to describe this phenomenon: the 'chilling effect', or 'regulatory chill'.

'Stuck in the mud' was coined by Lyuba Zarsky at Tufts University's Global Development and Environment Institute, who has been a participant in two separate studies into the relationship of FDI and sustainable development, both commissioned by the World Wildlife Fund - one of the few important sources of systematic, critical research into this subject (Zarsky and Gallagher 2003; Mabey, McNally and Zarsky 2003). At the aggregate level, the studies agree that market size rather than less-than-stringent environmental legislation, or even labor cost, is the main pull factor for transnationals relocating operations. Sustainable performance is highly ambiguous and depends on a number of factors. The impacts of FDI may be positive or negative depending on host country policies, and also depend highly on the industry sector as some industries are more technologically dynamic than others: there is no determinate trend linking FDI to environmental performance, positive or negative. That said, the studies assert that FDI can drive economic development at a scale and pace that overwhelms the regulatory capacity of the host country. Further, pollution intensive industries especially are likely to relocate to areas with lower regulatory standards, lending the 'pollution havens' hypothesis some credence at least in these sectors.

Finally, despite some difficulty in measuring it, the ‘chilling effect’ does exist and can be observed to an extent. Altogether, the WWF studies do align themselves with the transformationalist thesis on globalization, as it was presented earlier. Nearing sustainable development is possible through FDI given the right conditions, but the studies urge for more research into ‘best practice’ by local governments in negotiating and cooperating with transnationals, as well as identifying barriers for technology dissemination. The focus of the debate is now on determining what constitutes the right ‘enabling environment’ for sustainable development such as legal, regulatory and political institutions, and social infrastructure such as education of the overall workforce.

Recall that Wolfgang Sachs had a more fundamental critique of the environmental implications of increased economic activity driven by transnationals. He did not contest that, as rational actors, they would be eco-efficient, using fewer resources per production unit and improving environmental performance as they established their operations in the developing world. Instead, the critique dealt with global consumption patterns and lifestyles that were inherently unsustainable. This falls outside the scope of this study, for this question requires a global and radical focus which this study does not offer – it is, however, important to keep in mind.

With regards to the social side of sustainability, much of the criticism relates to the quality of jobs offered by transnationals and their effects on income distribution (Fortanier and Maher 2001, 120). The debate also mirrors that of the ‘pollution havens’ hypothesis, with host countries in the developing world tempted to be less vigilant in enforcing legislation in the social sphere. An interesting insight on the link between the presence of transnationals and income distribution is given by Herkenrath and Bornschier (2003) in a statistical macro-analysis presented in the *Journal of World-Systems Research*. World-systems research has its roots in the *dependencia* school of development theory, which argues that poor countries become trapped in a dependent role in the international political economy. Thus the study is fundamentally critical of transnationals. Their conclusions indicate that while there has been statistically significant evidence showing harmful effects on social equity related to the presence of transnationals in studies since the late 1960s, this strong statistical effect simply withers away in comprehensive statistical analysis today. Herkenrath and Bornschier point to two possibilities. First, developing countries have begun to implement what they call ‘smart’ regulations on foreign firms. Secondly, whereas in the past, transnationals were heavily represented by extractive industries, ‘new’ types of activities need to be accounted for today. This seems to fall in line with what has generally been seen in economic globalization, as secondary and tertiary sector industries increasingly drive FDI² (UNCTAD 2006, 269). The conclusions also seem to support the transformationalist thesis in hinting that it is possible to manage FDI to ensure social equity.

To be sure, all is not well when it comes to globalization and social issues. Jeffrey Sachs (2005) is one to recognize that though the era of globalization has brought with it a decrease in the number of people who live in poverty worldwide, the situation in the poorest countries, largely synonymous with Africa, has greatly worsened. Sachs argues that market access has been the key reason for why this has occurred, not because of it, but because of lack of it. FDI statistics illustrate how globalization has bypassed the poorest countries.

² Estimated world outward FDI flows in millions of dollars in 2002-2004 amounted to 51,128 to the primary sector, 165,526 to manufacturing and 476,438 to services (UNCTAD 2006, 269).

Region	Inward stock				Outward stock			
	1980	1990	2000	2005	1980	1990	2000	2005
Developed economies	75.6	79.3	68.5	70.3	87.3	91.7	86.2	86.9
European Union	42.5	42.9	37.6	44.4	37.2	45.2	47.1	51.3
Japan	0.6	0.6	0.9	1.0	3.4	11.2	4.3	3.6
United States	14.8	22.1	21.7	16.0	37.7	24.0	20.3	19.2
Developing economies	24.4	20.7	30.3	27.2	12.7	8.3	13.5	11.9
Africa	6.9	3.3	2.6	2.6	1.3	1.1	0.7	0.5
Latin America and the Caribbean	7.1	6.6	9.3	9.3	8.5	3.4	3.3	3.2
Asia and Oceania	10.5	10.8	18.4	15.4	2.9	3.8	9.5	8.2
West Asia	1.4	2.2	1.1	1.5	0.3	0.4	0.2	0.3
South, East and South-East Asia	8.8	8.5	17.2	13.8	2.5	3.4	9.3	7.8
South-East Europe and CIS	..	0.01	1.2	2.5	..	0.01	0.3	1.2
World	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Figure 4 – Distribution of FDI by region and selected countries, 1980-2005, percent (UNCTAD 2006a).

As seen in Figure 4, developed economies account for the overwhelming majority of FDI inflows and outflows. However, FDI is still the largest component of net resource flows to developing countries, illustrating its developmental importance, and while Africa saw record inflows in 2005, it is telling that the poorest countries receive so little share of it (UNCTAD 2006a).

Sometimes personal experience counts for something. The author of this study has been fortunate enough to have been able to see the globalization at play in developing countries first hand, first from a childhood growing up in the Philippines, Indonesia and Thailand (right at the time the Thai Baht collapsed and set off the East Asian crisis). Recently, the author has undergone an internship with an American transnational solar cell producer in an export processing zone near Manila in late 2006, working in the Environmental, Safety and Health unit. It is the author's opinion that the issue of FDI and sustainability is of extremely vast importance to the developing world, but that it would be apathetic and cynical to cast aside belief that globalization can be harnessed to facilitate sustainable development. It is not blind faith in the market that is behind the belief in the transformationalist thesis, however, but a pragmatic stance that alternative pathways to development are growing harder to envision as globalization takes hold in the international political economy. The problems are real and exist. Seeing first-hand how developing countries go out of their way to attract transnationals, for instance by setting up special economic zones that offer tax-exemption incentives, it is easy to be skeptical to the notion of environmental and social benefits and spillovers. And so it should be. Critical thinking is the foundation of solid research. When Mittelman speaks of exploited workers in the Philippines living in squalid conditions, this author can profess to have seen the problems based on personal interaction with the very same workers, at a level entirely different from an academic researcher working on the topic. Globalization in this and many other cases seemingly does strongly favor its contents over the discontents, yet the transformationalist thesis persists, in the author's view, so long as examples of success can be found. The example in this study is Costa Rica, where the aim is to learn and understand how the successes have been made possible.

2. Research Design

With the main problem area outlined, the next step is to clearly define the study's objective and how it is intended to be carried out, a step taken in this chapter with the presentation of the research design. Here the initial approach is described, moving on to the definition of the study's overall research question and its sub-questions and an account of the data collection and analysis methods.

Initiating the Study and Problem Statement

This thesis takes its point of departure in studies carried out in Costa Rica during the 10th and final semester at the M.Sc. in Environmental Management program at Aalborg University in 2007-2008. This author's field of interest has always been matters pertaining to the themes of sustainable development and the role of markets in the developing world, which significantly shaped the previous introduction. This initial mindset determined the need for on-site studies, and the opportunity was given to carry these out with help from the CINPE³ research center at the National University of Costa Rica in Heredia, the International Centre of Economic Policy for Sustainable Development.

The introductory chapter focuses on the question marks surrounding the role of transnationals, as the main FDI and development drivers, in promoting sustainability. This thesis seeks to examine whether evidence of any positive linkage between the two can actually be found in the specific context of a developing country, in this case Costa Rica. Particularly, this thesis seeks to question the idea of transnationals as vehicles of knowledge and technology diffusion, which is a recurring claim from proponents of FDI about transnationals' most important contributions to helping developing countries along a sustainable development path. The aims in the study are to understand how knowledge and diffusion processes take place, how they are thought to be important for sustainable performance and to uncover what institutional set-ups are conducive to these processes, analyzing the Costa Rican case. This is made succinct with the following overall research question:

Which institutional set-ups in Costa Rica have helped facilitate sustainable performance of transnationals in the globalization process, and how are these applicable to developing countries in general?

The question of institutional set-ups remains an important matter. As presented earlier, Lyuba Zarsky and associates come to the careful conclusion that approaching sustainable development could be possible through FDI but only given the right 'enabling environment' and studying 'best practice' by local governments (Zarsky and Gallagher 2003; Mabey, McNalley and Zarsky 2003). In other words, that states implement appropriate responsive strategies to managing the presence of transnationals, and that the state-market interplay positively reflects this relationship. Herkenrath and Bornschier (2003) also spoke in similar terms, of countries successfully adapting to the presence of transnationals through 'smart' regulations. And what do these concepts constitute? The right 'enabling environment' is defined by Zarsky to include legal, regulatory and political institutions as well as underlying determinants of an economic system such as labor market conditions. This thesis will seek to uncover how these factors have evolved Costa Rica to help shape it into what is arguably a 'best case' in terms of attracting and managing FDI to help facilitate a sustainable development. Though this is elaborated upon further into the study, it is made clear

³ *El Centro Internacional de Política Económica para el Desarrollo Sostenible.*

here that among developing countries, Costa Rica enjoys a unique position and is in several respects a frontrunner. It thus presents an ideal case study in which to conduct an analysis much as imagined by Zarsky et al., and this is reflected in how the research question is posed.

Research Questions – Conceptual Framework

To be sure, the overall research question cannot be answered immediately without a comprehensive understanding of the way knowledge and technology diffusion processes occur within a developing country, as mentioned previously, and how this relates to sustainable performance. To this end, a conceptual framework is sought which might be able to capture the idea of transnationals as vehicles for this sort of knowledge dissemination. However, it should be kept in mind that this carries with it a pitfall assumption that knowledge production indeed is a core determinant for sustainable development, which may or may not prove to be true as other factors can be more important. Therefore, part of the aim in this thesis is to examine whether such a hypothesis has any merit when looking at the specific case of Costa Rica. The sub-questions related to the part of the overall research question on the conceptual framework are as follows:

- *How can knowledge and technological diffusion processes of transnationals in developing countries be understood?*
- *In what manner do these diffusion processes determine sustainable performance?*

In seeking this understanding, this thesis draws on innovation systems theory, which is a branch of economic theory widely utilized at Aalborg University and the CINPE research center that places knowledge creation as the core determinant of market competitiveness and performance, be it economic, social or environmental – in short, sustainable performance. This perception thus links knowledge generation and sustainability, and this is seen to apply to both economies as a whole and within the individual actors in a system of innovation, companies being the chief economic agents. Although an innovation systems approach is chosen as the conceptual framework in this thesis, it should also be noted that the perception of a link between knowledge generation and sustainability contains the previously mentioned assumption on knowledge production that stands to test. To introduce briefly, an innovation systems approach perceives of markets as being comprised of all manner of firms, organizations and government agencies which interact together in many different ways. Performance is, according to this understanding, determined by the manner and degree of interaction between these actors within the system, because individual agents are rarely believed to be able to improve their performance by acting in isolation. In an innovation systems approach, institutions are understood to be integral elements because these govern much of the interaction between its actors in the knowledge diffusion process. Innovation systems can be delineated in a variety of ways, i.e. at the national, sectoral, local or even supranational level. This thesis defines its area of delineation at both the country level in Costa Rica as well as one specific sector, the electronics sector that has received much FDI and which is distinguished by the presence of Intel (the global microprocessor giant) having established itself in the country.

With a basis on the sub-questions, the conceptual framework section of this thesis takes point of departure in systems of innovation literature in order to identify which specific elements of such a system are deemed important for knowledge production and dissemination. Also, the section looks to showing how and why academic users of the approach see that this is connected with overall sustainability – both with regards to actors within the system, and the system as a whole. It is worth reiterating that accepting the premises of the approach at face value may lead to an overemphasis on knowledge production as a determinant of sustainability. This stands out as a possible weakness in an innovation systems approach. For instance, in the context of a developing country, it may be the case that other factors undermine knowledge production and technological innovation

as imagined in an innovation system, such as greater macroeconomic structural conditions, under-resourced government agencies or corruption, see for example Arocena and Sutz (2002) and Muradian and Martinez-Alier (2000). Therefore, the use of systems of innovation as the conceptual framework in this thesis is not one that is uncritical of the approach. Rather, its applicability as a tool in which to evaluate sustainable performance remains an open question. Systems of innovation frameworks have surfaced only relatively recently as a tool used outside of the economic area and into the environmental and social spheres, and also relatively recently on the question of the effects of FDI, see for instance Lundvall et al. (2002) and Franco (2007). Several theorists who have contributed to developing the approach hail from developed countries such as scholars at Aalborg University, who have used the Danish context to stress the importance of innovation in what is termed the new ‘knowledge economy’, see Lundvall (2002). On the other hand, users of the approach from developing countries, such as scholars at the CINPE research center in Costa Rica, have applied the same framework to third world contexts and deal extensively with sustainability issues, see for instance Segura-Bonilla (1999) and Orozco (2004). All this makes it an interesting proposition to introduce a systems of innovation approach into this study on FDI effects in the Costa Rican electronics sector. To put it more precisely, however, the innovation systems conceptual framework contributes to the subsequent, concrete analyses of Costa Rica by establishing an understanding of key concepts:

- Definition of innovations and classification of innovation types
- Definition of institutions and classification of institution types
- The relationship between innovation systems and sustainability
- Delineation of innovation system boundaries and components (actors) in an innovation system
- Innovation systems as seen in the context of globalization, developing countries and the activities of transnational companies

In answering the sub-questions, the prerequisites are laid for conducting an innovation system analysis focused on examining the institutional set-ups that have arguably made the Costa Rican case successful. In particular, one segment of the economy is chosen for analysis because it stands out as having been impacted by FDI markedly, and one which has clearly affected Costa Rica’s development trajectory. The electronics sector, with Intel as an important contributor to GNP in to the country, is the object of study in the innovation system analysis, detailed in the following.

Research Questions – Innovation System Analysis

As mentioned, with an innovation systems framework, system delineation can be approached differently, from the national level to sectoral systems of innovation and to locally defined, geographical systems. For the purpose of investigating the chosen case study of Intel and the knowledge and technology interactions in the domain it belongs to, the sectoral approach applied to Costa Rica is seen most fitting. Drawing from the conceptual framework established previously, the electronics sector is analyzed, guided by the following sub-questions.

- *What are the innovation system characteristics of the electronics sector in Costa Rica?*
- *How do the specifics of the electronics sector innovation system in Costa Rica affect sustainable performance?*
- *What institutional elements have been key for facilitating sustainable performance through knowledge and technology diffusion?*

Preceding the innovation system analysis as such, however, and the answering of the above sub-questions on the electronics sector, this section of the thesis first contextualizes the case of Costa Rica geographically and historically. An introductory overview is given to Costa Rica by placing it in

light of globalization tendencies that have occurred throughout all of Latin America. Using international development literature, this overview examines how macroeconomic tendencies have affected change throughout the region. Specifically, an account is given of the structural changes that have taken place in the shift from inward-oriented Import Substitution Industrialization (ISI) to outward-oriented policies following the so-called 'Washington Consensus', leading to a much increased role of FDI in newer times. Because a systems of innovation approach can carry a weakness in underemphasizing how these structural conditions affect knowledge and technology dissemination, this insight proves useful. Particularly, it is seen that current globalization processes throughout Latin America continue to deeply affect sustainability issues such as the environment and labor markets, as well as the degree of state involvement into the private sector. This is important from an innovation systems perspective because of the negative effects this might have on the institutional arrangements that govern the actions of the market.

In identifying the innovation system characteristics of the Costa Rican electronics sector, this section of the thesis then moves on to first examining globalization and FDI patterns within the country. Market data is used to show the level of FDI inflows over time, with supporting data reflecting how this has been distributed among various sectors, showing in particular the relatively recent surge in new value-added sectors such as electronics and medical devices. Innovation systems literature and development literature are both used to give a characteristic of the country's production structure and the policies and institutional frameworks that have relevance for governing FDI and the electronics sector. The effects of Intel's establishment in Costa Rica merits special attention, and this section therefore includes an examination of literature on this subject. This literature includes a CINPE conference paper on Intel's establishment using a systems of innovation approach, titled and is used in this section together with information garnered from an interview conducted with the paper's author.

The above gives a useful indication of FDI patterns centered on the electronics sector and overall effects, mostly based on a general literature review. However it is not entirely indicative of whether the actors in the sector truly engage in sustainable knowledge dissemination as theoretically understood in a systems of innovation framework, nor whether the institutional set-ups have had an actual influence in this respect (and if so, which ones and how). The final element of the analysis therefore seeks to investigate the actual conduct of actors in the Costa Rican electronics sector by presenting the findings of original research by this author. This research consists of field visits and interviews with various companies in the electronics sector, from Intel to smaller companies, as well as interviews with representatives of various important public and private organizations that are also important actors in an innovation system. Among others, these include representatives from Costa Rica's investment promotion agency and the American-Costa Rican Chamber of Commerce's action committees on environment and corporate social responsibility. Specifically, the study looks at whether certain innovation types, which are theoretically imagined to contribute to sustainable performance (such as the use of ISO 14001 environmental management systems or cleaner technologies), are actively practiced. Importantly, this reveals something about the key institutional conditions for promoting their use, if these conditions exist. However it is also helpful in breaking down any illusory pictures about how the 'innovation system' works, if it is revealed that actual conduct of the actors in the electronics sector does not show them to be driven to act in a sustainable manner. Taken together, the general literature review and the Costa Rican field studies directly address the first part of the overall problem statement.

Determining the applicability of the successful institutional set-ups in the Costa Rican electronics sector to other developing countries is an answer to the final part of the overall problem statement. It is also the area of this thesis that will have the weakest conclusive foundation, as no insight is given here to the innovation systems of other countries. However, since insight is given to the broader context of the Costa Rican case, informed opinions can be given to determine whether the successful institutional set-ups are unique to Costa Rica.

Research Methodology

Answering the overall problem statement and the related sub-questions in this thesis has called for a varied methodological approach to give any meaningful basis for a conclusion. The unit of analysis, i.e. the specific area of study, grows more detailed as the thesis progresses, and this has in turn necessitated the use of different ways of analyzing. Whether the focus is on overall globalization effects on economies in Latin America and their labor markets and natural environments, or whether looking at the use of specific 'sustainable' innovation types among companies in the Costa Rican electronics sector and their institutional incentives/deterrents, a methodological approach has been chosen which is thought to be most fitting for to the scope of the subject matter.

Use of the Conceptual Framework

Prior to the above mentioned analyses, this thesis first establishes an overall conceptual framework that is based on systems of innovation theory. It has already been described previously how this section deals with the theoretical aspects of this approach, showing how its theorists believe knowledge production is connected with sustainable performance in a given segment of an economy. It has also been described how an innovation systems approach may contain fallacy assumptions. The use of it therefore causes the concrete analyses of Costa Rica to resemble an exploratory study on the merit of using innovation systems as a tool to study sustainable performance. At this stage, prior to any in-depth study of the electronics sector innovation system, no obvious conclusions can be drawn in this regard. It remains to be seen if the innovation system links between market actors and other components of the system function in Costa Rica as imagined by its theorists.

In general, the innovation systems conceptual framework has influence on the overall research methodology in this thesis because it underscores important factors that are paid attention to in the Costa Rican analysis. For instance, when examining the macroeconomic effects of FDI in the electronics sector, the conceptual framework stresses that for sustainable knowledge production to work optimally, there need to be linkages with other actors in the innovation system such as local suppliers and government agencies. This theoretical proposition steers the analysis toward finding any evidence to show whether transnationals in Costa Rica carry out their operations as an integrated part of the local economy, or essentially as isolated 'maquila' island production facilities. But the conceptual framework is not solely restricted to guiding the analyses of Costa Rica and giving a theoretical understanding of the problem complex. It is also used as a basis for choosing interview case study subjects in the more detailed analysis on the electronics sector innovation system. This is described in detail further below.

Data Collection Strategies

Overall, conducting a study can entail the use of different data collection strategies, from experiments to surveys to face-to-face interviews. This study contains an analysis on the electronics sector innovation system in Costa Rica at two levels, and in turn makes use of two different strategies. Firstly, there is the large-scale look at the effects of globalization on Latin America and on Costa Rica, narrowing in focus from the regional level to deal with Costa Rican FDI patterns and the developmental effects of Intel's establishment in the electronics sector. This study is carried out almost exclusively on the basis of market data and literature reviews into the subject matter. Both development literature and innovation systems literature is used, and specific dedicated literature describing the special case of Intel's establishment and developmental effects

is used as well. Secondly, following on from the large scale analysis is a more detailed account of the conduct of actors within the electronics sector innovation system in Costa Rica. The data collection strategy used for this part of the study is the use of interviews with representatives of companies in the electronics sector and with various other important actors in the innovation system. This is described in more detail in the following.

Interview Case Design

For this thesis, a multiple interview study is chosen ahead of more quantitative data collection methods. The reasoning for this is it can be strongly argued that measuring the sustainable performance of companies in the electronics sector cannot be done so easily, for instance on the basis of even a comprehensive questionnaire survey. Also, it is important to keep in mind that the institutional context around the activities of transnationals is a central part of the study, and neither does this lend itself so easily to the same kind of quantitative analysis. Adherence by companies to formalized institutions such as environmental legislation might be quantified by certain indicators, for example the number of issued Notices of Violation from authorities, but more intangible institutions like the normative behavior of companies isn't measurable to the same extent. A weakness in these types of analysis methods is that they may not be as open as case study interviews to gathering perceptions and opinions by the companies about the institutional set-ups under which they operate. As Yin (2003, 13) states, surveys "*can try to deal with a phenomenon and context, but the ability to investigate the context is extremely limited*". Interviews and associated field trips to companies in the electronics sector are on this basis seen as more fitting for the purpose of the study. Figure 5 shows an overview of the companies interviewed.

Interviewee	Position	Company/Organization	Description
Anibal Alterno	- Environmental Engineer	- Intel (Componentes Intel de Costa Rica, S.A.)	- Semiconductors (Microprocessor assembly & test)
	- Chairman, Environmental Action Committee	- AmCham (Costa Rican-American Chamber of Commerce)	- Commerce chamber
Eugenio Gordienko	Operations Vice President,	AeTec (AeTEC de Costa Rica, Ltda.)	Contract electronic manufacturer (printed circuit boards)
Lucas Garro [†]	Engineer, Head of Occupational Health and Safety	Conair (BabyLiss Costa Rica, S.A., Grupo Conair)	Consumer electronics (hair dryers, etc.)
Carlos Chassoul	Manager	Current Controls (Controles de Corriente, S.A.)	Electronic components (transformers and toroidal inductors for power control systems/power supplies)
Alessandra Catarinella	External consultant, chemical specialist	Magnéticos Toroid (Magnéticos Toroid de Costa Rica, S.A.)	Electronic components (toroidal inductors)
- Claudio Ubaña - Francesco Rojas	Research and Development Engineers	Merlin VME (Merlin VME, S.A.)	Electronic components (design of analog/digital signal converters for US submarine sonars)
- Marin Mileeta - Sergio Chavarría	- General Manager & Vice President - Quality Manager	Tico Electronics (Tico Electronics, S.A.)	Contract electronic manufacturer (rotors and stators for motors in avionics systems)
Gifford Mejias	Manager	Saco International (Saco Internacional, S.A.)	Consumer electronics (human vision testers)

Figure 5 – Conducted interviews with companies in the Costa Rican electronics sector. † Interview conducted in Spanish

The sum of the interviews constitutes a multiple case-study of electronics companies that have sprung out from foreign investment into Costa Rica. According to Yin (2003, 13) a case study as a research strategy is "*an empirical enquiry that investigates a contemporary phenomenon within its*

real-life context, especially when the boundaries between phenomenon and context are not clearly evident". As understood by Yin, a case study research strategy is ideal when the aim is to deliberately uncover contextual conditions of a phenomenon, and this definition of a case study is one that applies very well here. The relationship between phenomenon and context in this thesis can be understood to mean the conduct of electronics companies within the scope of a theoretically conceptualized system of innovation, whose actual functioning as imagined by theorists may or may not hold true. By attempting to examine the institutional conditions within the innovation system that have enabled or dissuaded these companies to act more sustainably, the focus here indeed is on the relationship between phenomenon and context.

Yin describes two overall approaches to case studies, namely the single and multiple case designs (Yin 2003, 39). The rationales for choosing a single case study include three possibilities. If the case is a *critical* case, it is believed to exhibit the conditions for confirming, challenging, or extending the propositions of a theory. If the case represents an *extreme* or *unique* case, it represents a rare set of conditions that fall outside of a theoretically understood pattern and therefore merits examining. If the case is a *representative* or *typical* case, the conditions exhibited by the case reflect common everyday conditions and is therefore sufficient as a study on its own.

When considering the purpose of this thesis, one might consider these rationales on the idea of using Intel, the biggest FDI investor in Costa Rica, as the sole case study. However this would be fraught with a number of problems. From prior knowledge this author has of a similar facility in the Philippines, Intel in many ways functions as an exemplary transnational company. It is actively engaged with government and other stakeholders, and makes use of comprehensive environmental management programs and community outreach efforts because these are priorities in the daily operations of this particular company.

Given this, basing an analysis of FDI in the Costa Rican electronics sector on Intel alone will likely create a false, positive impression – the case carries dangers if taken as a representative case. Neither would it be beneficial to treat Intel as a critical or extreme case. Although it would seem that Intel might serve as an interesting anomaly to focus on, the real object of study is the institutional set-ups that enable transnationals to act more sustainably, and not the individual transnationals themselves. Therefore the analysis makes use of a multiple case study. Mainly, this approach is seen to have the advantage that any gathered evidence is considered more compelling (Yin 2003, 46). It is argued that examining several companies will give a more thorough and accurate picture of their general conduct in the innovation system.

The interviews and field visits were conducted throughout the course of 2007. The companies were identified through a list given to this author by a representative of CINDE, Costa Rica's investment promotion agency. This list showed the different foreign companies in the electronics sector that had been established in Costa Rica under the Free Trade Zone regime, including Intel, covering companies in a variety of sub-sectors: Telecommunications (6), Electrical Assemblies (5), Electronic Components (11), Contract Electronic Manufacturers (4), Consumer Electronics (5), Engineering and PCB Repair (2), Metalwork (5) and Semiconductors (1). As can be seen on Figure 5, not all sub-sectors are represented in the multiple case study. One main reason was the unresponsiveness of many companies or outright unwillingness in at least two cases to take part in the study. It is worthwhile to mention that three of the companies who were approached appeared to be interesting cases because they alone, with the exception of Intel, were ISO 14001 certified, but they ended up not being part of the study. Still, it can be argued that there is a good variation in the represented companies, with companies as large as Intel down to Merlin VME, which is a company with no more than 4 employees in Costa Rica. The interviews were done as semi-structured interviews, with a set of standard questions prepared beforehand but with leeway given to question a particular topic more thoroughly, or leave out questions that didn't appear relevant.

All except the interview with Anibal Alterno were face-to-face interviews, because the lead environmental engineer at Intel had several other scheduling commitments.

The understanding of a system of innovation is one where market actors do not act alone but form collaborative networks with many other stakeholders as part of an overall imperative to remain competitive. For this reason, and because a case study on companies alone might run the risk of being subject to bias, interviews with other relevant organizations were conducted to bolster the overall analysis. Figure 6 shows an overview of the conducted support interviews.

Interviewee	Position	Company/Organization	Description
Hector González	Investment Promotion Coordinator	CINDE (La Coalición Costarricense de Iniciativas de Desarrollo)	The Costa Rican investment promotion agency.
Roberto Calvo	Director	Costa Rica Provee ('oficina nacional de desarrollo de proveedores')	Management unit for domestic supplier development under PROCOMER (The Foreign Trade Corporation of Costa Rica)
Ana Quirós	- President - Chairwoman, Corporate Social Responsibility Committee	- Eco Global - AmCham (Costa Rican-American Chamber of Commerce)	- Private company offering environmental consultancy engineering services - Trade organization
Leiner Vargas, Ph.D.	Vice Rector	UNA (Universidad Nacional)	Major public university in Costa Rica based in Heredia, and the seat of CINPE
Akira Hidalgo [†]	Administration staff	CNP+L (Centro Nacional de Producción mas Limpia)	National Center for Cleaner Production under Cámara de Industrias (Chamber of Industry)
Manuel González [†]	(Not specified)	INTECO (Instituto de Normas Técnicas de Costa Rica)	Private, non-profit association officially recognized as Costa Rica's national entity for developing technical norms and standards
- Paula Chavez [†] - Carlos Sanchez [†]	Training staff, sub-section for Environmental Management	INA (Instituto Nacional de Aprendizaje)	National Training Institute (public vocational training institute in several of fields at below-university level)
Jose Alfredo González [†]	Director of Technology Management	CEFOF (Centro de Formación de Formadores y de Personal Técnico para el Desarrollo Industrial de Centro América)	Japanese- and Costa Rican- funded training institute for technical competencies in support of industrial productivity and competitiveness
Juan Carlos Salas Jiménez [†]	Manager	CTTA (Centro de Transferencia y Transformación de Materiales)	Waste recycling center in the Cartago Free Trade Zone initiated by ITCR (Technological Institute of Costa Rica, a major public university)
Alberto Gallardo [†]	Commercial Director, Electronics	Fortech (Fortech Microabrasivos, S.A.)	Local free trade zone company which has begun to treat electronic waste from other companies as part of daily operations
Blake Schmidt	Journalist	The Tico Times	Costa Rica's English-speaking newspaper

Figure 6 – Conducted support interviews with public agencies, private companies, public/private organizations and others. [†] Interview conducted in Spanish

CINDE and Costa Rica Provee stand out as the most important public agencies relevant to FDI activities in Costa Rica, the former as a private but officially recognized non-profit investment promotion agency and the latter as a special government program for developing linkages between foreign companies and domestic suppliers. Regulatory authorities for electronics companies such

as MINAE (the Ministry for the Environment and Energy) and the Ministry of Health might have been valuable additions. However it was found that MINAE concentrated its activities primarily on areas such as forest conservation and coastal area protection and not so much on industrial oversight. The Ministry of Health, on the other hand, was the actual most important regulatory body in this regard but proved unresponsive to this author's approaches.

A private sector perspective removed from the electronics sector is given by Eco Global, a leading environmental engineering consultancy and also member of the AmCham (Costa Rican-American Chamber of Commerce), where its director is holder of a chair position on the committee for Corporate Social Responsibility. As such the director of the company, Ana Quirós, was able to give a unique and technically well-founded view on the normative conduct of companies in Costa Rica in both the environmental and social areas, as well as the institutional conditions regarding these areas.

Researchers at UNA's (Universidad Nacional) CINPE research center have worked extensively with systems of innovation approaches in Costa Rica due to an earlier collaborative project with Aalborg University to develop its research capacity⁴. One such study is titled "*New Economies and Innovation for Developing Countries: The Case of Intel in Costa Rica*" by Leiner Vargas, who is Vice Rector at the university. An interview with Leiner Vargas was conducted because the author of that study was able to talk about the case of Intel specifically with a systems of innovation understanding.

CNP+L, INTECO, INA and CEFOF are institutional support organizations that give technical training and assistance to companies and to their workforces, or in some way or another work at developing best practices. Interviews with these bodies have been mostly focused on environmental management. They have been useful in a systems of innovation approach because the technical training and know-how services that these organizations provide constitutes an important part of the institutional set-ups for sustainable performance that this thesis aims to examine. CNP+L is Costa Rica's National Center for Cleaner Production and is a special unit under the Chamber of Industry which promotes cleaner production as an integrated part of company operations, with financial assistance from the Costa Rican state and European foreign aid agencies. INTECO is Costa Rica's accreditation body for technical norms and standards, including ISO 14001. INA is a governmental institute which aims at giving vocational training for those with a high-school level education in a broad range of fields, including basic environmental management. CEFOF is another training institute that was created through a joint partnership project between Costa Rica and Japan. While its primary activities are giving training support to industries with a pure business focus, i.e. so-called 'lean' production and quality management, environmental management is also a part of its training programs.

Certain specific organizations within the electronics sector innovation system have also been regarded as interesting to examine closely because they appear to help support electronics companies in conducting their operations in a more sustainable manner. CTTA is a unique organization that was created by one of the three main public universities in Costa Rica to collect waste material from companies in the Free Trade Zone in Cartago for processing and resale, for instance packaging material. Currently it runs as a profitable enterprise. Fortech is a locally based company in the same Free Trade Zone that has found a market niche in collecting electronics waste from companies with the same intention of process and resale, though this is a relatively new part of its business.

⁴ The Danish International Development Agency (DANIDA) financially supported the SUDESCA project (Sustainable Development Strategies for Central America) which roughly ran from 1996-2001. For more see Johnson, Müller and Orozco (2007)

In summary, the multiple case study analysis is intended to be comprehensive enough to support the general analysis of Costa Rica's contextual situation under globalization and increasing FDI. By speaking with not only companies in the electronics sector but also with various other important organizations regarded as part of the innovation system, the case analyses is intended to make up a true innovation system analysis, as much as this has been made possible given the constraints of producing this study. The most important interviews have been reproduced as full transcripts in the physical appendix of this thesis – these include the interviews with Intel, CINDE, Costa Rica Provee, Eco Global and Leiner Vargas of UNA. The rest have been added as original audio recordings in the digital appendix because time constraints have limited being able to transcribe these in full.

3. Systems of Innovation

Here a conceptual framework is established for helping to understand the knowledge and technological diffusion processes following the set-up of activities of transnational companies in developing countries. The chapter introduces the systems of innovation approach, which later is taken as a point of departure in an analysis of the Costa Rican electronics sector.

Origins and Premises

Rather than a formal economic theory, systems of innovation is normally presented as an approach or a conceptual framework from which to understand economic activity, placing knowledge production, and the broader processes in which this is generated, as its most fundamental element (Lundvall 1992; Edquist 1997). Though the scholars and policymakers who have applied the thinking have been able to show links to early theoretical groundings, innovation systems are thought of as a concept originating relatively recently (as late as the 1980s), and thus one still undergoing development (Lundvall et al. 2002). One factor claimed to have led to the emergence of the term is the inadequacy, at the time, of predominant, standard macroeconomic theories and policies in giving satisfactory explanations about the underlying factors behind competitiveness and economic development. Heavy interest in the reasons behind different national growth rates and international competitiveness in the 1960s and 1970s led various governments and international organizations to point to differing research systems between economies as one explanation; Systems of innovation subsequently came to the fore during the 1980s, when the concept was developed as a collaborative effort between a number of research groups from industrialized nations – the US, UK, France and Scandinavia. Among them was the IKE group at Aalborg University, a research group at the Department of Business Studies studying industrial development and international competitiveness. The IKE group began to realize that innovations and innovation processes, crucial to Denmark's competitive standing, did not hail exclusively from formal research and development set-ups at universities and industries. Instead, these increasingly occurred due to broader contributions resulting from i.e. customer interaction with firms, creating the need for a better understanding of these competitiveness-enhancing, knowledge creation processes in society. In its research, the IKE group often referred to a nation's innovative capability in its production system, and Bengt-Åke Lundvall (1985) of the IKE group was the first to use the term 'innovation system', referring to the interplay between firms and institutions involved in knowledge production (Lundvall 2002, 43). However, it was formally introduced to literature elsewhere, in a work by Christopher Freeman (1987) on technology policy and the economy in Japan. Freeman (1987, 1) defines a national system of innovation as "*the network of institutions in the public and private sectors whose activities and interactions initiate, import, modify and diffuse new technologies.*"

Freeman's broad definition has since been expanded upon into more detail, and this will be duly shown in this chapter. Some fundamental premises of an innovation systems approach are given by Lundvall (1992), who firstly notes that by placing knowledge creation as the fundamental resource in a modern economy, standard economics is less applicable. This is owed to, among other things, how knowledge is not easily transacted in markets and does not always function as a conventional resource in terms of how it can be appropriated and transferred between economic agents. As argued by Edquist (1997, 16), the understanding of learning processes in a systems of innovation approach contrasts with neoclassical economic analysis, where technological change is treated as an exogenous factor emerging from outside the system and thus understood poorly. Instead, learning is crucially understood as primarily an interactive process and therefore one that is socially embedded and where it is important to take its institutional and cultural context into

consideration (Lundvall 1992). Firms are seen to almost never innovate in isolation, as their pursuit of competitive advantages requires interaction with other organizations in gaining, developing and exchanging knowledge and information. Examples of organizations in this respect include supplier, customer and competitor firms but also universities, research institutes, government ministries, etc. which are all components of an innovation system. Generation and diffusion of innovations is rarely seen to occur as a direct result of profit-maximizing behavior of firms, rendering this neoclassical model inadequate (Edquist 1997, 1-2, 6). Many different actors and agents are involved in learning processes, which are complex and involve complicated feed-back mechanisms at all stages of innovation processes, from the emergence of knowledge elements to their diffusion and translation into products and new ways of production (Edquist 1997, 1-2; 16). Despite this complexity, it is nevertheless regarded as important to analyze the formal R&D system in an economy as well as the learning processes in everyday, routine activities of firms. Together, Lundvall (1992, 9-10) terms this the 'structure of production' which forms one of two important dimensions of a system of innovation. The second dimension, central to an innovation systems approach according to Lundvall, is the 'institutional set-up' within a system, whether it be a specific firm, a constellation of firms or a nation. Briefly, institutions are here introduced as guide-posts for action of both agents and collectives in an innovation system. A broad definition is given by Johnson (1992, 26) who writes that institutions are "*sets of habits, routines, rules, norms and laws, which regulate the relations between people and shape human interaction*". Freeman (1987) also places institutions centrally in his definition of an innovation system.

Definition and Taxonomy of Innovations

The terms 'knowledge', 'learning' and 'innovations' have been used loosely in relation to each other thus far. Though they are closely connected, Innovations specifically are an integral focal point of an innovation systems approach, and set apart from the former terms. As the end result of learning and knowledge-acquisition as it occurs within a system, they are understood to largely determine competitiveness and performance of firms in an economy. At this stage it is therefore beneficial to define what constitutes an innovation and make distinctions about what types of innovation exist.

One common point of departure for innovation systems theorists is Joseph Schumpeter, the influential economist famous for his theories on capitalist development and business cycles who can be regarded as the pioneer in innovation studies (Fang 2006, 18). Schumpeter conceives of innovations very broadly by making them synonymous with what he calls 'New Combinations' of factors combined to set up a new production function (Schumpeter 1939, 87-88; Edquist 1997, 9). Production functions are defined by Schumpeter to include new commodities as well as new organization types and the opening of new markets. It is apparent here that this understanding encompasses not only new, concrete product innovations, but also innovations in the wider sense of new organizational set-ups. Or, put more plainly in Schumpeter's own words, "*the doing of new things or the doing of things that are already being done in a new way.*" (Schumpeter 1947, 151; Mejías 2006, 16). With this understanding, one may distinguish between product innovations, explained as a new good or quality of good, and process innovations, which cover a new production method or commercial handling of a product (Schumpeter 1934, 66; Mejías 2006, 16).

Many follow in the same vein as Schumpeter with a broad, overall understanding of innovations. Edquist (1997, 1) places the stress on innovations as new creations of economic significance, which may be brand new but usually arise as combinations of existing knowledge, and similarly take the shape of various types such as technological and organizational innovations. Likewise, Lundvall (1992) understands innovations as the outcome of on-going learning, searching and exploring processes within firms that result in new products, techniques, new forms of organization, new markets and also institutional innovations - however, the non-technological types of

innovations are not covered in this work in systematic detail (Orozco 2004, 31; Edquist 1997, 10). Others still choose to interpret innovation within a narrow focus such as Nelson and Rosenberg (1993), where they are seen as primarily technical phenomena and where the focus in their work is on studying the institutions and mechanisms which support technical innovations in various countries (Fang 2006, 19; Edquist 1997, 9-10). Their interpretation in this case extends the understanding of innovations to include “*the processes by which firms master and get into practice product designs and manufacturing processes that are new to them*” (Nelson and Rosenberg 1993, 4-5; Edquist 1997, 10). This understanding thus not only includes technical innovations and the introduction of new technology, but also their diffusion. Clearly, different theorists and users of a systems of innovation approach do not work with a singular definition of innovation, though for Edquist (1997, 10) this reflects pragmatic choice-making based on the purpose of analyses and is not necessarily problematic. Central to all approaches is the focus on technological innovation as well as an interest in organizational and institutional change.

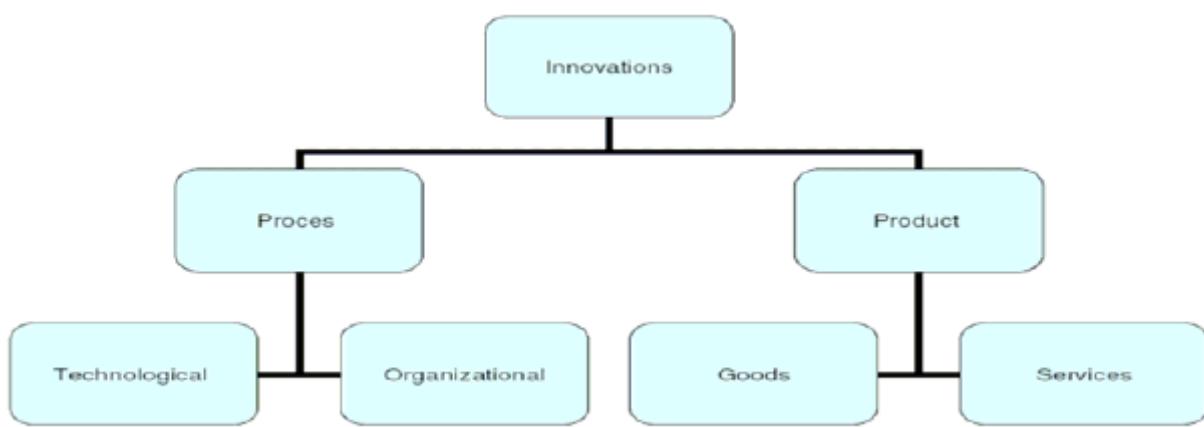


Figure 7 - Classification of innovations (Edquist 2001, 7).

An attempt at classifying innovations more specifically has been given by Edquist (2001, 7) in a research paper presented at the 2001 DRUID⁵ conference. Edquist argues that different kinds of innovations can be expected to have different determinants, and that it is therefore necessary to build taxonomies to disaggregate them and better identify them (Orozco 2004, 35). According to Edquist, innovations are either product innovations or process innovations, the former being goods or services and the focus on what is being produced (Fang 2006, 19). Process innovations are either technological or organizational, and have to do with the way goods and services are produced. Lastly, goods and technological processes are seen as innovations of a material nature, while services and organizational processes are seen as intangible. Edquist's taxonomy is shown on Figure 7. Orozco (2004, 35-36) points to some weaknesses in Edquist's approach, namely that it largely ignores institutional innovations, but uses the same taxonomy as a basis for developing a more comprehensive one which will be shown later in this chapter.

Institutions and Systems of Innovation

Institutions were seen by Lundvall (1992) as one of the two important dimensions in a systems of innovation approach, acting as sets of formal or informal guide-posts for interaction between

⁵ Danish Research Unit for Industrial Dynamics, where the Department of Business Studies at Aalborg University is an active participant.

agents and actors in a system. As either habits, routines, rules, norms or laws, institutions shape the behavior of firms and other organizations as both rigid obstacles to innovation or support for innovation processes. Institutions are fraught with conceptual vagueness, however, because the term's wide reach has been known to cause confusion as regards what exactly constitutes an institution. For instance, there is considerable ambiguity in authors' uses of the terms institutions and organizations, which are often used interchangeably. Because of this obscurity, and because the present report contains an institutional focus, it is advantageous to examine institutions more closely within a systems of innovation approach.

Edquist and Johnson (1997, 43) note that the term institution among users of a systems of innovation approach often falls back on an understanding of its everyday meaning, as a synonym for organization. They give the example of specific elements in a country's research and development system, where universities, research institutes, consultancy agencies, etc. are sometimes individually understood as institutions because they are crucial to processes of innovation. To help aid the distinction made between the two, a definition of organizations is "*formal structures with an explicit purpose and... consciously created. They are players or actors.*" (Edquist and Johnson 1997, 47). Or more commonly put, they are groups of people with a common goal (Christensen and Rasmussen 2006, 51). On the other hand, institutions comprise the framework in which organizations operate. They are formed and work under their premises, but also influence change in them. One comprehensive definition is given by the institutional theorist Richard W. Scott (2001, 48), reproduced below:

- Institutions are social structures that have attained a high degree of resilience.
- Institutions are composed of cultural-cognitive, normative and regulatory elements that, together with associated activities and resources, provide stability and meaning to social life.
- Institutions are transmitted by various types of carriers, including symbolic systems, relational systems, routines and artefacts.
- Institutions operate at multiple levels of jurisdiction, from the world system to localized interpersonal relationships.
- Institutions by definition connote stability but are subject to change processes, both incremental and discontinuous.

Scott's definition falls in line with the broader definition introduced previously as far as showing that institutions exist as both formal and informal guide-posts for action (loosely coinciding with regulatory and cultural-cognitive or normative elements, respectively). It also acknowledges that they are subject to change, and further defines ways in which institutions are transmitted by defining institutional carriers. Edquist and Johnson (1997, 49-51) offer their own specification in a taxonomy that breaks down institutions into the following:

- Formal and informal – Laws and regulations vs. customs, traditions, norms.
- Basic and supporting – Hierarchic levels of institutions, loosely compared with legal systems in a country, i.e. constitutional laws, statutes and ordinances. In other words, basic 'ground rules' and their supporting rules.
- Hard and Soft – Perceived as binding and policed, and rules of thumb and suggestions.

Finally, Jeffrey Orozco (2004, 35-37) places emphasis on innovations at the institutional level and includes them in his taxonomy of innovations. Orozco argues that changes in the institutional set-up that are designed towards an explicit goal can be considered innovations unto themselves. In his taxonomy, Orozco adds to Edquist's classification of technological innovations by adding three categories of designed institutions: Laws, Policies and Formal Organizations. A detailed taxonomy of innovations as understood by Orozco is given on Figure 8.

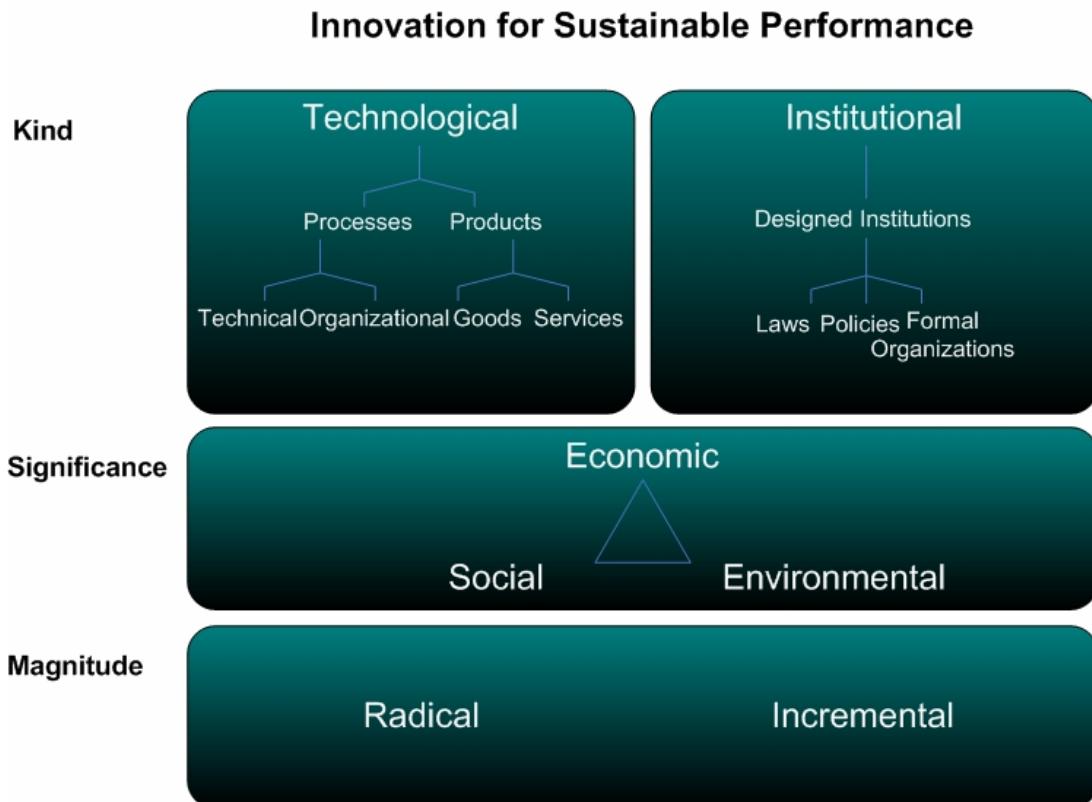


Figure 8 – A Detailed taxonomy of innovation (Eldquist 2001; Orozco 2004)

Further points require some clarification with regards to Orozco's detailed taxonomy. Besides technological and institutional innovation types, already introduced, two further overall classifications are given. Magnitude is one classification, and deals with a distinction between innovations that lead to innumerable incremental improvements in performance, and radical innovations that can involve wholesale structural changes in an economy (Orozco 2004, 36). Within a systems of innovation approach, there exists an understanding that innovations far from always occur in a linear, evolutionary manner, and this reflects that understanding. However this matter will not be explored in significant detail in the present report. Rather, what is important is Orozco's final classification, which is termed Significance. Here, innovations are distinguished in terms of the three elements that are important for sustainable development: Economic, Social and Environmental. Innovations are thus not seen to be phenomena that are only restricted to the economic sphere – here an explicit link is made between systems of innovation and sustainability, which will be explored further presently.

Sustainable Systems of Innovation

The systems of innovation approach, as presented hitherto, is heavily slanted toward a focus on innovations as determinants of economic performance in a system, whether its actor firms or the system as a whole constituted by all components of the system. This is not too surprising considering that economic theorists have been at the heart of developing the approach. However what is increasingly being seen is a heightened focus on environmental and social issues and their integration into theory as sustainability has come to the fore, and a recognition that these issues have significant bearing for economic performance. Johnson (1998) is one theorist who acknowledged early that innovations may have a positive role in bolstering sustainability, who also

states that “*the possibility of economic growth without environmental destruction is to a large extent a question of institutional change, including design and redesign of institutions, in order to stimulate cleaner technologies, habits and values.*” (Quoted in Segura-Bonilla 2000, 64). It should be noted that this stressing of institutional design for bolstering the use of sustainable innovations is an example of a possible fallacy assumption inherent in the systems of innovation approach, and could be argued to depend entirely on whether conditions in a system make it possible to create the institutional change as imagined. Some innovation systems theorists have been made aware that this may not always be easy, as detailed further on in the final segment of this chapter. On innovation and sustainability, Lundvall et al. (2002, 228) write that “*Technical innovation, for instance in terms of developing substitutes for naturally scarce resources, may help to overcome the fact that natural capital cannot always be reproduced. In a similar vein social innovation and institutional redesign may help to overcome a crisis where the social capital is foundering. In both cases it is important to note that the workings of unhampered market forces will erode the basis of economic growth.*” Lundvall et al. (2002, 227-228) go further to explain that economic growth is faced with a double challenge in terms of sustainability, pointing to inherent risks in undermining the material basis for material production if environmental sustainability is not taken into account. Likewise, intellectual capital, the knowledge basis that is crucial to modern economies, would be undermined if social capital is not taken into account, i.e. social sustainability. This is illustrated below in Figure 3.

	Easily reproducible resources	Less reproducible resources
Tangible resources	Production capital	Natural capital
Intangible resources	Intellectual capital	Social capital

Figure 9 - Resources fundamental for economic growth (Lundvall et al. 2002, 228).

The explicit introduction and development of a systems of innovation approach with a focus on sustainability is credited to Olman Segura-Bonilla of the CINPE economic policy center in Costa Rica, in a Ph.D. dissertation for Aalborg University (Lundvall et al. 2002, 228; Orozco et al. 2005, 12). Segura-Bonilla (2000) applies a systems of innovation approach to an analysis of the forest sector in Guatemala, Nicaragua and Costa Rica, where the question of natural capital being undermined and threatening actual production capital is an apparent problem. Inspired by Lundvall (1992), he integrates sustainability into a systems of innovation approach with the following⁶ (Segura-Bonilla 2000, 80; Orozco et al. 2005, 12):

A sustainable system of innovation is constituted by the human, social and natural elements and relationships which interact in the production, diffusion and use of new, and economically useful, knowledge.

Or, according to an expanded definition based on the above which has been proposed by Johnson and Lehmann (2006, 18):

A Sustainable Innovation System is constituted by human, natural and social elements and relationships, which interact in the production, diffusion and use of new and socially, environmentally, economically and institutionally useful knowledge that contributes to sustainable production and consumption patterns.

It is apparent that the second definition is a great deal more comprehensive than the first. One may argue, as Johnson and Lehmann do, that the first carries with it a simplistic understanding of sustainability, particularly because it contains an overriding priority towards economically useful knowledge alone. As argued by Johnson and Lehmann (2006, 18), a sustainable innovation

⁶ It is interesting to note that the original definition only speaks of human and natural elements and relationships, though later on the social aspect has been retroactively added to the definition by Orozco et al. (2004) without explanation.

system understanding ought to move beyond solely looking at the dyadic relationship between environment and economics and include the social and institutional pillars of sustainability as well. When considering the expanded definition, it can be seen how it poses significantly stronger demands on any given innovation system for it to be sustainable. Not only should new knowledge be beneficial in an economic sense, but it ought also to prove beneficial in the other dimensions of sustainability. Included herein is the important addition that mentions sustainable production and consumption patterns which, when considering the implications, in reality requires radical change to occur in deeply seated normative behavior patterns in human lifestyles and production methods. It can thus be argued that the second definition falls much more closely in line with the concept of sustainable development. It is much more explicit in including all aspects of sustainability, and it is more far-reaching. However, whether it remains workable as a practical understanding of innovation processes in an economy and how they contribute to sustainable development is another matter. Though the definition is comprehensive, one may still address critique toward it because it remains to be seen if the ‘relationships’ and ‘interactions’ in fact do occur as theoretically imagined. As mentioned earlier, this is part of the reason why a study into the specific context of Costa Rica is done in this thesis.

Following the Segura-Bonilla’s work, subsequent works at the Ph.D. dissertation level by Orozco (2004) and Mejías (2006), scholars at CINPE, have applied similar systems of innovation approaches with regard to a focus on environmental and social sustainability, respectively. Mejías’ social focus deals with the Costa Rican labor market and the institutional framework regarding learning and innovative competence-building among employees at the firm level, i.e. social capital. Orozco deals with innovation and sustainable performance improvements in cooperatives in the Costa Rican palm oil industry, focusing on cleaner technologies. Here it is worthwhile to consider how systems of innovation specifically relates to this aspect of environmental sustainability within firms, where innovations in cleaner technologies are seen to be able to play a role in overall performance. The argument is put forward that just as firms have economic performance targets, so too do they have environmental and social targets as part of an overall imperative to be competitive. While operative targets in the social dimension include quality of life issues such as income, health, social security among others, targets in the environmental side include reduction of resource consumption, emissions, recycling and substitution of toxic chemicals and materials (Orozco 2004, 29). Innovations are then introduced to tackle these issues, eventually leading to target fulfillment. Separate from the imperatives of firms, innovations at the institutional level (as laid out in Orozco’s taxonomy of innovations) can also affect their sustainable behavior. It should be pointed out here, however, that the above arguments by Orozco contain many assumptions and generalizations on the operations of companies. It is far from proven that companies in general follow imperatives other than economic ones, and it therefore remains to be seen in the Costa Rican study in this thesis if these assumptions carry any merit.

Orozco details how innovations in cleaner technology can be systematized into his taxonomy of innovations. A point of departure used regarding cleaner technologies is given by Remmen (1999), who classifies three types of cleaner technology concepts based on studying environmental policy in a historical Danish context: cleaner production, environmental management and cleaner products. Cleaner production focuses on the reduction of emissions and resource consumption in production processes, which involve the earliest and most basic forms of environmental innovations that were put into use from the beginning of the mid-1980s. As innovations these achieved some impressive results⁷ but were ultimately regarded as singular, one-shot investments that picked off ‘low-hanging fruits’. After a decade, an increasing emphasis for preventing pollution led the drive toward a more dynamic approach to cleaner production, and environmental

⁷ Remmen (1999, 5) mentions case examples of the Danish fish processing industry and slaughterhouses which were both able to reduce water consumption by 50% or more, and the textile industry where there has been a demonstrated potential for reducing water use and electricity use by 90% and 70% respectively.

management took on more importance. Environmental management is a shift in cleaner production away from earlier technical solutions toward organizational preconditions for ensuring systemic, continuous and preventive efforts. They are exemplified in formalized environmental management systems such as ISO 14001 and are usually undertaken as voluntary actions by firms that can see an advantage in doing so. Finally, cleaner products is the most recent focus in cleaner production innovation, and entails not only reducing the environmental impacts within firms, but in broader society as the impacts of their products at their use stage becomes more important. Characteristics of firms using these types of innovations include broader stakeholder participation interactions to diffuse environmental management. Also, environmental management tools focusing on the impacts in all stages of a product become more frequently utilized at this stage: among others, these include product life-cycle analyses/assessments and eco-labeling.

Besides the technological innovation types in cleaner production described above, Orozco (2004, 55) describes innovations at the institutional level. Normative behavior of firms regarding environmental management is one important focus, with firms adopting increasing self-regulation and more proactive behavior with regards to regulation. This can be promoted with the help of government support schemes toward cleaner production. Another element is the use and promotion of participatory processes with stakeholders for policy formulation and implementation. Authorities can also stimulate changes in normative behavior by way of a number of different methods: differentiated regulation according to environmental performance, 'carrot' and 'stick' incentives and informative drives on tools such as eco-labeling. The set-up of new organizations can also play a role in institutional innovation. As Orozco (2004, 55) states, "*For promoting all kinds of cleaner technologies some new formal organisations could be also used, for example new industrial organisations, new nongovernmental organisations or even new state agencies. These new organisations are not institutions, but they are responsible for application of regulations or incentives, which are institutions.*"

Orozco's complete taxonomy of innovation on cleaner technologies is given on Figure 10. The purpose here has been to illustrate in some detail how sustainability can be explicitly linked with a systems of innovation approach, and how the environmental dimension relates to specific innovation categories. To this author's knowledge, the literature does not deal with innovations in the social dimension to the same extent, though the argument is put forward here that this can be done in a similar manner. Some firms can be seen to be increasingly using social tools and approaches that have some equivalents in the environmental innovation categories. Among others, these include fair trade product labeling, formal Corporate Social Responsibility initiatives, increased employee participation and community outreach efforts, and more. In the same manner as the environmental dimension, it is also argued that designed institutional innovations can affect normative behavior on this front. A social innovation will thus not be drawn up here, but will be asserted to resemble the detailed taxonomy shown below.

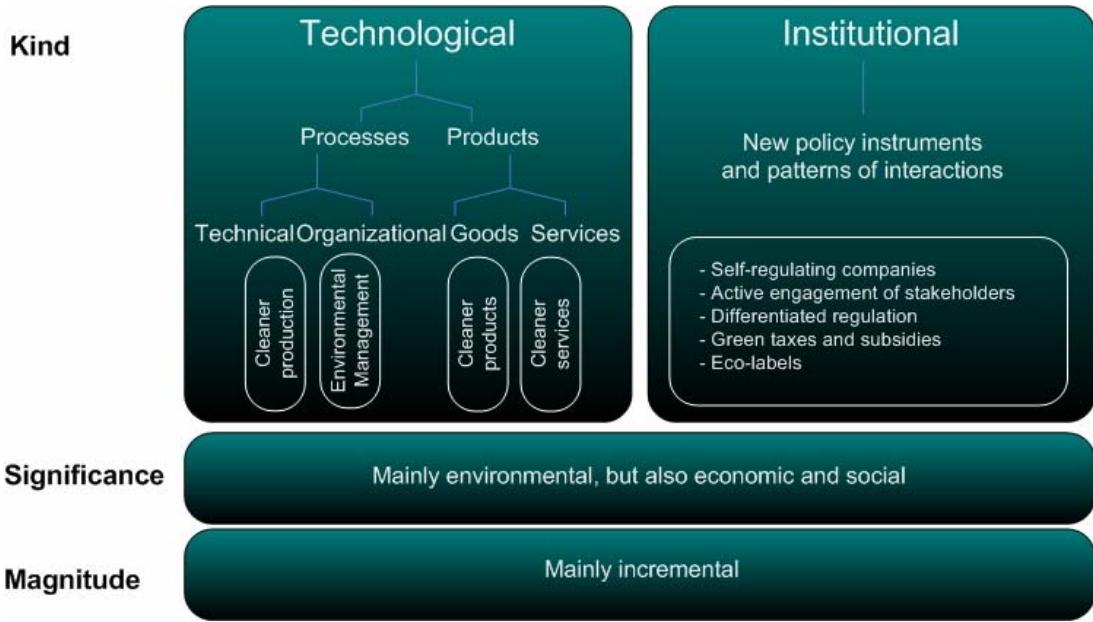


Figure 10 – Taxonomy of innovation on cleaner technologies (Orozco 2004, 55).

On the question of sustainable systems of innovation, developing a taxonomy for technological and institutional innovations does not offer a complete discussion without going into detail about exactly what elements constitute such a system in which these innovations may arise and diffuse. As earlier explained, firms and other actors in a system rarely act in isolation, and indeed institutional innovations, as described above, imply a strong emphasis on the role of authorities and their regulatory powers. The following will describe system of innovation approaches with the intent of specifying components and interaction areas in a system.

System Delineation

The introductory definitions of an innovation system in this chapter give some general, conceptual understanding of what is meant with the approach, but fall short of describing what components make up such a system and the interactions which are so central to it. As well, they leave it up to the users of the approach to set up a system delineation that is most appropriate for their objects of study. System boundaries are fundamental to the scope of any system approach as they identify what is within and outside of the system, making it essential to do define them in an innovation system as well (Fang 2006, 21). A system itself is a term that refers to “*components which mutually condition and constrain one another, so that the whole complex works together, with some reasonable defined overall function*” (Fleck 1992, 5 quoted in Edquist 1997, 13). In a systems of innovation approach, the delineation of systems occurs in either spatial and/or sectoral terms. In a geographical perspective, the system can be local, regional, national or supranational (Orozco 2004, 43). Here, no distinction is given as to the types of industry or technologies, as instead all industries in the defined region and their supporting institutions are covered. Alternatively, there is the sectoral focus as defined by Breschi and Malerba (1997, 131):

A Sectoral Innovation System can be defined as that system (group) of firms active in developing and making a sector's products and in generating and utilizing a sector's technologies; such a system of firms is related in two different ways: through processes of interaction and cooperation in artifact-technology development and through processes of competition and selection in innovative and market activities.

It is important to note that innovation system delineation does not exclude its actor firms from being components of several different systems at once, for these can obviously belong to networks spanning national, local and sectoral systems simultaneously. In some cases both geographical and sectoral system delineation is made. Figure 11 shows convergence and divergence in different innovation system boundaries, D showing convergence with all three at once, B, E and F where two systems converge, and A, C and G as areas of divergence.

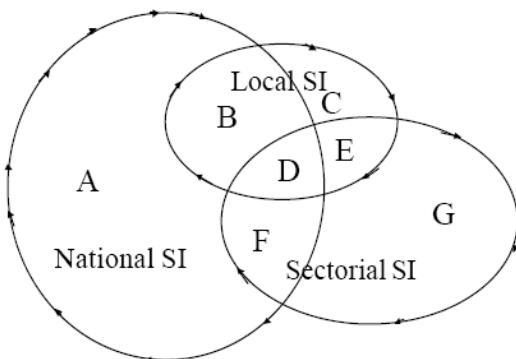


Figure 11 – Convergence and divergence in systems of innovation (Orozco 2004, 44).

Within any system boundary, there are specific components that make up the innovation system. A so-called propeller model has been developed by Lindegaard (1997) to illustrate, shown on Figure 12. The model is described as one of an individual firm or an industry's possible functioning within a system of innovation network in a sector model, rather than an innovation system itself (Remmen 1999, 25). 1-5 point out the external sources of knowledge acquisition for organizations, and A-D describe ideal learning network domains.

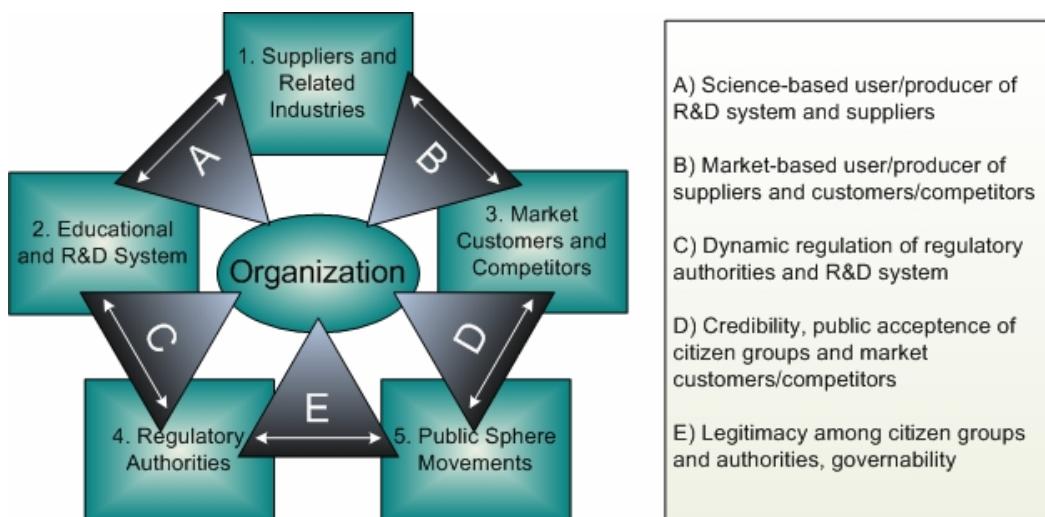


Figure 12 – The Propeller Model of components within the interactive network domains of innovation systems (Lindegaard 1997, 18)

Lastly in this conceptual framework chapter, it is important to point out that globalization and increasing FDI in developing countries pose challenges to conceptions of innovation systems at the national level in these countries. This is particularly a subject of interest in the present report, with an innovation system perspective focused on the electronics sector innovation system in Costa Rica. The following will cover a discussion of these issues.

Globalization, Transnationals and Innovation Systems in Developing Countries

Literature appears to show that a geographic focus on the national level is prevalent among users of a systems of innovation approach. By their own admission, delineation at this level is controversial in a context where globalization has come in to focus (Orozco et al. 2005, 2). Lundvall (1992, 1) agrees that traditional role of nation states has been challenged by internationalization and globalization. In a situation where these phenomena are seen to be accelerating, what is said to be increasingly acknowledged by Lundvall is the presence of multinational forms loosening their relations to their home-country and spreading their innovative activities as well as ‘sourcing’ different national systems of innovation for their activities. Ultimately, globalization is interpreted as a process which weakens the coherence and importance of national systems, yet for this same reason it is seen as pertinent to understand them and their role in supporting and directing learning processes, for the argument goes that this does not make it any less important to understand how national systems work (Lundvall 1992, 3).

François Chesnais (1992) wrote on national systems of innovation, FDI and the operations of multinational enterprises early on when globalization was in its infancy. Two main concerns in his work are firstly, and yet again, that globalization may be “severely *imparing the overall capacity and willpower of governments to continue enhancing many of the institutions supporting innovation at the national level*” (Chesnais 1992, 268). The second concern is that multinational enterprises are having impacts on national innovation systems through investment decisions, takeover of domestic firms and location of production and research and development activities. Chesnais’ findings indicate that competition to attract and keep multinational enterprises is a visible effect of their activities, and that the outcome of this competition is not a zero-sum effect but one that results in winners and losers (Chesnais 1992, 280-281). He argues that countries experiencing growth and devoting resources toward their technological capacity are more likely to attract investment from multinationals, and more likely to benefit from their technological accumulation and have it disseminate. On the other hand, countries that are losing ground in international competitiveness face only being able to attract investment in terms of assembly and low value added activities (Chesnais 1992, 292). This entails uneven development, and Chesnais calls for need for new policies to put in place in the face of this effect. Overall, there are three approaches with which to address the dichotomy. Firstly, there is a policy approach that calls for the primacy of the market and the limiting of state intervention into the activities of multinationals, though this one is met with skepticism (Chesnais 1992, 294). Second is an approach by which governments use a wide range of policy instruments to attract the ‘right’ sort of activities by multinationals and the monitoring of governments of relationships between the components of innovation systems. This approach is viewed by Chesnais as an improvement on the first, though an element of skepticism remains because of a risk of the same outcomes as the first. The third and last approach is a rejection of the role of government, on political grounds, in giving multinationals a free hand in their activities and ‘woo-ing’ them. This approach is the most preferable according to Chesnais, but it requires a strong emphasis on building national institutions and supporting domestic firms.

Touching upon similar themes of uneven development driven by globalization and given above, some scholars from both the developed and developing world have considered the applicability of systems of innovation approaches when dealing with developing countries (Orozco et al. 2004; Arocena and Sutz 2002). Interest in the approach is growing among these countries in Latin America, Asia and Africa, but it is argued that it contains a number of weaknesses when applied to these contexts. As an approach that has mainly originated in developed countries, it has taken point of departure in strong innovation systems with strong institutional and infrastructural support for innovation activities. According to Arocena and Sutz (2002, 5), the approach has mainly been used as an ex-post rather than an ex-ante concept, and has thus not been used to the same extent in systems building which, in many cases, is the most appropriate approach in developing countries where existing systems can be characterized as fragmented and weak. One of the most important points of criticism is directed toward the weakness in recognizing political and power aspects of development. Conflicts over income and power are in many cases at the heart of innovation processes, which is true at the global level as implied by Chesnais above, but also at the local level where increasing learning and innovation can lead to polarization in incomes and employment. Finally, the element of corruption is a major factor that breaks down idealized visions of innovation systems at work, as well as the prerequisite of macroeconomic stability.

Franco (2007) focuses on the role played by FDI as a means of international technology transfer, where it is argued that national systems of innovation have a dual function. Firstly, they play a role in attracting FDI types that are "*most conducive to the possibility of positive spillover effects*" (Franco 2007, 5). Also, they play a role in supporting local firms to be more absorptive of these effects. Franco's findings point to the importance of certain components of an innovation system that are most important in these respects, namely a country's education system and its research and development capabilities. The findings also show that institutional variables are not usually taken into account in explaining spillovers, and that the necessary institutions and organizations to support local firms are often lacking (Franco 2007, 24-25). It should be noted that Franco has an exclusive focus on economic and competitiveness in his work, and does not handle the issue of sustainability explicitly. Nevertheless, it is informative regarding the role of governments in handling FDI spillovers.

This chapter has sought to answer the overall research sub-questions how knowledge and technological diffusion processes of transnationals in developing countries can be understood, and in what manner these diffusion processes might be seen as improving sustainable performance. With the purpose of setting up a conceptual framework for the remainder of the present report, a point of departure has been taken in a systems of innovation approach. This approach has helped specify a taxonomy of what constitutes an innovation of the type that might be diffused through the activities of transnationals. Through the same approach, the institutional set-up is viewed as a critical determinant of these processes, and this chapter has duly provided a vocabulary and framework for discussing and analyzing institutions. With part of the main research question of the present report being to find out how transnationals contribute to sustainable development in Costa Rica, the question of sustainability has also been discussed linked with systems of innovation. Lastly, current trends of globalization, increasing FDI and increasing activity by transnationals has challenged conceptions of national innovation systems in different ways, making an analysis of the electronics sector in Costa Rica all the more timely.

4. Globalization, Development and Innovation in Costa Rica

To lay the basis for an analysis of the electronics sector in Costa Rica, this chapter provides an introduction to the country in light of the globalization processes that sharply define its current development path. To the extent that Costa Rica is part of a wider economic regional unit, it is a country that has been subject to the same influences on its development as Latin America as a whole, including macroeconomic effects that have affected its innovation systems and the actions of transnational companies within them. For this reason, this chapter will describe the problem complex, drawing on international development literature. The chapter then reorients its focus toward Costa Rica itself focusing on FDI, the impacts of FDI in its Free Trade Zone regime and the effects of Intel's establishment.

Globalization and Transformations in Latin America

The introductory chapter, focusing on the problem complex related to transnationals at the forefront of FDI and market-driven development in the third world, has shown that their role in promoting a sustainable development path is weighed by challenges on a wide range of fronts. Of those mentioned, these range from matters of legislative enforcement, the diffusion of cleaner and efficient technologies, corporate behavior in labor markets and the greater socio-economic effects of the activities of transnationals on wealth distribution and equity, to name but a few. Introducing the systems of innovation approach has provided a framework in which to perceive these challenges in the context of specific innovation types that may help alleviate them, and the institutional arrangements within a system that may help in promoting the use of these innovations. However, as also illustrated in the previous chapter, present-day globalization processes pose challenges to this approach, including the manner in which transnational companies operate. It has also been hinted that underlying structural conditions in the world economy are behind some of the dichotomies that weaken innovation systems in the third world. For this reason, it is worthwhile to examine the greater geographical context of the Costa Rican case before considering it as an isolated economy. Costa Rica is an embedded part of a wider regional unit, and has been subject to the same influences on its development that have affected the Latin American political economy as a whole. As a small Central American country that inevitably has an interdependent relationship with its immediate neighbors and those beyond, it has a shared history that has had implications for the make-up for its own and similar innovation systems. The following will describe these implications, showing how globalization has taken hold and has driven fundamental changes in this region of the world, and that there are ongoing problems fraught with these transformations; In adapting states and markets to new realities and with the sustainable development imperative ever-present in the background.

Set apart from the sparse systems of innovation literature on economies under development, there is a rich literature in international development studies which deals with the impacts of globalization. Latin America is frequently taken together as an object of study, in light of similar development trends experienced throughout, though it encompasses a great assortment of countries, and as a 'region' spans wider than even a continent. What is interesting to note is that Costa Rica represents something of an anomaly as a country that has in many respects bucked overall trends in a positive manner. In Latin America, Costa Rica might thereby might be said to present a best case, though this will be elaborated on further ahead.

Much of the international development literature surrounding globalization in Latin America centers on a paradigm shift (Gwynne and Kay 1999, 12) that has affected Latin America just as it as

affected countries everywhere. As in the rest of the world, neoliberalism⁸ has impacted macroeconomic conditions deeply in Latin America, which had earlier been deeply grounded in ideologically-grounded policy measures inherent in Import Substitution Industrialization (ISI). Many see neoliberalism as the key factor shaping globalization (Nielsen 2005, 12). The ISI period in Latin America preceding globalization began in the post-1930s following the worldwide economic collapse of that era, when countries began to adopt measures to seclude their economies from the rest of the world. The emphasis was on promoting domestic industrial development and the expansion of governmental involvement into its management. ISI was thus an inward-oriented approach that pursued self-determination and autonomy, in contrast to the colonial period, where liberal market ideology⁹ called for open economies relying on exports of primary products to industrialized countries. The ISI paradigm remained dominant until the 1980s where involuntary changes were made due to a number of internal and external factors. While the biggest economies in Latin America industrialized with some success, ISI largely left the region with inefficient industries dependent on state protection, economies vulnerable once the problems of stagnant export trade and rising instability due to spiraling inflation rates began to make themselves apparent (Gwynne and Kay 1999, 16; Green 1999, 14). Social unrest and persistent economic inequality were some of the symptoms of the deeply-seated problems. A borrowing spree initiated in the 1970s came to a head the following decade when the influx of hard currency stopped, and countries found themselves in the midst of a severe debt crisis during a global recession. In August 1982, Mexico made the 'dramatic' announcement that it would be unable to keep to its foreign debt repayment commitments, and was soon followed by Argentina, Brazil and Costa Rica (Silva 1999, 53; Stiglitz 2006, 36).

External factors then began to play an important role in facilitating major transformations throughout the region. The 'Washington Consensus'¹⁰ forcibly advocated market-oriented reforms at a time when countries in Latin America had nowhere else but the IMF to turn for financial support. As preconditions for financial aid, there had to be reforms on trade and capital market liberalization: rolling back of government, deregulation and rapid liberalization and privatization of state firms. Latin American countries were required to open up their economies to the world market to make FDI easier, increasing the significance of the private sector in particular as the main instrument of economic growth (Gwynne 1999, 83). Through severe fiscal austerity and structural adjustment programs to create a functioning market economy, countries were to aim for export-led growth to encourage diversification in the private sector (Green 1999, 14). However, these paradigmatic transformations were far from problem-free. The initial impacts of following the Washington Consensus fell far short of its intended objectives as Latin America slumped to the most severe recession seen since the Second World War and started off a 'lost decade' of stagnant growth (Green 1999, 14-15; Stiglitz 2003, 86). Imports were slashed through public spending cuts and inflation rate hikes designed to bring down domestic demand, with the resulting trade surplus used to repay foreign debt at the expense of education, health, and infrastructure services, sometimes called the 'social debt'. This was aggravated by an investment collapse as investors took flight and bank loans petered out, leading to a significant decrease of FDI to Latin America during the first part of the decade¹¹. The transition thus often left countries with reduced

⁸ Neoliberalism is taken to mean the resurgence of liberal-minded market ideology (see following footnote) that development theorists use to best describe the current post-1980s paradigm characterizing globalization (Green 1999, 13).

⁹ Embodied especially with the classical political economic works of Adam Smith (*The Wealth of Nations*, 1776) and David Ricardo (*The Comparative Advantage of Nations*, 1817), advocating open trade to ensure the most efficient allocation of resources and maximum productivity (Nielsen 2005, 14).

¹⁰ So-called because it was an agreement forged between the IMF, the World Bank and US Treasury in Washington on what constituted the 'best' policy framework under which developing countries could pursue development (Stiglitz 2006, 16-17).

¹¹ From \$8 billion in 1981 to \$3 billion in 1983 (Green 1999, 15).

room for policy maneuver, ‘supervised’ as they were by the global institutions behind the Washington Consensus (in turn influenced to a great degree by transnationals), and was unable to resolve the region’s external vulnerability problems, even being said to worsen the problems of social exclusion and poverty (Gwynne and Kay 1999, 4, 9). With firms finding it difficult to adapt to the international competitiveness in outward orientation, labor market restructuring was carried out to reduce the bargaining power of trade unions and introduce flexible hiring and firing systems. The result: substantial increases in unemployment, decreases in real wages and real minimum wages, and disproportionate wealth distribution favoring the highest income earners (Gwynne and Kay 1999, 22-23; Green 1999, 22-24).

The 1980s evidently showed no indication of either economically or socially sustainable development. The environmental side of the discourse had never taken center stage in the policy-making arena during this period as other issues seemed more overriding, though conditions governing the environment clearly did not improve either (Barton 1999, 186). It was not until the 1990s that more constructive approaches to the environment began to surface, coinciding with the advancement of the sustainable development discourse and the milestone UN conference in Rio de Janeiro in 1992. In general, Latin America fared better during the 1990s as the tumultuous economic restructuring of the previous decade began to stabilize; capital flows returned, FDI grew¹² and the region achieved moderate growth rates, though still only half pre-1980 rates at 2.9 compared to 5.4 during the 1960s (Green 1999, 17; Stiglitz 2003, 86). However, the increased levels of FDI during this period markedly affected production structures in this period as well as patterns of interaction with the environment. Notably, the expansion of trade and investment was particularly focused on non-traditional exports, and especially centered more on exports in natural resource areas as opposed to manufacturing (Murray and Silva 2004, 117). The manufacturing sectors that did grow were primarily in low-tech goods, with only the largest economies able to make the shift to high-tech exports (Green 1999, 20). When economies thus increasingly began to specialize in the export of primary sectors such as agriculture, fishing, forestry and mining, this in turn put into focus the question of environmental sustainability. In many cases, this export expansion led to detrimental environmental effects such as significant land clearing and poor management of renewable resources, for instance fisheries depletion (Murray 1999, 132-142).

As FDI increased, so too naturally did the presence of transnationals. Neither here were there many noticeable positive indications of sustainability – again, the social aspect was one where the negative impacts were most visible and felt most heavily. When FDI began to grow during the 1990s, a lot of the initial investment largely represented transfers of ownership of previously state-owned enterprises, and was often accompanied by job losses as firms optimized production (Green 1999, 17-18). FDI began to play a more productive role in job creation as the 1990s progressed, but the role of transnationals became controversial. As they increasingly became more important for Latin American economies, they became the major, if not only, importers and diffusers of technology and capital (Murray 1999, 141). This is from some quarters seen as technological and financial dependence. To compound the problem, little technological diffusion actually occurred, and government policies failed to develop indigenous technological capacity to ensure the contribution of transnationals to this process (Gwynne and Kay 1999, 7). Other misgivings include an outflow of profits and the view that in the globalized system, there is little incentive for transnationals to act in a manner explicitly beneficial for sustainable development in a country.

Though conditions improved in Latin America during the 1990s, the region fell back into stagnation and recession towards the end of the decade in step with global trends, and as a whole, developmental results have been mostly mixed. Today, many say there is widespread disillusionment in Latin America with the Washington Consensus, the region seeing a resurgence

¹² From \$6.7 billion in 1990 to \$44 billion in 1997 (Green 1999, 17).

of leftist governments that are increasingly becoming more assertive in local and global geopolitics, including economics (Stiglitz 2006, 36-37). Among them are the governments of Lula's Brazil, Hugo Chavez in Venezuela and Daniel Ortega, his Sandinista party in control of Nicaragua once again. The assertiveness can for instance be seen in global trade talks – displeased with a system where agricultural subsidy cuts have not been reciprocated in developed countries, the latest Doha round talks as well as a recent 'G4' (USA, EU, Brazil and India) round in Potsdam in June 2007 collapsed, due primarily to the opposition of Brazil among others (The Economist 2007, 16). Caught up in the often ill-tempered debate surrounding globalization's effects in Latin America, Costa Rica plays its own unique role, described further ahead.

Transformations of Latin American Innovation Systems

With a specific eye on the effects on Latin American innovation systems, Jorge Katz (2004) is one who has written about the changes that globalization and market-oriented reforms have had on the entire region. The point of departure is the same Latin American historical overview given in the above by international development literature. With an innovation systems approach, Katz attempts to examine why neoclassical expectations in going from 'inward-oriented' and 'state-led' growth strategies to 'market-led' and 'outward oriented' strategies have been proven to be far from realistic. The results in creating sustainable, long-term improvements in economic expansion and productivity growth, in encouraging faster innovation and modernization, are claimed to have fallen far short of expected. Although the issues on hand here are mostly focused on economic productivity and competitiveness and not on sustainability as such, the study nevertheless reveals some interesting points especially regarding the way transnationals under globalization affect national systems of innovation in Latin America.

The study is especially interesting because it highlights the differences in the effects of FDI on Latin American innovation systems under two sharply different conditions, the first being the ISI era prior to the 'Washington Consensus' and the second being the most recent era of globalization and the rapid expansion of FDI. Katz focuses specifically on the conditions for knowledge generation in Latin America, meaning public expenditure on research and development as well as how foreign firms contribute to developing local technological activities, e.g. through 'in-house' engineering and linkages with the local economy. The study notes that research and development has always been low in Latin America as a percentage of GDP, at rarely more than half a percentage point during the ISI era. However, the public sector and public-owned enterprises still accounted for close to 80% of overall research and development efforts, largely due to the conventional wisdom of the time for the public sector to be the main engine for growth. Public research and development centers and laboratories were established and support given through financial aid, equipment and training, forming the 'backbone' of national innovation systems. Foreign firms, on the other hand, are said to have contributed to these innovation systems, in contrast to the modern era. As Katz (2004, 381) states, "*Foreign firms did not come to Latin America with the intention of developing local technological activities, but many found that they needed them in order to operate in a highly idiosyncratic and institutional environment... As a result, many firms found it necessary to set up engineering departments and supplier development programs geared to meet the needs, scales and organizational patterns of local production.*" During this era, the activities of transnationals are seen to have been quite significant, with these engineering departments becoming important over time as part of the incremental technological knowledge that was built up during the ISI era.

Under the current globalization era, the contrasts with the above have caused implications and challenges for public policy-making. Research and development in the public sector continues to remain low, lagging behind on expenditure at levels at no more than one quarter in comparison to developed countries. Compounded with this are changes being made in the manner of public

sector knowledge production. Katz (2004, 384) writes that public research and development institutes and laboratories are increasingly turning to demand-side subsidies for technological activities, forcing them to compete for funds with private research and engineering firms, at the same time as the private sector is being seen to expand its role in education services. Trade liberalization and privatization of state-owned companies is seen to have helped significantly reduce the technology gap with developed countries, with globalization bringing some benefits (Katz 2004, 383-384). Cheaper equipment has been made available, the use of new information and communication technologies is expanding rapidly, just as new computer-based and 'just-in-time' production routines are being diffused within economies. As well, there is an increasing adoption of international quality standards and norms and an upgrading of management skills. One big 'however' is that local research and development and technological capacity is not being brought into the innovation system. Katz (2004, 383-384) writes, "*Domestic subsidiaries of large multinational corporations (MNCs) have now vertically disintegrated their production, becoming part of international integrated production systems (IIPS) co-ordinated by their central offices... Firms have become less vertically integrated, cutting down on the number of parts and components they manufacture internally and outsourcing production services and intermediate inputs. As a result, domestic production chains have become less locally rooted, with local parts and components being substituted by foreign firms.*"

Under these current tendencies, Katz argues that there is a strong need for public policy to focus on strengthening domestic research and development capacity (Katz 2004, 385). It is seen as fundamentally problematic that firms are increasingly relying on imported machinery and equipment, technology and engineering know-how, because it is seen as a mistaken view that 'technology' can be purchased 'off the shelf' without considering local contexts and needs. Katz' argumentation also brings issues of sustainable development into focus, because it is claimed that in areas such as health, education and environmental protection, no country can proceed exclusively on imported know-how. Overall, the policy measures that are called for include significant local research and development and engineering, stronger institutional links between firms, universities and government agencies, and new forms of public/private interaction. The particular issue of encouraging transnational companies to participate more actively in local innovation systems is described as 'worrying' (Katz 2004, 386). What is called for here is the establishment of new partnerships with transnationals, in a manner that requires considerable strategic planning.

Most of the policy priority recommendations by Katz are mirrored by a collection of studies into innovation systems undertaken via the long-running SUDESCA project between Aalborg University in Denmark and several regional partners throughout Central America. An analysis of the entire research paper series would be too comprehensive to include here, though it should be noted that these studies make extensive use of innovation system frameworks to analyze several different industry sectors throughout the region, and are focused on developing policies for supporting innovation and sustainable development (Orozco et al. 2004). Among these are the previously mentioned Ph.D. works by Segura-Bonilla (1999) on forestry in Costa Rica and Orozco (2004) on palm oil cooperatives in the same country. There have also been studies of forestry in El Salvador and Nicaragua (Cummings 1997; López 1997) and studies of the textile industry in Costa Rica, El Salvador and Nicaragua respectively (Vargas 1997; Mena 1997; Amaya 1997), among others. In a meta-summary of the SUDESCA projects findings, the policy recommendations follow very closely in line with Katz (Orozco et al. 2004, 14-24). Firstly, there is a need for developing the knowledge infrastructure in light of pressure stemming from internationalization and globalization, which includes the university level and vocational training. Second, there is a need for 'better institutions' to support learning and innovation capabilities – as with Katz, the focus is on linkages between different actors in innovation systems such as the promotion of networking activities in different sectors. Third, new organizations need to be created, for instance bodies to support certification and labeling for international markets. Fourth, it is claimed that systems of innovation 'clearly' affect

the environment and environmental performance, so policy-making should include the use of a variety of instruments focused on environmental issues. Finally, in agreement with Katz, policy should take local contexts into account and apply the concept of innovation systems in Central America keeping in mind conditions of poverty, insecurity and poor health. It is argued that the approach is both possible and meaningful to apply to Central America and that it is not necessarily a contradiction to stimulate technology and knowledge while at the same time focusing on basic living conditions. It is recommended that policies need not only support learning and innovation, but also channel substantial portions toward alleviating poverty, though this is not seen as an easy task.

To conclude this section with a subjective commentary on the use of innovation system approaches on Latin and Central America, this author believes that the theorists who have formulated policy recommendations have in fact done well to recognize that globalization has stunted local knowledge building capabilities to the detriment of the countries' overall development trajectories. The recommendations appear ambitious, especially because technology and research and development capacity-building in Latin America have traditionally been given low priority and continue to be so. To change these institutionally grounded and set patterns would seem to be difficult, as even admitted to by the theorists themselves. Herein lies the critique, for it may be argued that even with a transformationalist approach to globalization that this author shares, it remains to be seen if the above policy recommendations are workable when applied even in those countries where some have claimed success in harnessing globalization. Costa Rica is sometimes seen as one of these countries. With this critical starting point, the following sections re-orient the focus of this thesis toward the innovation system analysis of Costa Rica and its electronics sector.

An Introduction to Costa Rica

The question of sustainable development under globalization in Latin America, with increasing volumes of FDI inflows driving development, is particularly interesting to witness in Costa Rica. One of the small southernmost countries on the narrow Central American isthmus bordering Panama to the south and Nicaragua to the north (see Figure 13), Costa Rica is inhabited by some 4 and a half million people of primarily European and mestizo (mixed-race) extraction¹³. As most of the region, Spanish colonial rule has left the country overwhelmingly Spanish-speaking, with Roman Catholicism the predominant religion (92% Christian, 76.3% Roman Catholic) (CIA 2007). The country has the highest standards of living in Central America and, unique to the region, has a long-standing democratic tradition, the only country in Latin America to have experienced no democratic breakdown between 1950-1996 amidst recurring cycles of poverty and dictatorship (Vorhees and Firestone 2006, 35; Molina and Palmer 2006, 141). Extraordinarily, it has been without any armed forces since they were abolished by the constitution it adopted in 1949. A popular tourist destination, tourism being the biggest source of foreign exchange earnings since 2001, Costa Rica today attracts Europeans and North Americans alike who among other things are drawn to the country's rich biodiversity with the highest species count (615) per 10,000 sq km in the world, and a third of its area under environmental protection (Nielsen 2005, 27; Vorhees and Firestone 2006, 43, 54-55). The *Lonely Planet* writes that Costa Rica is unique for its 'green' economic revolution and is a 'pioneer' in sustainable development, "... providing a model in which economic and environmental interests are complementary" (Vorhees and Firestone 2006, 35, 43). However, even this renowned travel guide series is not so easily prone to simplification. It observes that at this particular junction in time, developments in Costa Rica are not happening without

¹³ Population 4,133,884 according to the *CIA World Factbook* 2007 estimates, 4,402,251 in 2006 according to CountryWatch (2007). Demographic break-down is: European descent (including mestizo) 94%, African 3%, Amerindian 1%, Chinese 1%, Other 1% (CountryWatch 2007, 2).

serious strain on the environment and on the fundamental democratic institutions that are said to have been the hallmarks of Costa Rican history.



Figure 13 – Regional Map of Central America (CountryWatch 2007, 5).

It would appear beneficial to examine exactly why the institutional setting in this country appears better developed compared with its Latin American peers and see how Costa Rica either followed or deviated from development trends in the region as presented in previous sections. As with the rest of Latin America, Costa Rica shared the experiences of colonialism and has always been heavily dependent on commodity exports, first coffee and then bananas (Vorhees and Firestone 2006, 35, 39-40). As distinct from Latin America as a whole, Central America has always been a region of small, economically vulnerable and trade-dependent states surrounded by larger and more industrialized economies, so that even during the ISI era there was a high degree of foreign ownership and penetration of US transnationals, albeit under a high degree of state oversight and intervention (Klak 1999, 98-100). This was no different in Costa Rica, but if anything, the coming of the neoliberal era and globalization has meant an even greater emphasis on attracting foreign investors for export markets – from the middle to the late 1980s, growth in nontraditional agricultural exports was 348% (Klak 1999, 100; Gwynne and Kay 1999, 20). Previously, under ISI, Costa Rica accumulated a large foreign debt as with the rest of Latin America, and was among the first to default on its debt payments after an economic crisis in 1981 (Nielsen 2005, 26). As a result, it quickly acquiesced to IMF structural adjustment programs and was a heavy recipient of US foreign aid. Despite following overall Latin American developmental trends in this manner,

however, Costa Rica managed to achieve higher rates of economic growth than most of its neighbors during the 1990s, and kept to its long held commitment to social spending (Sánchez-Ancochea n.d.(a), 33-34). In addition, almost uniquely, Costa Rica has managed to move into new economic sectors with higher technological content, the growing tourism sector and electronics now accounting for the vast majority of foreign exchange earnings at the expense of coffee and bananas (Sánchez-Ancochea n.d.(a), 34; Nielsen 2005, 27). Figure 14 shows how non-traditional products have outstripped the importance of traditional coffee and banana production by 90% to 10% in 2005 from 13% to 72% in 1963.

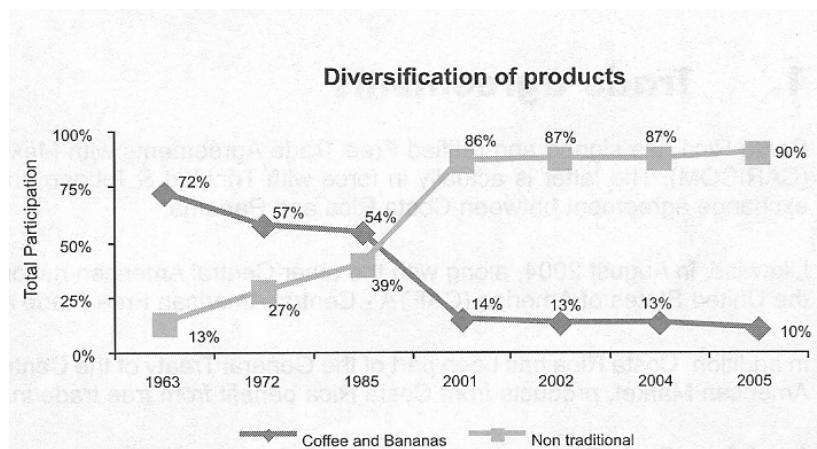


Figure 14 – Diversification of products in Costa Rica 1963-2005 (PROCOMER 2007, 17)

These developments have not happened without putting considerable strain on the democratic institutions Costa Rica has built up over time. University of London-based Costa Rican economist Diego Sánchez-Ancochea (2003, 2-3) writes that Costa Rica has been particularly successful in attracting FDI in new sectors of the economy, including high tech, but at the same time, income inequality during the 1990s has steadily increased, with the country experiencing "... intense difficulties to maintain the quasi-welfare state that had built during the 1950s, 60s and 70s". Sánchez-Ancochea (2003, 34) goes further to elaborate:

Costa Rica constitutes an excellent showcase of the impact that globalization has so far had on developing countries. Economic growth performance in Costa Rica has been better than in most neighboring countries and exports of manufacturing goods has been impressive. Nevertheless, economic growth has been lower than in the preceding decades and volatility has increased. Costa Rica has also been unable to maintain the expansion of public spending in health and education that had characterized its development model during the 1950s, 60s and 70s. Partly as a result of the crisis of Costa Rica's welfare state income inequality has increased and new social problems such as crime and violence has [sic] appeared.

This is strongly suggestive that, now more than ever, Costa Rica is at a crossroads in its bid to reach developed nation status. However, its unique success in diversifying its economy should not be so easily discredited, for it has not been without conscious effort and planning that the new tourism and electronics sectors have surpassed the traditional primary sectors in importance. Indeed without the social investment of its state institutions throughout the previous decades (creating a stable political environment, investment in infrastructure and nurturing an educated workforce) it could be argued that the successful interplay with new FDI partners might not have succeeded. This in effect turns the above perspective on its head, for while it is wary of globalization eroding away at Costa Rica's welfare state, it also perhaps shows that the state institutions built up earlier have enabled the country to better manage its effects.

An example of the above is the case of Costa Rica having been able to attract Intel to invest in the country. The *Lonely Planet* offers an introduction into this famous case (Vorhees and Fireston 2006, 160). Intel, the leading manufacturer of the Pentium microprocessors used in personal computers, is one of the highest-profile transnationals around and was scouring Latin America in the 1990s for a place to establish a new base of operations. Costa Rica didn't even make the initial list of countries for Intel's scouting team, which included the bigger economies of Brazil, Chile and Mexico. It was disadvantaged by being small and ranking among the most expensive countries in the hemisphere. Intel was lured to assess what Costa Rica had to offer, however, and the sales pitch proved very convincing. Attracted by an educated and computer-literate, English-speaking workforce, a history as a peaceful democracy and high penetration of internet services, Intel decided to invest in the country. Production of microprocessors began in 1998. Costa Rica offered an attractive piece of property, very generous tax breaks and also offered to collaborate with Intel by investing in its school and university systems to accommodate its workforce requirements. More importantly, even though Costa Rica was eager to attract FDI, the collaboration wasn't so one-sided that it didn't place demands on the company. The country did not wish to see its environment compromised, and convinced Intel to keep its most water-intensive and toxic production processes in the US, as well as ship all waste products out of the country for disposal. Intel's investment was seen as a flagship success for Costa Rica, and produced a signaling effect that it was hoped would cause other similar companies to follow suit. Indeed, some did. Today, Intel remains a potent force in the Costa Rican economy, accounting for some 10% of GDP and 40% of exports, with local talent responsible for product design and software development.



Figure 15 An estimated 23,500 protesters march against CAFTA on the streets of San Jose, Costa Rica's capital, on February 26, 2007 (Stanley 2007, 1).

The above might be seen as an exception rather than the rule, FDI in developing countries rarely being so unambiguously positive as presented in this case. FDI remains a contentious issue in Costa Rica, as events during the course of 2007 have shown. A running debate throughout the previous year on the opening of Costa Rica's markets to foreign capital was centered around the extremely controversial Dominican Republic and Central American Free Trade Agreement (CAFTA-DR, popularly referred to as CAFTA or the 'TLC' in abbreviated Spanish¹⁴), which the country signed as early as 2004 (Nielsen 2005, 24). The agreement is designed to remove trade barriers between its signatory parties and covers the United States, Costa Rica, Honduras, Nicaragua, El Salvador and later the Dominican Republic. Until a referendum was taken on October 2007, Costa Rica still needed to ratify the treaty before it could actually take effect. The vote passed with a slim majority of 51.7% after months of public debate, the first free-trade pact in the world to be put to the vote, and as the unprecedented first referendum to be held in Costa Rica ever since it voted in favor of independence from Spain in 1821. The CAFTA issue has been a divisive one in Costa Rica ever since it was first signed. To illustrate, the incumbent president, Oscar Arias, won the 2006 election by a narrow 1.2% margin of popular votes

¹⁴ Tratado de Libre Comercio.

(18,169) amidst investigations of voting irregularities, against an opposition party new to the scene and CAFTA as the dominant campaign issue for the two parties (Vorhees and Firestone 2006, 34).

While the CAFTA vote may have marked a defining milestone for Costa Rica for its future development to pave the way for further increases in FDI, it is worthwhile to examine more closely how FDI patterns have been historically and what this has meant for the electronics sector, especially following Intel's investment.

Costa Rica and Foreign Direct Investment

It is claimed that Costa Rica began to adopt an economic development model based on exports in the mid-eighties, when the turning point was achieved for non-traditional products to surpass the traditional production of coffee and bananas even though their growth in volume and value has increased (PROCOMER 2007, 17; CINDE n.d.). Likewise, it is claimed that efforts on behalf of the productive sector as well as national authorities have resulted in an increase in knowledge-intensive or science-based exports from 8.5% of the value exported in 1994 to 12.5% in 2005 (PROCOMER 2007, 17). Regardless of the degree to which this can be attributed to strategic government economic policy planning, it can be seen that FDI has grown considerably in Costa Rica during the past 20 years, after the country managed an economic recovery in the wake of the economic crises that affected the majority of Latin American countries (CINDE n.d.). Figure 16 shows the development of FDI inflows from 1986 through to 2006, and reveals that overall trends have mirrored the global FDI patterns of a surge beginning in the early 1990's, a dip at the turn of the millennium following the global recession of the time, and renewed activity following it.

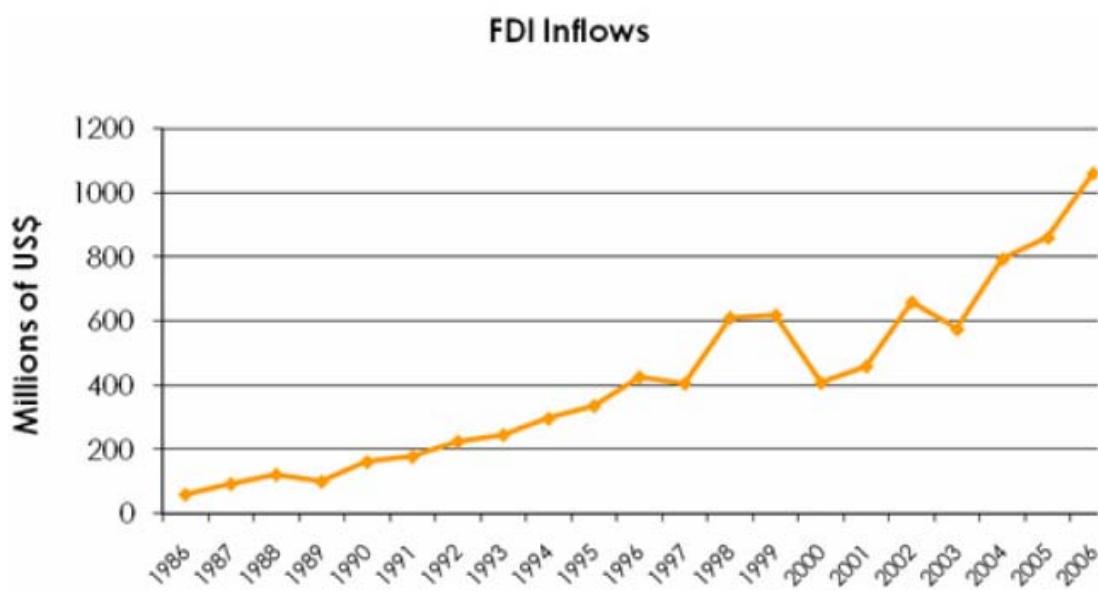


Figure 16 – FDI inflows to Costa Rica in millions of US Dollars (CINDE n.d.).

One important factor that is claimed to have helped Costa Rica generate the foreign exchange reserves needed to pay its way out of the 1980's debt crisis is the establishment at the time of such new trade regimes as the Free Trade Zones, which served as an institutional set-up that attracted a wave of investment from transnational companies (CINDE n.d.). Initially the wave of investment came from basic manufacturing activities such as textiles and low-value-added electronics manufacturing. Over time, as the secondary and tertiary sectors acquired greater importance in the Costa Rican economy as a whole, the tendency was seen replicated in the structure of

investments and new types of activities began to be seen, textiles and primary production giving way to more advanced manufacturing and new sectors such as food products, financial services and tourism entering the picture. The services sector in particular has grown so that today it accounts for 50% of participation within the country's GDP (CINDE n.d.). Figure 17 shows a breakdown of FDI in the 1990-2006 period to confirm the rise in importance of new economic sectors, as well as the continuing, though slowly declining importance of manufacturing activities.

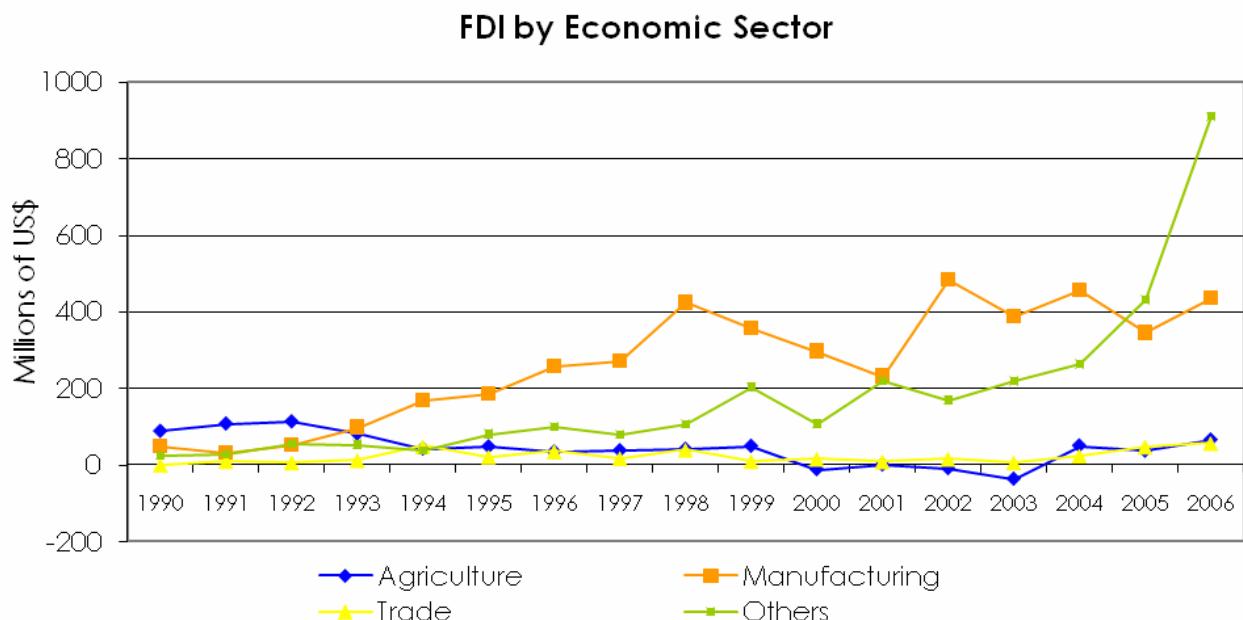


Figure 17 – FDI to Costa Rica by economic sector in millions of US Dollars, based on statistics from the Central Bank (CINDE n.d.).

Essentially the same thing can be seen in greater deal when examining how GDP contribution is distributed by sector in Costa Rica on Figure 18, though it should be noted that FDI is not separated from the nationwide GDP production here. Outside of services combined, manufacturing accounts for the single greatest contribution to the country's GDP.

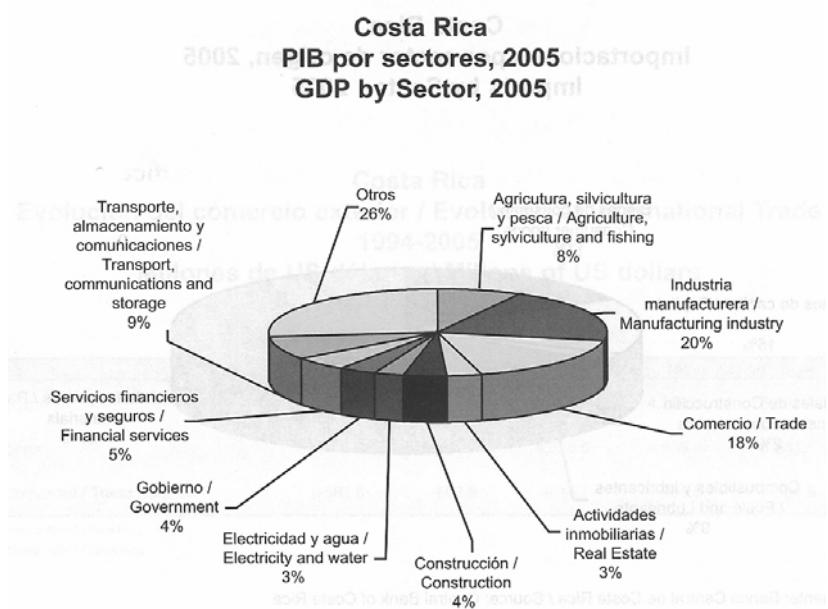


Figure 18 – GDP breakdown by sector, 2005 (PROCOMER 2007, 33)

Examining the export structure in greater detail reveals the contribution of the electronics sector in particular, where it can be seen that at 30%, it is the segment of the Costa Rican economy with the greatest importance, see Figure 19. Supporting data shows that in 2005, agricultural exports accounted for 1.45 billion US Dollars while industry as a whole accounted for 5.37 billion, with electronics alone at 2.12 billion (PROCOMER 2007, 37). In terms of products traded, 'Integrated circuits' and 'Other parts of modular circuits' in 2005 accounted for the greatest percentage shares of traded exports at 11.5% and 9.7% respectively, followed by 'Textiles' (7.5%) and 'Bananas' (6.8%) (PROCOMER 2007, 34). The percentage shares for the industrial sector by itself show that electronics stand even more out when agricultural products are left out, with 'Integrated circuits and electric micro-structures' accounting for 18.9% and 'Other parts for modular circuits' at 9.8% in 2006 (Cámara de Industrias 2007, 34). The main recipient countries for Costa Rican exports are the United States, Hong Kong, the Netherlands, Guatemala and China, with the United states alone receiving 37% and the lion's share of exports as of 2005 (Cámara de Industrias 2007, 35).

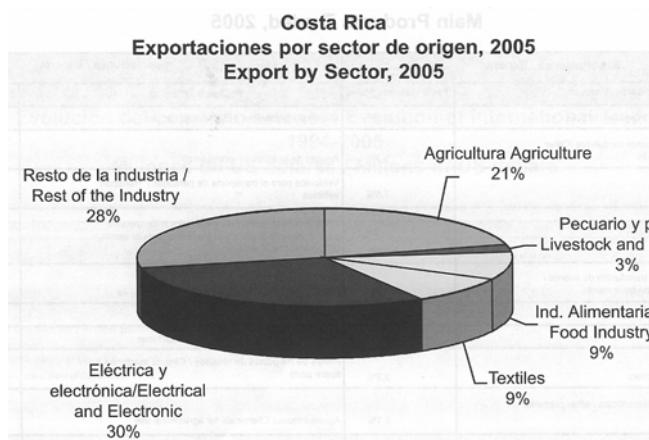


Figure 19 – Export breakdown by sector, 2005 (PROCOMER 2007, 33).

Quantification of FDI has shown the degree to which manufacturing and the electronics sector in particular have been some of the most important contributors to GDP and exports in Costa Rica in recent times, though not forgetting that the service sector is experiencing burgeoning growth. Still a further distinction might be made regarding FDI, namely showing how exports specifically stemming from the Free Trade Zone regime stack up against regular exports. This is an important distinction for this thesis because the qualitative innovation system studies into electronics companies further ahead is limited to companies under the Free Trade Zone regime. By definition, Free Trade Zones are primary extraterritorial customs and fiscal operations zones authorized by the executive branch of government, which constitute delimited areas with no resident population (PROCOMER 2007, 22). Companies setting up operations in Free Trade Zones enjoy special tax exemption benefits on for instance income and imports of raw materials as designated under the specifics of Law 7210. They serve as a special institutional set-up with the aim of providing special incentives for FDI to the country, and may also be argued to be an important element in the functioning of Costa Rica's national innovation system, and for the electronics sector innovation system as well. Figure 20 shows that exports originating from the Free Trade Zones, or 'Zona Francas', make up the majority share of exports, accounting for a little over half.

Régimen	2001	2002	2003	2004	2005
Zona Franca / Free Trade Zones	2,377.5	2,665.3	3,326.3	3,241.7	3,698.3
Régimen Definitivo / Regular Exports	2,317.5	2,296.5	2,486.6	2,706.3	2,965.6
Perf. Activo / In-bond Export Manufacturing System	345.0	332.5	309.0	333.3	336.8
Total	5,040.0	5,294.3	6,121.9	6,281.3	7,000.6

Figure 20 – Evolution of exports by regime 2001-2005, in millions of US Dollars (PROCOMER 2007, 38).

To illustrate further, Figure 21 shows that the percentage of total exports made up of Free Trade Zones have hovered at the roughly same level during the entire 1998-2006 period. It is apparent from the market data presented that the Costa Rican Free Trade Zone system has a significant bearing for the country's economy as a whole. However, as an institutional set-up it remains to be seen if this regime has had any significant positive benefits other than contributing to overall macroeconomic performance with the generation of exports. From an innovation systems approach, evidence of contributing to the social dimension of sustainability is a question that may be posed, for instance do the Free Trade Zones and the companies who operate within them contribute to the creation of high value jobs? The following will examine a study made into these developmental impacts of the Costa Rican Free Trade Zone System.

Free Trade Zone Exports as % of Total Exports

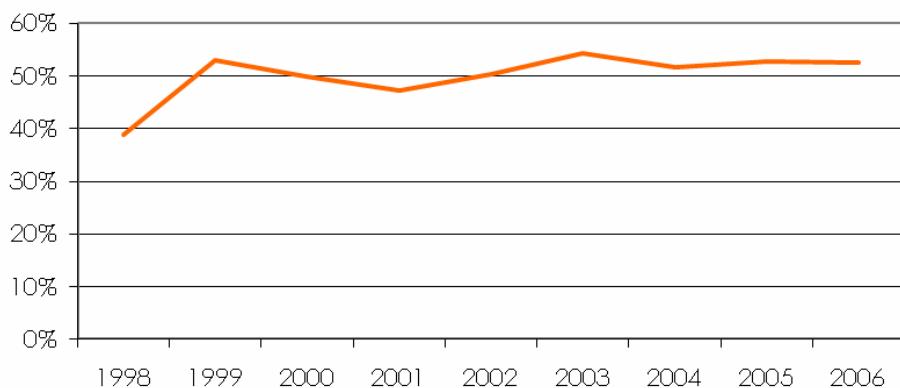


Figure 21 – Free Trade Zone Exports as a percentage of total exports 1998-2006 (CINDE n.d.).

Impacts of the Free Trade Zone System

A study into the Free Trade Zone regime in Costa Rica has been done on behalf of the Organization of American States (OAS) by Monge-González, Rosales-Tijerino and Arce-Alpízar (2005) of the Office for Trade, Growth and Competitiveness. The study is titled *Cost-Benefit Analysis of the Free Trade Zone System: The Impact of Foreign Direct Investment in Costa Rica*, and looks into the developmental impacts of the regime over the past 15 years with an eye toward examining the productive linkages between transnationals and locally-based suppliers and analyzing some of the main channels where knowledge spillovers take place. It is a study that was instigated by PROCOMER (Costa Rica's Trade Promotion Office) because it came to be realized that there have been few analyses of FDI associated with Free Trade Zones in the country. Also, the study was initiated because developments in trade regulation from the World Trade Organization have begun to impose tighter restrictions on developing countries in terms of attracting FDI, threatening the basis of Free Trade Zone systems all over and causing Costa Rica to be faced with policy implications in this regard.

As part of an outward-oriented economic development strategy aimed at diversifying Costa Rica's productive basis in response to the economic crisis at the time, Free Trade Zones (or FTZs) emerged in Costa Rica in 1981 with the promulgation of law 6695, the Export Processing Zones and Industrial Parks Law (Monge-González et al. 2005, 7). Initially, the law was designed to stimulate development in lesser-developed areas of the country, and authorized FTZs to be established in the provinces of Puntarenas, Limón and Guanacaste away from where economic activities are concentrated in the Central Valley area near the capital of San José. It was found, however, that investments in these outlying provinces did not arrive at the levels hoped for in these areas, due to a lack of infrastructure and human resources that were not available. Initial legislation on FTZ's also placed restrictions on which activities were allowed to take place by firms who wished to establish themselves under the system, excluding services. In 1990, Law 7210 amended this situation and remains the legislative foundation of the FTZ regime today, placing no constraints on the activities of firms in terms of markets or product types. The specific incentives in the FTZ system to attract FDI are fiscal in nature and are mostly based on taxation exemptions on imports and profits. They are as following (MIGA 2006, 8):

- 100% exemption on import duties on raw materials, components and capital goods
- 100% exemption on taxes on profits for eight years, and 50% on the following four years¹⁵
- 100% exemption on export taxes, local sales and excise taxes, and taxes on profit repatriation
- 100% exemption on municipal and capital taxes
- No restrictions on capital repatriation or foreign currency management
- Fully expedited on-site customs clearance
- Ability to sell to exporters within Costa Rica
- Ability to sell up to 40% in the local market with exemption from sales tax

Seen over time, the FTZ regime in Costa Rica has benefited from an increase in overall FDI especially since the second half of the 1990's as high technology and services companies increased their investment activities in line with overall FDI inflow patterns (Monge-González et al. 2005, 10-11). Although FTZs have not increased their percentage share of total annual FDI inflows and have remained relatively constant at around 45%, it is claimed that most of the high-tech firms and international service providers are operating under the system. This is seen in how the make-up of firms within the FTZ system has shifted markedly from when the system was first introduced to today, illustrated on Figure 22. In the mid 1990's, textiles accounted for 35% of goods exports from FTZs, while this share has decreased to 9.5%. By contrast, exports of electronic and electrical goods have increased from 20% to 47% in the same period, while medical devices and pharmaceuticals likewise increased their share from 5.9% to 13.2%. Much of the reason behind the change of composition is, as claimed in the OAS study, that while some of the lower value-added textile firms moved out of the country in search of lower production costs, the country reoriented its strategy toward attracting activities with a high demand for skilled labor where Costa Rica is claimed to have an advantage. Undoubtedly, however, much of the difference in the composition of export goods in these two points in time is also simply because of the establishment of Intel, and

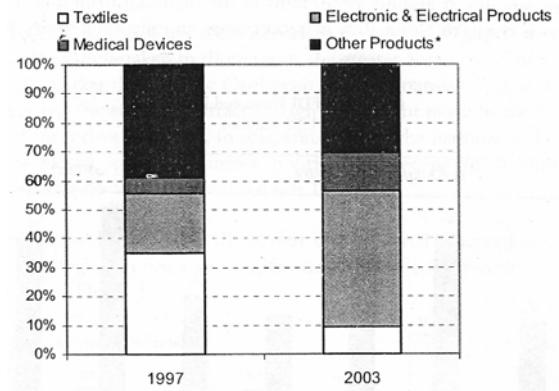


Figure 22 – Composition of goods exports from FTZs, 1997 and 2003 (Monge-González et al. 2005, 12)

¹⁵ This is extended to 12 years and 6 years respectively, if a company establishes itself in a relatively less-developed area (Monge-González 2005, 8).

indeed the OAS study does point out that since Intel accounts for a significant portion of FTZ activity, it is necessary to examine how value added in FTZs has evolved over time with and without Intel (Monge-González et al. 2005, 12). Taken together, value added¹⁶ by FTZ firms increased with an average annual growth rate of 31.4% from 1990 to 2003 (see Figure 23 for an illustration), however even without Intel this figure remains high, with the average annual growth rate at 20.5%. When looking at the export record of FTZ firms, the data shows a similar tendency. Including Intel, FTZ exports have posted an annual growth rate¹⁷ of 31.4% in the 1990-2003 period (though, as shown in the previous section, it has remained relatively constant as a percentage of total national exports in recent years). Without Intel, this figure still remains significant at 25.8%. A decline in overall export performance is detected in the period between 2000 and 2001, and is a direct reflection of a sharp drop in Intel's activity following the global recession at the time.

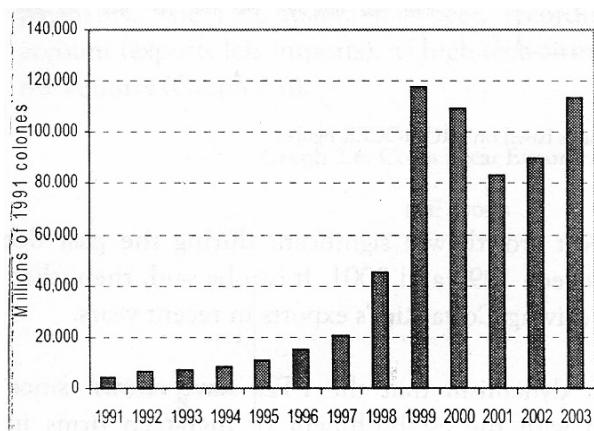


Figure 23 – Value added by FTZs in 1991-2003 in millions of 1991 Costa Rican Colones, based on OAS calculations (Monge-González et al. 2005, 15).

More supportive data reveals further interesting points about the make-up and evolution of companies in the FTZ system. Within the FTZs, just as the United States is the major export market for Costa Rican exports, so too is it the main source of FDI. US capital accounts for fully 62% of companies established within FTZs in Costa Rica, as of 2001. The number of companies has increased from 56 in 1990 to more than 200 in 2002, and companies already in the country continue to reinvest in operations in Costa Rica¹⁸. With regard to the labor market force employed by companies established in the FTZs, the data shows this has increased from 7,000 jobs in 1990 to 35,000 in 2002, representing a change in the percentage of industrial employment from 3.8% in 1990 to 15.6% in 2002.

In analyzing the overall macroeconomic impacts of FDI in the FTZ regime in Costa Rica, the authors of the OAS study firstly point to an increase in production, value added and the contribution to overall economic growth, which over the period of 1990-2001 was estimated at 9.6% (Monge-González et al. 2005, 15). It is claimed that FDI associated with FTZs has been the main driving force of Costa Rica's exports in recent years because of the overall contribution to total exports, and that because of the dynamism seen in the FTZ system throughout the 1990's which is linked with the establishment of high-tech activities, it has generated a gradual 'upgrade' of Costa Rica's exportable products. This is supported by data here and in the previous section. The FTZ activities have also benefited Costa Rica's balance of payment, though this will not be explored in detail here. What is interesting to focus on especially with a systems of innovation approach is how the study has concluded on the effects on FDI in the FTZ system on backward linkages with the Costa Rican local economy.

Backward linkages in the study are understood to mean local purchases by FTZ firms of inputs and services from Costa Rican small and medium sized enterprises (SMEs), which represent indirect exports for the national economy (Monge-González et al. 2005, 19). In absolute terms, these purchases have shown a rising tendency over time in the 1993-2002 period. However, when compared with the purchases of raw materials, mostly from abroad, these local purchases

¹⁶ Value added refers to the additional value created at a particular stage of production. In the OAS study it is measured in terms of billions of Costa Rican Colones (Monge-González et al. 2005, 12).

¹⁷ Measured in terms of millions of US Dollars (Monge-González et al. 2005, 12-13).

¹⁸ In the 1997-2003 period, around 60% of FDI inflows have been due to investments by companies already in Costa Rica, both within and outside of the FTZs (Monge-González et al. 2005, 14).

represent on average only 6% during the same ten year period. The increase in the evolution of local purchases by companies in the FTZs is illustrated in absolute terms on Figure 24.

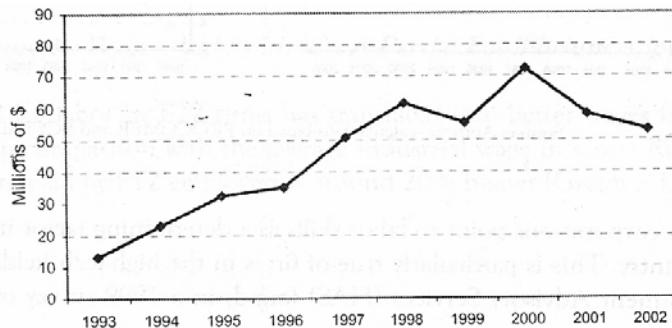


Figure 24 – Local purchases by FTZs in Costa Rica, based on OAS calculations (Monge-González et al. 2005, 19).

Further important impacts of FDI in the FTZ system that the study highlights is that there has been an increasing demand for skilled labor since the 1990's. As earlier mentioned, the number of jobs has increased from 7,000 to 35,000 in the period from 1990-2002. It is claimed that with the investment in especially the electronics and medical equipment sectors, an increasing demand has been seen for more highly skilled human resources. The OAS cites a study by Rosales and Gibson (2001) finding that for firms in the electronics and medical devices sectors, education indeed is one of the main factors that transnationals have pointed out as reasons for investing in Costa Rica. The findings of the cited study are given below on Figure 25, where it can be seen that skills and abilities, learning speed and education together make up the three most important factors. From an innovation systems approach, the empirical findings present some tangible evidence to show that the level of latent knowledge and education in the workforce is indeed an important factor for FDI companies. One may argue that this constitutes a positive interrelationship between market actors in the FTZ regime and the labor force, both components of the national innovation system, and with both components gaining from it.

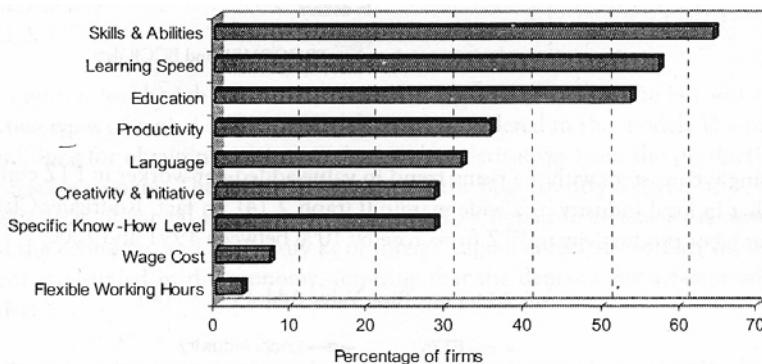


Figure 25 – Determinants of Labor demand by FTZ companies in Costa Rica (Rosales and Gibson, 2001; Monge-González et al. 2005, 21).

However, when returning to the issue of backward linkages between transnationals and local firms, the data suggests that the existence of very few purchases of local inputs and services, and reveals a large gap between the activities in FTZs and the Costa Rican economy at large. From an innovation systems standpoint, this can be construed as a barrier for the notion of spillover effects from transnationals. It can be argued to constitute a negative interrelationship between market actors in the FTZ regime and locally based companies as components in the national innovation system. The OAS study looks more deeply at this issue. For Costa Rica, there is virtually no literature on the topic of positive spillovers stemming from FDI, and international studies fail to

consistently convince that spillover benefits occur (Monge-González et al. 2005, 27-28). However, in analyzing the Costa Rican case specifically, the OAS study points to certain measures that the country has begun to take that show potential for developing the right sort of linkages with local companies. Specifically, the recent institutional set-up (a designed, formal organization and an institutional innovation type as understood by Orozco) of a domestic supplier program has been seen to meet early success in establishing links between transnationals and local companies. This program, a joint effort by a number of public, private and academic agencies and supported by the Inter-American Development Bank, is named Costa Rica Provee. This author has interviewed the director of the Costa Rica Provee program, and its activities will be discussed in detail further ahead. Here, it is sufficient to state that the OAS study has found that the number of linkages that have been created through the work of the Costa Rica Provee program have been increasing since it was set up in 2001¹⁹.

The OAS study goes further in the analysis of backward linkages by examining already existing links with local companies. The study finds that the estimated 143 local companies producing inputs and services to transnationals in the FTZs have the following characteristics: A majority of 75% have only begun operations within the last 20 years when the Costa Rican economy was opening up, and most of them are micro, small and medium sized enterprises employing between 5 and 30 employees (Monge-González et al. 2005, 29). The study shows only 22.6% of the companies have had a relationship with transnationals prior to Costa Rica's opening up of the economy during the 1980's. This has been taken to mean that one important impact of FDI in the FTZs has been to create new markets for local suppliers of inputs and services, and the study implies that Costa Rica is still on a 'learning curve' in this respect. The study finds that 70.7% of local suppliers claim to have had a positive impact of their sales performance for being a supplier to a transnational, and it analyzes channels of knowledge spillovers that have occurred, seen below (Monge-González et al. 2005, 31).

- Training from transnationals to help sell inputs and services: Only 27.5% of local suppliers reported that this occurred.
- Hiring of qualified personnel that have previously worked for transnationals (managers, engineers and technicians): 36.2% of managers, 27.6% of engineers and 31.0% of technicians have previously worked for transnationals.
- Number of supplier firms created by former employees of transnationals: 27.6% of local suppliers reported that at least one of their owners had previously worked for a transnational.

Some of the figures in the above study are characterized as being relatively high for an economy like Costa Rica. The hiring of qualified personnel having previously worked for a transnational is particularly highlighted as an indication of stiff competition for this kind of personnel in the labor market. The OAS study bolsters the above analysis with a statistical analysis of knowledge spillovers between transnationals and local suppliers. The results indicate that there is a basis for improving these linkages.

A final and important part of the OAS study focuses on the social impacts of FDI, centered around case studies of two FTZs in the cantons of Cartago and Belén, respectively, both in Costa Rica's Central Valley area. The Cartago site is the oldest industrial park to be established in a FTZ, and Belén is home to three transnationals (Intel, Firestone and Trimpot Electronics) that operate under the FTZ regime and legislative conditions but are stand-alone industrial operations and not located in an industrial park. Four main topics are examined in this part of the OAS study: employment and wages generated by transnationals, productive linkages with local companies, the environmental

¹⁹ 2001:1, 2002:9, 2003:32, 2004:100 (Monge-González et al. 2005, 28).

impact and the social responsibility of transnationals (Monge-González et al. 2005, 47). The findings are condensed below on Figure 26:

Topic	Findings
Employment and Wages	In Belén, as many as 20,000 workers come from outside the canton, whereas in Cartago 94% of workers in the FTZs live in the same city. FTZs were perceived by interview subjects to 'pull up' average wages among national and foreign companies alike. FTZs were also perceived favorably by interview subjects in terms of gender issues and openness in employing women.
Productive Linkages	Belén FTZ companies were perceived favorably in terms of benefiting local firms through purchasing goods and services, and also because of training and awareness campaigns by FTZ companies on environmental and product quality issues. Overall, there are differences between the case studies, Belén reporting average local purchases of 4.8 million US Dollars, while the figure is 900,000 US Dollars in Cartago.
Environmental Impact	Interview subjects viewed FTZ companies unfavorably with regards to air pollution, but less so when asked in comparison to other companies in the area. FTZ companies were on the other hand perceived favorably with regards to water pollution and solid waste. In general, FTZ companies were viewed as setting an example for local companies. Intel was singled out as a company that was most actively committed to protecting the environment, citing the company's reforestation campaigns and their sending of speakers to schools.
Social Responsibility	Interview subjects believed technology transfer to the community occurred through donations of computers to local schools and training for teachers. Cartago FTZ companies had a lower community profile than Belén companies in transferring technology. Intel was again singled out as having played an outstanding role with four community outreach programs for education, environmental awareness, technological awareness and improving living standards. Belén companies were perceived favorably in terms of local infrastructure development, with the FTZ companies funding a highway overpass (Intel) and more than 1 km of sidewalks (Firestone).

Figure 26 – Summary of the OAS multiple interview study on the social impacts of FDI in Cartago and Belén (Monge-González et al. 2005, 57-51)

To offer concluding remarks on the OAS study of the impact of FTZs in Costa Rica, this author can agree that the institutional set-up for attracting FDI within this specially designed tax-exemption framework has had benefits to the country in terms of economic performance and upgrading the technological level of its overall production. It is noticeable that a running feature throughout the study is the effect of Intel's establishment in the FTZ system as having possibly been the single, most important factor in improving the performance of the country on both counts. With an innovation systems approach, certain points of critique may be placed on the conduct of FTZ companies, particularly in the area of backward linkages with the local economy. It remains to be seen if designed institutional innovations such as the Costa Rica Provee program will help alleviate the problem of FTZ companies essentially operating as isolated enclaves in the economy, with a limited occurrence of knowledge spillovers. By the same token, it remains to be seen if the issue of developing local linkages is in fact only a question of time for the Costa Rican local economy to mature to globalized market conditions, as implied in the OAS study. The case studies of FTZ companies in the cantons of Belén and Cartago on sustainability issues are quite interesting, and if taken at face value would seem to indicate positive feedback contributions by FTZ companies to the national and local innovation systems they are seen here as being part of. It would appear that certain companies have normatively embedded, sustainable behavioral patterns and take measures to engage with local stakeholders in many areas that help contribute to improving

sustainable performance in local communities. However, it can be argued that the study reveals more about these companies (Intel in particular) than the FTZ system as a whole. In fact, because companies in the Cartago FTZ are consistently perceived of in a relatively lesser light than those in the Belén canton where Intel is located, this author is more inclined to believe that the FTZ companies in Cartago constitute a more representative case study of the whole FTZ system. Nevertheless, the OAS study is indicative of the important contributions Intel has made to the development in the country that make the case of the electronics sector innovation system an especially interesting one. The following section will examine the establishment of Intel in Costa Rica in more depth, as an introduction to the analysis of companies in the electronics sector innovation system.

Inside Intel – Post-Establishment Developmental Effects

Previous sections have made it apparent that Intel's decision to invest in Costa Rica has been key for the country's macroeconomic development in recent times in terms of boosting exports, and also being important for diversifying the production structure from moving beyond traditional coffee and banana production towards high-tech electronics and other new sectors in the economy. It has been seen that on the whole, the FTZ regime which constitutes the institutional framework conditions for Intel's investment has fostered a tendency for transnationals to conduct their operations as enclaves removed from the local economy, with few linkages taking place as a channel for the so-called spillover effect. However, it has also been hinted that Intel constitutes an exception to the rule, with a positive public perception of the company in light of the comprehensive engagement efforts towards local stakeholders in areas that do not necessarily have anything to do with maintaining a business, such as environmental awareness and education. This merits a closer look at the developmental effects of Intel's decision to invest in Costa Rica and see what implications this has had for the electronics sector innovation system.

With an innovation systems approach as the chosen conceptual framework for an analysis of the electronics sector, a natural starting point is a study by Vargas and Lindegaard (2002) into the impacts of Intel's investment into Costa Rica using the same framework. The study, titled *New Economies and Innovation for Developing Countries: The Case of Intel in Costa Rica*, aims in particular to ascertain if the case of Intel constitutes what the work calls an 'classic island development process', drawing a parallel to the so-called 'maquiladora' island developments seen in Mexico which have severe negative associations to them. Briefly, maquiladoras, or maquilas, are foreign-owned, low value added, export processing assembly plants that have been established along the Mexican-US border exclusively using imported machinery and materials, and have been historically controversial because these operations have been severely destructive on the environment and on human health (CorpWatch 1999). The study uses statistical methods on a number of Central American countries²⁰ to examine two important factors used in the analysis of Intel in Costa Rica. First, the study examines export specialization patterns in the Central American countries because "*The specialization pattern of the economy is a central aspect of the study of National Systems of Innovation (NSI). The dynamic and the structure of the pattern signify the base from where a particular country can learn and innovate. Somehow, we can consider this pattern as a starting point for the understanding of the particular learning processes along the economic structure.*" (Vargas and Lindegaard 2002, 3). Using regression analysis on trade data to the United States and the OECD countries over different time periods²¹, the study finds general

²⁰ The economies examined are Guatemala, Honduras, El Salvador, Nicaragua, Costa Rica and Panama (Vargas 2002, 4).

²¹ 1979-1984, 1984-1988 and 1988-1992 in the first statistical test, and 1979-1992 and 1977-1994 in the second (Vargas 2002, 4).

increasing tendencies which are especially pronounced for Costa Rica. However, the analysis is not complete without taking into consideration the second factor, which are the technological specialization patterns in the same countries. As explained, “*The tension between convergent/divergent trade specialization processes on the one side and divergent technological specialization processes on the other and the unclear relation between the processes taken together are all seen as the ‘core of the dynamics of national systems of innovation analysis’*” (Vargas and Lindegaard 2002, 5). The Central American technological exports specialization index which is used for the second component of the analysis is shown on Figure 27. The first important conclusion drawn from the analysis is that the technological specialization patterns are low and haven’t changed over the time period analyzed. Vargas and Lindegaard argue that efforts for attracting FDI “... could contribute to reduce the demand constraints for Science and Technology in production processes, if they really could develop internal linkages with local economy [sic]” (Vargas 2002, 5). However this appears not to have been the case, for while exports in general have increased in the Central American countries, they have not necessarily increased the technological content of production processes, as the analysis of the technological exports specialization index shows.

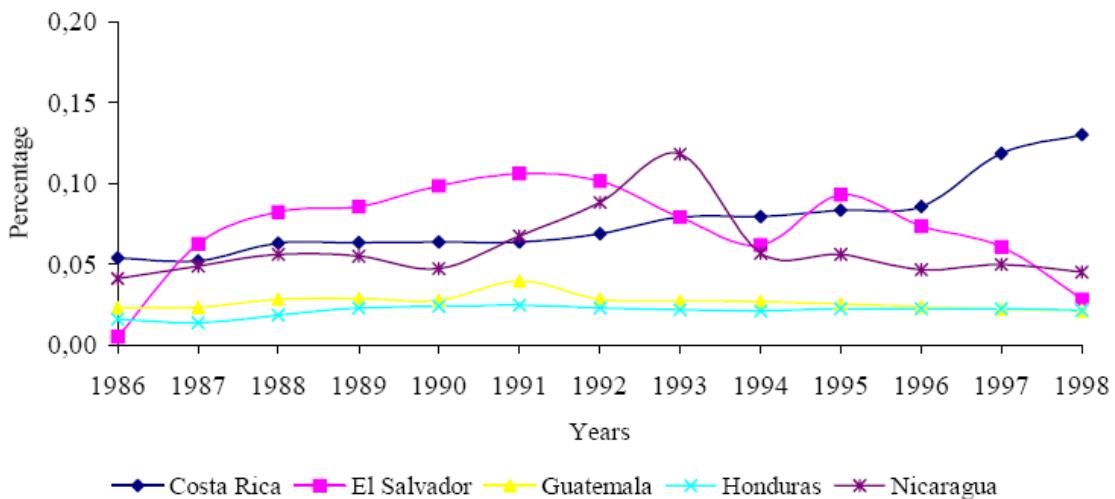


Figure 27 – Central American technological exports specialization index, own elaboration by Vargas and Lindegaard (2002, 6).

One clear exception to the general findings, as can be seen on the figure, is Costa Rica. The increase in the technological specialization index in the latter part of the 1990’s is attributed to the result of Intel’s investment and the ensuing boom in high-technology exports (Vargas and Lindegaard 2002, 6). The second part of the study moves on from the Central American statistical analysis and examines the Intel case more closely to determine whether it is a classic island development process or not, i.e if it is a transnational operating isolated from the economy at large with little contribution to development. The study notes that the immediate effects of Intel’s operations in the country resulted in such an increase on GDP and exports that national accounts needed to be redefined to with and without Intel figures. This immediate impact led some to consider if the Intel investment on this basis marked the beginning of a high-tech cluster development, but the global recession following the IT Dot Com bubble burst at the turn of the millennium affected Intel and Costa Rican exports, and downplayed expectations in this regard. Taking point of departure in the current situation, the study poses the question: What are the main linkages between Intel and the rest of the economy, and is there a chance for promoting a

clustering industrial policy program? If so, what would then be the objectives, told and advantages of such a program?

The study does not in reality give concrete answers to the above questions other than stating that the technological and industrial effects of Intel's establishment are too early to make out, because upgrading of human resources and technological spillovers requires time (Vargas and Lindegaard 2002, 8). The study does examine local linkages as they appear to have happened at the time of writing, to which the following conclusion is drawn: most of the local economy relations with Intel appear to be limited to low value added activities, except for some recent software acquisition from local companies. Although the study claims definite conclusions are difficult to draw, the authors point out that there are some promising early signs of universities showing interest in upgrading human resources training and updating university programs, and also participating in technological transfer. The study of Intel ends with three policy points that should be important to consider for the future (Vargas and Lindegaard 2002, 10):

- The need for implementing local strategies for improved technological links with local organizations in local innovation systems
- The need for upgrading of local human resources and the possibility of transfer of technological capabilities to local companies in hardware product and software activities
- The need to consider local institutional development in terms of facilitating the further establishment of new companies²²

An interview was conducted with an author of this Intel study five years after its publications in order to clarify some of the reasoning behind adopting an innovation systems approach and how it related to the use of the statistical analysis methods. On this question, Vargas elaborated (Appendix A):

... One of the major questions we at the time was to clarify which were really the tendencies into the specialization pattern in the region, because there is a kind of misunderstanding in the situation. Most economists think that to reduce tariffs and open the economy will just immediately help in the process of becoming more efficient in terms of production and getting prices right and resources well allocated. That is basically what the neoclassical economic theory tells you... we were in particular interested in how knowledge moves into the picture, so we tried to make a comparison with this index that was developed by ECLAC and was in the literature in the 60's, this technological specialization index... what we wanted to show was that it was exactly the opposite situation in terms of knowledge and in terms of industry.

It cannot be disputed too strongly that the statistical analysis has in fact shown that export specialization under globalization is not necessarily linked with technological specialization, as otherwise imagined by neoclassical economic theory. On the specific case of Intel's establishment in Costa Rica, the question was posed as to whether there were stronger technological specialization patterns today, five years on from the publication of the study and ten years from Intel's investment. The question intended to see if further high-tech developments had been the result of Intel's establishment, now that a longer period of time had passed to assess the impacts. Although the answer given did not quite answer the question directly, it did reveal some of the authors understanding of how innovation systems work in Intel's case, and expanded on the reasoning behind the three previous policy points on developing local innovation systems (Appendix X):

²² This policy point is unclear in its formulation, and refers to "... facilitating the increase in others[sic] firms agglomeration strategy" (Vargas and Lindegaard 2002, 10)

... It's a new way, I would say. Indeed I would prefer to have an endogenous industrial process... Most of the literature about endogenous growth tells you that you need to have local capabilities, you need to have investment from the government, you need to have entrepreneurs... if you do not have all these conditions, you need to sort of mix. And what we see here is that those free zones are getting into a pattern that helps the economy to increase the technological capabilities in two ways. It will create demand for new human labor with higher conditions, with higher technological capabilities. So for example Intel raise the level of technological capability of the engineers, and that means you have a demand effect on the innovation system. So you have an effect on the educational system to become more competitive to the cost. And the other side, you have the other process which is those companies which are getting into a cluster, that... become those Intel linkages.

In other words, the author of the study believes that local capacity building in the form of public investment and other measures are important for developing higher technological capacity, but in the absence of the ideal conditions needed for this, it is seen that Intel and the FTZ regime alone has had some 'demand' effects on the innovation system in the form of stimulating education capacity in the labor force and the development of some industry cluster linkages. In the interview, Vargas continues by stating that the 'supply' side is one that has not worked quite as well, e.g. the development of a supply of local companies, who are constrained in their attempts to forge linkages with transnationals because of the demands they put on supplier companies. Some of the most important points made during the course of the interview expanded on this, with Vargas saying that one of the biggest reasons for the lack of more coordination in research and development between industry and universities has been the lack of priority given to public sector funding to research. This mirrors the previously mentioned view of Katz (2004). The potential consequences of this neglect is seen by Vargas to mean that in the future, Costa Rica might miss out on the opportunities for attracting FDI activities on higher steps of production, namely in-house research and development activities that transnationals so far have restricted to their countries of origin. Finally, moving away from topics of technology and research and development, in the interview Vargas was asked to put a perspective on the unilateral efforts by companies such as Intel to promote issues of sustainability like the environment with their engagement efforts to the local community. Vargas agreed that transnationals like Intel bring their environmental knowledge to Costa Rica and excel in these areas because they favor the use of international standards, but pointed out that this cannot compensate for the development of local institutions on for instance the environmental area. Specifically, Vargas mentioned two points. Firstly, importance was placed on the institutional set-ups related to enforcement mechanisms of legislation, and secondly, importance was placed on civil society institutions such as the stimulating of NGO activity.

In summary, Vargas and Lindegaard argue that analyzing convergent or divergent patterns in export specialization and technological specialization says much about Central American national systems of innovation. The issue at hand is whether efforts to attract FDI have resulted in demand effects on strengthening science and technology in the host countries, and actual increases in technological specialization. With the exception of Costa Rica, there appears to be no convergent pattern between the two, and this is seen to be some of the direct results of Intel's establishment. Limited evidence of actual linkages between Intel and the local economy have been seen to occur, however, when the analysis looks specifically at the Intel case. In the view of this author, the analysis by Vargas and Lindegaard focuses exclusively on technological specialization in national innovation systems without explicit consideration of how or why this is important for issues relating to sustainable development. The analysis is limited in this respect, and appears to contain normative assumptions that the first factor is an automatic determinant of the other. However, the interview with Vargas shows an expansion of the argument that local capacity building in Costa Rica is necessary in order to gain further benefits from investment decisions such as Intel's, and also offers some perspectives on sustainability issues such as environmental performance. An

important point made here is that it is not sufficient for market actors like Intel to contribute unilaterally to innovation systems with environmental know-how, because this needs to be matched by building up state and civil society institutions in order for the system to work optimally as a whole.

Since the analysis by Vargas and Lindegaard does not go into significant detail about the concrete developmental effects of Intel's establishment in Costa Rica, it is worthwhile to examine a study that goes further into the issue published by the Multilateral Investment Guarantee Agency (MIGA) under the World Bank Group. The 2006 study, titled *The Impact of Intel in Costa Rica: Nine Years After the Decision to Invest*, offers some of the most up-to date information on the subject. It focuses on the post-1996 investment years to trace direct and indirect impacts attributable to Intel's introduction to the country. A timeline showing some of the most significant reinvestment decisions by Intel following its initial investment is given below on Figure 28.

Year	Significant Developments
1996	Intel, the world's largest semiconductor company, announces decision to construct an assembly and test plant in Costa Rica for the value of US\$300 million. Annual revenue sales of USD\$20 billion by the company at this time approach twice the level of Costa Rica's GDP. Initial plans include establishing operation facilities for up to four plants and employ up to 3500. Projected total investment to reach US\$500 million.
1997	Start of construction begins on an A&T plant in April. 'Greenfield' investment at US\$300 million creates 52-hectare campus for A&T of microprocessors, with final plans to establish 2 plants for approximately 2000 employees.
2000	Intel expands into services in Costa Rica with its Latin America Engineering Services (LAES) Group, providing over 100 engineers for global engineering support in circuit design and validation and 40 engineers for design of microprocessor enabling code.
2003	Volume of A&T products represent 22-25% of total corporation sales. 2 plants at full operation. Announcement made in October to expand operations with a third production line for an additional USD\$110 million, to add 600 more employees over 2 years. Third production line to be A&T for chipsets, considered a more value added, more advanced technology product.
2004	Further expansion into services sees the addition of a financial services group.
2005	USD\$260 million to date invested in expansions for the third facility as well as new services. Accumulated investments reach US\$770 million, generate 2900 jobs and a further estimated 2000 indirect jobs. Further expansion into services sees the addition of a procurement and technical assistance unit.

Figure 28 – Timeline of significant Intel developments following establishment (MIGA 2006, 7-8).

The MIGA agency under the World Bank group is a unit that works almost exclusively on economic effects of investment decisions. The study on Intel's impacts deals with some of the same topics that were looked at regarding the effects of the FTZ system in the previous section and replicates some of the findings. Attention is given to the impacts of Intel on macroeconomic performance and local supplier development, but also to developmental and social impacts, including the environment. The findings are condensed in Figure 29.

Post-Investment Impact		Main Findings
Macroeconomic Impacts	FDI	'Rapid' and 'dramatic' impact on increasing FDI flows, with a 50% increase in 1998-1999 compared with 1996-1997.
	GDP	GDP 'surged' through 1997-1999. GDP growth in 1999 was at 8.4% with Intel's contribution but only 3% without it. More than 60% of GDP growth thus directly attributed to Intel. 2000 saw a sharp decline of Intel activity with GDP growth at 1.4% with Intel, but 3% without. Realization for the need to diversify investment projects in other sectors.
	Trade	Evolution of top exports from 'golden bean' (high-grade coffee) to 'golden chip'. FTZ exports surpassed bananas and coffee in 1996-1997. Intel became the top exporting company, microchips became the top export, and electronic components became the top export category.
	Value Added	Value added estimated at US\$90-500 million a year. Direct employment at 2900 jobs, and an average of 2000 in 1999-2004. Intel estimates indirect jobs at 2000 through local purchases: locally acquired direct materials account for 2% of total Intel export value, but reaches 10-12% when goods and services are added. Significant contribution to Belén County through patents and real estate taxes.
Investment Climate		Pre-investment stipulations put conditions on Costa Rica to improve in four main areas: technical education and workforce skills, infrastructure and support industry, permits and construction and tax incentives. Some examples of responses by the Costa Rican government include doubling communications and logistics spending from 1996-2003, upgrading airport facilities and streamlining the construction permit process. Universities made changes to curricula and introduced new courses based on Intel's recommendations.
Costa Rican Industry	The Electronics Cluster	The electronics sector became the most important export sector. Despite efforts by CINDE, the country's investment promotion agency, however, no other global leader in high-tech industry followed after Intel. Some companies considered, but did not invest because of the global economic downturn.
	Support Industry	Satellite offices were established in Costa Rica by some of Intel's global suppliers.
	Local Firms	Some local firms upgraded their operations to supply companies in the electronics cluster, and some won contracts with Intel, for instance in cardboard packaging. Intel is claimed to have tried to increase the local content in its exports and develop a local supplier base.
Developmental and Social Impacts	Technical Education	Reinforcement of technical programs and curricula at three major education institutes (ITCR - Technical Institute of Costa Rica, INA - National Training Institute and UCR - University of Costa Rica) in 1993-2003. English reinforcement program at ITCR. Links with UCR's School of Physics and electronics vocational schools.
	Hands-on Learning	Intel-led programs in teaching students and teachers, and supporting elementary and secondary schools. Includes donations of computers, computer teaching programs, and environmental awareness campaigns and recycling programs.
	Sharing Knowledge, Business Culture and Standards	Investments made in raising of performance standards through continual training for workforce and suppliers. Claimed to have produced a high technological 'halo' effect to encourage entrepreneurs to orient towards technology and innovation. The National Insurance Institute used Intel as a benchmark for creating the country's first national Job Safety and Health Standard.

Figure 29 – Main findings of the study, The Impact of Intel in Costa Rica: Nine Years After the decision to Invest (MIGA 2006).

The findings of the MIGA study condensed above reveal that Intel has contributed positively to a wide range of developmental areas in Costa Rica following its establishment. It is quite clear that an overall positive impression is what the study has intended to present. This author has come across language that has appeared to 'gloss over' some of the less positive findings, for instance on the subject of local suppliers when no supportive data is used to strengthen claims of efforts by Intel to engage more in the local economy. Nevertheless, from an innovation systems perspective the study offers many noteworthy examples of Intel's actively pursued interactions with other

components of the system. From interactions with public agencies such as education institutes and the investment promotion agency, with other actors in the electronics sector such as global and local suppliers, and also with civil society, it can be seen that Intel has produced a demand effect on the innovation system as explained by Vargas earlier in this section. It can be debated whether any designed institutional set-ups as such have enabled Intel to act in this manner: rather, Intel itself has appeared to have stimulated a number of institutional changes in the framework governing FDI into the country and to the economy in general. These changes range from physical changes (development of physical infrastructure), legislative changes (changes in construction permits), normative changes (development of a Job National Health and Safety Standard), and even cultural-cognitive changes (environmental awareness campaigns). In the case of e.g. the occupational health and safety standard and the environmental awareness campaigns, these can be construed as elements in the innovation system that contribute to sustainable performance.

On the subject of sustainability issues such as the environment and occupational health and safety as it relates to the electronics sector, mention is due of a study involving the potential detrimental effects of the sector under development in Costa Rica. This 1998 study, titled *Eco-Efficiency in a High-Tech Cluster: A meta analysis of the evolving high-tech electronics Cluster headed by Intel in Costa Rica*, is a working paper produced by the Costa Rica's INCAE Business School. It is a comprehensive study aimed particularly at understanding the scale and nature of human health and environmental implications for the development of a high-tech industrial cluster (Vieto and Pratt 1999, 7). Meant to identify the weaknesses in Costa Rica in this respect, it also intends to come up with recommendations and strategies addressed toward these challenges. As mentioned, the study is comprehensive, making use of case study experiences of electronics cluster developments in several places around the world, and also goes into specificities of material manufacturing input/output flows of a typical electronics industry and the hazards these pose for human health and the environment. In general, the study is characterized by being an ex ante study into possible future challenges of an evolving high-tech cluster in Costa Rica. It thus does not present an actual account of the developmental impacts of Intel's establishment. Nonetheless, some of the most important findings are examined here.

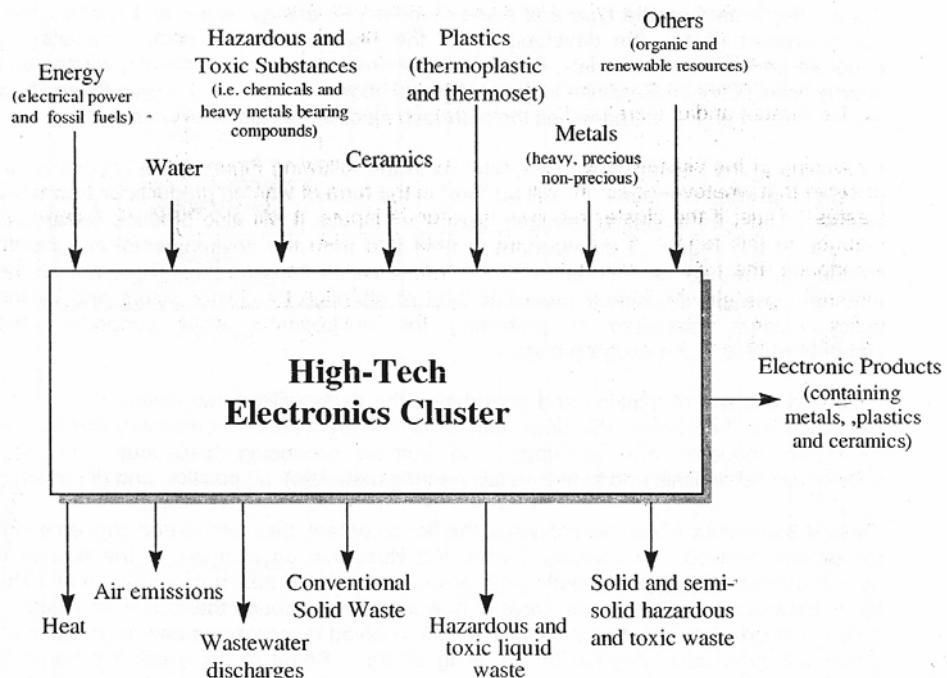


Figure 30 – Categorization of waste, materials and energy flows which will be affected by the evolving electronics cluster according to Vieto and Pratt (1998).

Figure 30 shows a categorization of the most important input/output flows resulting from the development of the electronics sector. These flows cause specific environmental aspect and potential impact categories that much of Vieto and Pratt's (1998) study examines systematically. These analyses will not be presented here, other than pointing out that the identified 'hotspots' in the electronics sector that pertain to adverse environmental and human health affects are focused on the following flows (Vieto and Pratt 1998, 76): 1) inputs and outputs containing hazardous and toxic substances (chemicals and heavy metals bearing materials), 2) plastics and 3) energy. One of the most common materials that flow through a typical electronics cluster is lead, which is highlighted by the study to be a source of great concern because it is a component found in solder, which frequently used in electronics manufacturing operations.

The study describes electronics cluster development in the South-West of the United States as well as in Japan, Scotland and Guadalajara, Mexico, warning that past experiences in several of these cases imply serious potential effects to the environment and human health (Vieto and Pratt 1998, 50-72). Some of the documented issues include exploitation of under-privileged social and ethnic groups, human health hazards (in particular studies on miscarriage rates among female industrial workers), groundwater pollution and resource depletion in the form of lowering of the water table. The potential severity of electronics sector activities as presented here mean that a critical perspective can be placed on the case of Intel at the head of electronics cluster development in Costa Rica. The recommendations in the study on response frameworks to address the potential problems are comprehensive and will not be covered in full detail here. They deal with the role of governments, cluster actors, the academic sector, and NGO's and local communities (Vieto and Pratt 1998, 86-97). These constitute important components in the electronics sector innovation system. Some of the specific recommended approaches to addressing environmental and human health problems by actors in the electronics industry include the following (Vieto and Pratt 1998, 86). They are argued here to constitute sustainable technological innovation types according to the innovation system conceptual framework.

- Substitution of environmentally harmful substances and materials
- Reduction of resource consumption
- Re-use and recycling of resources as much as possible
- Proper disposal of wastes

In the following innovation system analysis of companies already established in the Costa Rican electronics sector, attention has been placed on these aspects of environmental and occupational health and safety management and the degree to which they appear to be used among the interviewed companies. To conclude this section in general, it has been documented that the effects of Intel's establishment in Costa Rica has been very significant for the economy as a whole. There is a basis to conclude that Intel has had many contributions to the national innovation system, though it has been pointed out that a problem in Costa Rica is the insufficient local capacity to interact with transnationals to the fullest potential. Finally, the study focusing on the potential negative environmental and human health effects of the evolving electronics cluster puts Intel's positive contributions to the innovation system in a new critical light. It remains to be seen if other companies in the electronics sector generally follow suit, if there are institutional conditions for them to act more sustainably or if the conditions are not conducive toward sustainable conduct.

5. Case Study Analysis on the Costa Rican Electronics Sector

Following from the presentation of the effects of globalization and FDI in Costa Rica and the developmental effects Intel's establishment, this chapter presents the findings of the multiple interview case studies conducted on companies in the Costa Rican electronics sector, as well as other important components of the sectoral innovation system.

Case Studies of Electronics Companies

The conducted qualitative studies made through interviews and direct observations on field visits to electronics companies within the FTZ system constitute an exploratory study on actual conduct of the market actors within this sectoral innovation system. This is a perspective not shown in previous sections where the emphasis on the macro level and Intel's investment effects on the Costa Rican economy has obscured the question of whether other companies in the electronics sector (let alone other companies under the FTZ regime in general) have shown any inclination toward making use of innovation types that are theoretically perceived to improve sustainable performance. For instance, this may include the use of clean production processes or use of environmental and occupational health and safety standards. The macro level studies do not offer much information on institutionally set patterns of behavior regarding environmental and social sustainability issues, other than highlighting that Intel appears to have a strong profile in these areas with its level of engagement with local stakeholders through community outreach programs. Where the studies do show some indications of interactions with other innovation system components, i.e. with the amount of backward linkages with local companies, the results show gaps where knowledge spillover channels appear limited. This coincides with Katz's (2004) perspectives on globalization and Latin American innovation systems where transnationals are seen to make use of internationally integrated production systems with little rooting taking place in local economies. With little evidence to suggest that many companies other than Intel see it as an important part of their business activities to participate locally, the hypothesis at this stage is that companies in the electronics sector in general operate as 'maquila islands', as imagined by Vargas and Lindegaard (2002). Another hypothesis is also made here, returning to the earlier point on institutionally set patterns of sustainable behavior among electronics companies. Because the initial case study selection revealed only few companies that were ISO 14001 certified, who also chose not to participate in the study, one might suppose at this stage that sustainable performance of FTZ electronics companies is generally low overall. If this were in fact the case, then the negative perspectives on electronics cluster development by Vieto and Pratt (1998) on environmental and human health effects would seem to apply to Costa Rica to some extent.

The question structure template in the interviews with the case study electronics companies were in general based on three simple focal topics. The interview subjects were questioned on the following:

- Introduction to the company and its history in Costa Rica, its business activities, its workforce and its economic and overall performance.
- Linkages and cooperation with governmental agencies (CINDE, Costa Rica Provee, municipalities) as well as productive linkages with other industries in the electronics sector and downstream with local suppliers, if these exist
- Internal handling on environmental matters and social responsibility (ISO 14001, OHS 18001, community outreach programs, environmental awareness training, environmental practices, etc.) – whether these exist, have been planned or considered, or are not part of company practices.

Intel

Intel has already received much attention previously. It is the world's biggest semiconductor chip maker with established operations in at least 68 different locations around the globe, employing 95,079 overall as of December 2006 (Intel 2006, 8). Its operations in Costa Rica began following an investment decision in 1996, and its activities in the country today comprise assembly and test operations as well as corporate support services, including engineering support (MIGA 2006). Componentes Intel de Costa Rica, S.A., is the Costa Rican subsidiary of Intel that accounts for the most important activities, with plant operations assembling and testing three product platforms: server microprocessors, desktop central processing units (CPU's) and chipsets²³, the most recent and highest value added product line addition (MIGA 2006, 7). As of 2006, the number of employees at Intel's Costa Rican site amounted to 3,239 (Intel 2006, 8).

This author was not able to conduct a field visit to see Intel's Costa Rican facilities, but received comprehensive material pertaining to its environmental management activities on top of a telephone interview with the lead environmental engineer, Mr. Anibal Alterno. Having already gained insight into the overall developmental effects in Costa Rica, the interview was particularly focused on specific environmental activities made by Intel through representation in the Environmental Action Committee under the Costa Rican-American Chamber of Commerce. With an innovation systems approach, this was construed as a designed institutional set-up by market actors and seen as an important channel for interaction with the economy at large through which knowledge diffusion might be seen to take place. As well, the interview focused on internal environmental management inside Intel with specific questions directed at its relationship with stakeholders, its ISO 14001 system and environmental management as it occurred throughout Intel's local supply chain. The interview questions and transcript are provided in this thesis in Appendix B. It should be noted that the focus is almost exclusively on environmental issues and does not cover the programs and efforts dealing with social issues that Intel is also known to possess.

AmCham is a commerce chamber aimed at fostering commercial relationships between the United States and Costa Rica, whose members consist of 400 companies and 1300 corporate representatives claimed to be divided 50/50 between US and Costa Rican interests (AmCham n.d.). Its membership represents 80% of Costa Rica's FDI and 80% of the country's exports, and draws membership from most sectors of the Costa Rican economy. Mr. Alterno has held the chairmanship of the Environmental Action Committee for 4 years, while the existence of the committee itself is estimated to be 10 years old. According to Alterno, AmCham sees it as important to promote environmental initiatives among its members because "*it is important because you cannot separate business promotion from proper environmental stewardship. If you want to have a sustaining business in a country, if you want to make sure that you produce the positive impact, you need to do that in a sustainable manner. And by sustainable, we mean a balance between economic, which is basically the business core of the company, social development and environmental protection.*" Concretely, two basic action elements constitute the ways in which AmCham promotes environmental initiatives. Firstly, there is a focus on sharing best environmental practice at the business level between companies. The committee meets to discuss on issues such as hazardous waste management or air emissions control, occasionally calling in external experts, and also arranges workshops bi-annually on certain theme topics, for instance hazardous waste management or climate change. The committee also gets involved with NGO's who sometimes need help with campaigns, and the AmCham website is also seen as an important means of posting information. The second action element in the committee's work is a much more

²³ Chipsets are electronic components used to support an increase in the performance of desktop microprocessors (MIGA 2006, 32).

active role in influencing the institutional framework governing environmental performance of companies in the country: Mr. Alterno represents AmCham in Sustainable Commission of UCCAEP (the Costa Rican Union of Chambers and Private Enterprise) which is described as a national 'chamber of chambers', where Alterno is engaged in:

... tracking, influencing and participation of legal and policy-making in Costa Rica related to environmental matters... this commission is highly engaged and involved in new policy-making, new regulation, we intercept any new environmental regulation that they have out there, and then we work in task forces to review the technical aspects of those regulations. And then we speak in multi-sectorial groups in order to ensure that we can influence content and application of those regulations to make sure that they are intelligent, that they really promote environmental protection while at the same time does not impact significantly the ability to conduct business in Costa Rica.

As a consulted body in the environmental legislative-creating process, it can be strongly argued that AmCham through UCCAEP's Sustainable Commission exerts significant influential powers in forming the institutional set-up for environmental regulation in the Costa Rica. Alterno could not be pressed into saying whether this interaction channel with the regulatory framework on the whole pushed for strict or lax regulations. Instead, it was claimed that it pushed for 'smart' regulations that ensured environmental protection within the boundaries for acceptance by the private sector. This thesis does not provide a basis for evaluating the accuracy of this claim, though it may seem reasonable to presume that the Sustainable Commission body acts with the interests of the private sector first and foremost.

The interview section dealing with the activities of AmCham's Environmental Action committee revealed a final interesting piece of information regarding the general level of engagement into environmental issues by its members: Although membership of the committee stands at approximately 25 members, only 10 are estimated to participate regularly at meetings, though the figure is better for workshops at 30. One ought to be careful in drawing conclusions from this, though it does give an indication that environmental issues may not be seen as a priority among AmCham member companies as is optimal for the committee to function.



Figure 31 – (From left) Intel, aerial view; Groundwater monitoring well; Wastewater treatment system (Intel photos).

Intel's internal environmental management programs at the Costa Rican site can be seen as comprehensive, as formalized programs that are integrated within the framework of an ISO 14001 system. A full listing of the programs is reproduced on Figure 32, and show the environmental programs focused on daily site management. In addition to these programs, environmental management occurs at the corporate level to reduce environmental impacts at the product design stage, but none of these activities occur in Costa Rica. They are instead developed simultaneously at multiple 'technology hubs' where research and development is focused along Intel's global

network of sites, mainly in the US and also in Malaysia. Examples include the development of halogen-free packaging material²⁴ and the development of an 'Eco Rack' that can reduce data server electricity use by 18%. In general, environmental management at the corporate level is made explicit with annual Corporate Responsibility Reports, with concrete targets on the Business/Workplace, Environment, Education and Community that cover all Intel sites as a whole (Intel 2006).

Environmental Program System Element	Description
Hazardous Waste Management Program	Provides protocol for appropriate handling of hazardous waste in accordance with applicable EU and Costa Rican legislation. Defines a structure and process for segregation and collection of waste from manufacturing, packing and labeling within a specially designed storage area. Includes protocols for transport, shipment and appropriate handling.
Program for Storage and Management of Chemical Products	Provides procedures for management and appropriate storage of chemical products used in operations and maintenance. Establishes evaluation system for choosing new chemical products, and protocols for the management and prevention of accidental chemical spillages. Defines a process for storing hazardous chemicals within a specially designed storage area. Ensures use of MSDS information labeling on chemical risks, and the use of personal protection equipment as well as industrial hygiene evaluations.
Wastewater Monitoring Program	Monitoring and reporting of the performance of bio-active sludge used in the on-site processing of wastewater. Describes operation of the wastewater treatment system, protocols for sampling, parameters to be analyzed, etc. Provides contingency plan for emergencies.
Management and Recycling of Solid Waste	Identification, classification, segregation, management protocols, temporary storage, reuse or recycling and final deposition of ordinary solid waste. Includes monitoring and inventory of solid waste and calls for reduction strategies at the source as well as proper documentation of results for waste minimization and recycling. Includes the management of electronics waste and construction waste.
Program for Monitoring and Control of Air Emissions	Monitoring, documentation, detection, calculation and control of air emissions of volatile organic compounds (VOC), hazardous air pollutants (HAZ) and emissions arising from combustion processes (CO, CO ₂ , NO _x , SO _x) through mass balance calculations making use of chemical products purchase data and chemical shipments information, operations data from teams using fuel, as well as direct measurements wherever possible. Program also includes management of ozone depleting substances (ODS).
Prevention Program on Contamination of Surface- and Rainwater	Protocols for preventing contamination of rainwater drainage areas by chemicals or flammable materials.
Groundwater Monitoring Program	Establishment of 2 upstream and 2 downstream sampling points to evaluate water quality before and after use. Establishes sampling monitoring plan for internal use as well as for regulatory bodies.
ISO 14001 Environmental Management System	Environmental Management System designed to tie together all environmental program elements through structuring and systematizing planning activities, definition of responsibilities, identification of training needs, document control, procedures, practices and processes, internal and external auditing and maintaining the environmental policy of the company and compliance with legislation. The system requires commitment from all organizational levels as well as an audit program of the company, and encourages continuous improvement and continued maintenance of documentation to show compliance with the environmental policy.

Figure 32 – Environmental programs at Intel.

The dimension of corporate environmental management is explained by Alterno to have an effect on the way it is done at the Costa Rican site. The internal management programs at the Costa Rican site are claimed to ensure concrete and ongoing performance improvements, partly because the corporate culture of Intel as an 'engineer's company' has made it commonplace to use metrics

²⁴ Halogen is a potentially environmentally harmful fire retardant material used in electric components and in printed circuit boards.

to measure everything, but also because the Costa Rican site is required to send a list of indicators to corporate headquarters every quarter for evaluation. It was also claimed that corporate audits into the Costa Rican site's environmental management system were much more in-depth than those of the external ISO 14001 auditors. This was because whereas external auditors only evaluated according to the defined environmental management system, internal corporate audits look for opportunity conditions in all aspects of activities that are not necessarily defined as part of it.



Figure 33 – (From left) Hazardous waste storage facility; Waste segregation; “Save Our Planet” environmental awareness campaign poster (Intel photos).

Engagement activities with external stakeholders cover some of the community outreach programs already mentioned previously, such as the donation of computer equipment to schools. A community engagement activity at the corporate level that is practiced in Costa Rica is the set-up of computer centers in marginal areas of the country which offer free internet access. “Intel Involved” constitutes an important part of these efforts well, as a volunteer program for Intel employees to take time off to participate in projects on technology promotion, education and environmental awareness. Finally, an example given of interaction with local authorities is the case of an environmental fair by Belén municipality, which invited Intel to participate and promote their environmental programs and practices.

On the topic of environmental supply chain management, i.e. the way environmental considerations are part of interactions with local suppliers, Alterno explained that local purchases in Costa Rica are only made up of indirect materials and services, with 99% of raw materials in production coming in from abroad. Environmental considerations are considered in local supplier agreements as one out of a number of factors on an annex checklist in the pre-screening process, which is mainly the responsibility of the purchasing department. Environmental considerations in supplier linkages are not defined as part of the ISO 14001 management system, and on this Alterno states that a definite improvement opportunity potential exists. ISO 14001 certification is not currently a precondition for local suppliers to do business with Intel.

In summary, it can be seen that Intel makes use of environmentally sustainable product and process innovation types through the use of several formalized environmental management programs under the overall framework of an ISO 14001 system. Performance evaluation mechanisms with corporate headquarters are an important part of ensuring performance improvements, and may signify that interaction channels with more globalized innovation systems have an impact on performance at the Intel site. Intel interacts on sustainability issues more broadly with a variety of other components in the sectoral innovation system in Costa Rica through representation in AmCham, through local supplier contracts (though these are limited), with authorities and with local communities. No institutional set-ups in Costa Rica appear to have been

decisive in encouraging Intel to act this way, as most of these appear to have stemmed from corporate general practice.

AeTec

AeteC de Costa Rica, Ltda. is located in the Metropolitana FTZ near Heredia and is a company whose operations focus on the assembly of printed circuit boards for electronics companies mainly in the US market and some South American customers as well. Raw materials and components used for production are imported mainly from the United States, but also from China and Taiwan, with nothing locally supplied. The company employs 85 workers (8 administrative staff). The company has a facility in the Tempe, Arizona, in the US, but most of the printed circuit board assembly is concentrated on the Costa Rican site. Operations in Costa Rica started in 1998 when, at the time, the main reason for investing in the country was because an important part of its business was supplying circuit boards to Intel, who asked them to provide this service. Since then, Intel has changed its production processes and AeTec is no longer as supplier. Assembly at AeTec involves making use of solder and flux for attaching components to circuit boards, with isopropyl alcohol (cleaning agent) and conformal coating²⁵ as the main chemicals utilized.

AeTec makes use of an ISO 9001 certified quality management system. ISO 14001 has been discussed but is not something that the company is moving towards at the moment. The reasons for this were stated to be because Costa Rican legislation is 'very tough' and that AeTec was in compliance with all applicable laws, and also that there have been no requests from customers to be certified. Environmental impacts from production were claimed to be minimal. The company does produce wastewater outputs as a result of using 91 m³ of water per month in the production, but it runs through a water purifier and samples submitted to the Ministry of Health show that the output water is cleaner than the water that comes into the building. Solder outputs from the production are given to a local recycling facility. Solder containing lead is used in some production lines though most of the solder used is lead-free. The reason for the change to using lead-free solder was claimed to be because of customer requirements, some of whom sell to European customers. AeTec does not make use of an OHS 18001 system on occupational health and safety, for the same reasons stated for not implementing an ISO 14001 environmental management system. However, its US-based plant does have such a system implemented.

Two important observations were made on the visual inspection of the assembly facilities. Firstly was that though there were no formalized environmental or occupational health and safety management programs in place, informational notices and labeling were used to inform about health hazards of chemicals used.



Figure 34 – (From left) Two views of the PCB assembly facilities; Information sign on chemical health hazards (Own photos).

²⁵ Applied to circuit boards as protection against dust, moisture and temperature extremes.

Conair

Conair is otherwise known as BabyLiss Costa Rica (BabyLiss Costa Rica, S.A., Grupo Conair) and the Costa Rican subsidiary under the umbrella of the Conair group producing personal hygiene consumer electronics such as hair dryers, curling irons and foot baths, with hair dryers being the main observed manufactured product on the field visit. Export markets for Conair products include the United States, Canada, Mexico, Europe, some South American countries and a part of production geared toward the Costa Rican market as well. Conair in Costa Rica is located in the Zeta FTZ near Cartago. It employs approximately 2,000 workers, but this figure has fluctuated throughout its history of operations in the country. It first established operations in 1988 as a small enterprise that grew significantly over the years, but has been experiencing downsizing as of 2001 because of competition from China. Conair has no formalized environmental management system in place. It has previously had an ISO 9001 certification, but this was discontinued in 2005 because of the costs involved as a direct result of foreign competition and downsizing. This is stated to be the same reason why Conair has chosen not to implement an ISO 14001 or OHS 18001 system. It is worthwhile to mention, however, that occupational health and safety is a priority area for Conair. It employs a specialist engineer in the area, and also has an occupational health and safety policy.



Figure 35 – (From left) Hair dryer casing shells; Plastic pellets for injection molding; Injection molding machine (Own photos).

The general production processes at Conair begin with plastic injection molding, where plastic pellets are heated and formed to create the exterior shells for the product. These plastic shells are sent to Painting and Metallics, to be given a painting finish or an aluminum bombardment treatment for a metallic finish. Two parallel processes, 'ARTOS' and Resistance, prepare physical parts for final assembly. 'ARTOS' prepares jumpers, which serve as bridges of current between the different parts of the product, and Resistance prepares the resistance components used for heating airflows. The Joining areas assembles the components and packs the finished products on the spot. Raw materials are primarily imported from abroad, such as resins and plastics and motors, but a few materials are purchased locally, for instance cables that are used for connecting components.

Visual inspection of the production facilities showed classic conveyor belt assembly operations. Attention was made to the fact that Conair made use of CTTM for its packaging waste, a local waste recycling enterprise located in the same FTZ that was started up by the Technological Institute of Costa Rica.

Current Controls

Current Controls (Controles de Corriente, S.A.) is located in the Metropolitana FTZ, Heredia, near AeTec. It is an electronic components operation that produces transformers and toroidal inductors, which are parts used for power control systems/power supplies in a variety of electrical products

such as photocopy machines and television sets. Its mother company is located in Buffalo, New York, and established operations in Costa Rica in 1997 because Current Controls was interested in outsourcing to remain competitive. It investigated possible sites in Mexico, the Caribbean and other countries in Central America, subcontracting activities to begin with before deciding that Costa Rica provided the best investment climate to establish their own operations. It is a company that employs 90 workers (roughly the same number of employees in Buffalo). Production at Current Controls involves overwhelmingly low-skilled hand-made operations, mostly soldering and wire threading. Raw materials and machines for production are imported from the Buffalo mother company, which has the sales office and distribution center, and only packaging material and foam is purchased locally. The company has attempted to find local suppliers for epoxy resins in the past by contacting Costa Rica Provee, but no local companies could be found. Current Controls has no formalized environmental or occupation management system in place. ISO 14001 was considered when operations were beginning, but the idea was discarded because of the perceived costs involved, both economically and in terms of work hours, and because it wasn't asked for by the customers. The most visible environmental impacts from production include solder residue, which is sent away for recycling, and varnish residue, which is collected in a drum and later sent to a cement production company called Holcim, which has an incinerator.

Magnéticos Toroid



Figure 36 – (From left) Toroidal inductors; Soldering station with fume exhaust; Chemical waste collection canister for alcohol and acetone; Discarded products (Own photos).

Magnéticos Toroid resembles Current Controls in that they produce toroidal inductors, employing 30 people at its operations located at the Saret FTZ near Alajuela. It employs the same hand-made operations in production with the same soldering and wire-threading processes comprising most of the production processes. It is a family owned company with a small production facility at its mother company in Maryland, United States, and produces custom specified toroidal inductors in Costa Rica for its clients in the US. Components are imported from the US, while certain chemicals such as solvents and in some cases solder are purchased locally. The company is small and has had no plans for introducing environmental or occupational health and safety management systems for this reason. No formal environmental management programs are in place. Visual inspection of the facilities showed the use of fumes exhaust for the soldering systems and the use of personal protection equipment among its employees.



Figure 37 – (From left) Solder residue; Soldering process under way; Information notice on use of personal protection equipment (Own photos).

Merlin VME

Merlin VME is a very small company located in the Ultrapark FTZ in Heredia. Its operations are design and testing of analog to digital signal converters for sonar systems used in US navy submarines, and employs only 4 workers (a secretary, a financial officer and 2 research and development engineers). Almost no production or use of materials is involved in its activities, and for this reason the use of cleaner technologies or environmental and occupational health and safety management has not been considered.

Tico Electronics

Tico Electronics activities comprise production in two plants at the 'BES' FTZ near Alajuela, and is a Costa Rican owned company. The first plant has been in operation for ten years, while the new one is in its first year of operation. The company assembles rotors and stators, which are components that are put together for use in small motors that are used in avionics systems primarily for the US market. It also assembles rotors and stators that are used in small motors for surveillance cameras. The company employs 270 workers for both plants. Local purchases are limited to cleaning solvents and other chemicals, with the components used for production purchased from the US. The company has been ISO 9001 certified for 3 years because it is seen as a good market tool and also seen as improving production efficiency. It has been considering gaining ISO 14001 certification but intends to have the quality management system fully established first. Its existing environmental efforts include sending paper and packaging materials for recycling, and liquid chemical waste is stored and sent for incineration at Holcim, a cement company.



Figure 38 – (From left) Entrance to Tico Electronics plant 2; Assembled motors and stators; Production line, plant 2 (Own photos).



Figure 39 – (From left) Production line, plant 1; Production line close-up, showing fume exhaust; Chemical waste collection (Own photos).

The company has an interesting backstory to how it first became established in the country, and which has significance for its current initiatives in the social area. Its original start-up capital was provided by a US investor, who was also a missionary, and who had a desire to help address the problem of impoverished single mothers in the country. Its all-woman shop floor workforce today comprises 30% single mothers, and the company ensures that they receive education in contraceptives use and family planning.



Figure 40 – (From left) Rotors on display; Varnishing process under way; Alcohol waste collection canister; Flammable chemicals storage (Own photos).

Saco International



Figure 41 – (From left) Entrance to plant; Electronics test of vision tester; Vision tester on display (Own photos).

Saco Internacional, S.A is a company that conducts its operations under the FTZ regime but is not located in an industrial park, instead located as a stand-alone company in the Province of Guanacaste far from the Central Valley area where most economic activity in Costa Rica is concentrated. The company employs 30 and produces human vision testers, which are mostly sold to governments that use them to check eyesight for drivers, and are also sold direct to schools in the United States and Canada. The company was established in 1995, and was granted FTZ status with tax exemption for 12 years and 50% tax for 8 years following that. Vision testers are

made up of steel, aluminum, injection-molded plastic parts, electrical wiring and circuit boards, and the production processes in the plant consist of metalwork and component assembly. All of the materials used for production are purchased from abroad, because they either aren't available locally or, in the case of metals, the quality is not adequate. The company has no quality management, environmental management or occupational health and safety management systems in place, largely because the company sells to the end user and does not feel any pressure to implement any of it. Out of the waste products from the vision tester assembly process, steel and aluminum scrap are sometimes sold for recycling, and plastic scrap is accumulated or given to employees for resale on their own. However, much of the solid waste is simply accumulated outside the plant, as revealed by visual inspection. The company is located in a less developed part of the country, and offers vision testing freely for schoolchildren in the nearby town of Bagaces.



Figure 42 – (From left) – Metalworking process under way; Solid waste collection outside plant; Solid waste collection inside plant (Own photos).

To conclude on the findings of the field visits and interviews with FTZ companies in Costa Rica other than Intel, it can be seen that these, with the possible exception of Conair, operate on a much smaller level. Overall, they do not give a convincing picture of making use of innovation types to improve on sustainable performance, especially in the area of organizational innovations such as ISO 14001 use. These have been considered to varying degrees by the companies, but none claim to have the market incentives or resources in place to implement them. None have appeared to consider the environmental impacts of their products in the design stage.

As stated by Vieto and Pratt (1998), the single most potentially hazardous environmental and human health impact is the use of lead in soldering operations; Most companies in the study that include soldering operations in their manufacturing processes make use of fumes exhaust systems, seen on visual inspection of their facilities, and in most cases make use of personal protection equipment by their employees. This constitutes an example of use of cleaner production process innovations, though can be seen as basic counter-pollution measures.

Interactions with other components of the electronics sector innovation system are low. Only one company has been seen to engage in a local community outreach effort (Saco International). All companies have low degrees of interaction with local supplier companies, and appear to have made full use of the FTZ regime framework to import the majority of their raw materials from abroad. None of the case study companies have interactions with each other, with the exception of AeTec and Intel when the former first established itself in Costa Rica. Local company engagement does exist in terms of waste handling; there appears to be a ready supply of local companies who are willing to agree to dispose of chemical waste products (Holcim), and a market exists for recyclable packaging material. At this stage, however, it would appear that the hypotheses posed at the beginning of the case study have been correct in general, namely that the companies in the sector essentially constitute 'maquila' island developments.

Broader Institutional Set-Ups

Besides the company case studies into the electronics sector, this author has also spoken with other organizations perceived to be part of the electronics sector innovation system. These further qualitative studies provide a more solid basis from which to draw conclusions regarding the institutional set-up around FTZ companies in the electronics sector, and the findings will be outlined briefly here.

One of the designed organizations that are most observably engaged with FDI in Costa Rica is CINDE, the semi-private non-profit organization that is the country's official investment promotion agency (see Appendix C). The CINDE agency offers pre-establishment, establishment and post-establishment support for foreign investors in the country. Pre-establishment support activities include introducing potential investors to FTZs, government organizations, companies and education institutes. Establishment support includes legislative support for construction permits and entry visas for personnel, and on the post-establishment support phase, CINDE supports expansion work by promoting product diversification and holding joint seminars with foreign companies and local companies to build network support. Because CINDE sees that labor costs are not one of Costa Rica's main competitive advantages, especially in the electronics and medical devices fields CINDE claims to look for niche players who where quality is said to be of the utmost importance. CINDE's main 'selling points' for potential investors are firstly, the country's educated workforce, and because of geographical location, it is easy for US investors to conduct business there. Some important points made by CINDE on how foreign investors have contributed to development in Costa Rica, were firstly that over 83% of FDI was reinvestment by already established companies, and that it was claimed companies were moving from manufacturing or repair to design work. It was conceded, however, that it was difficult for local suppliers to service foreign companies.

Costa Rica Provee has been mentioned previously and is a relatively recently set up organization focused exclusively on developing linkages between transnationals and local suppliers (see Appendix D). While the success rate in forging linkages remains low in absolute terms, this is seen to be increasing as time goes on and the program gets more established. This is illustrated on Figure 43.

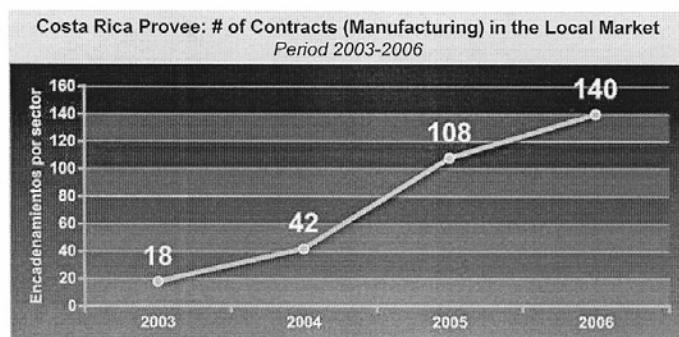


Figure 43 – Number of manufacturing contracts in the local market facilitated by Costa Rica Provee 2003-2006 (Costa Rica Provee data).

With an innovation systems approach, deliberately designed organizations intended to affect more sustainable behavior can constitute institutional innovation types for improving sustainable performance. A closer look was taken at some organizations in Costa Rica that with this perspective were seen as having the potential for supporting knowledge dissemination of concrete, sustainable innovation types like ISO 14001 in the electronics sector. The National Center for Cleaner Production (CNP+L), the National Training Institute (INA) and a Costa Rican/Japanese

training institute (CEFOF) constituted examples of these types of organizations. Interviews were taken to examine more closely what sort of sustainable innovation types were promoted by these organizations and what sort of success they have been having. CNP+L is a set-up under the Costa Rican Chamber of Industry, and focuses on promoting the use of the cleaner production concept. This is a holistic, integrated approach to environmental management involving preventive efforts to minimize environmental and human health risks in processes, products and services. INA is a public institute that offers vocational training in a wide range of fields, and has a small sub-section devoted to teaching environmental practices such as basic ISO 4001 implementation in companies and concrete environmental competencies in solid waste and wastewater management. CEFOF is devoted to training professionals in gaining skills and competencies for increasing production efficiency, focused on quality management principles and 'just-in-time' production methods originally developed in Japan. Here, environmental management practices are not treated as separate practices but are claimed to be included as an integrated part of teaching modules. The common denominator for these organizations is that their reach in the economy at large appears to be limited. All offer services under payment, and none have been able to claim customers from any of the electronics companies in the FTZs. CNP+L is a noteworthy example, however, of an organization that has had some degree of success in promoting sustainable practices to the local economy. It offers its services with the aid of overseas development assistance, and with the help of partial funding programs from the Costa Rican government, some local companies from a variety of sectors have been able to become involved in cleaner production projects.

This section does not cover all the background information gained from the support interviews, but the overall findings indicate the existence of certain elements in the innovation system that have the potential for supporting sustainable innovation if made use of in a larger scale, such as the training organizations. Interestingly, some of the support interviews revealed a beginning tendency on the creation of new organizations that have arisen in response to a market demand for environmental services. This includes the CTTM waste recycling center initiated by ITCR (the Technological Institute of Costa Rica), and also include the Costa Rican FTZ company Fortech, which has begun to treat electronics waste from other FTZ companies on a limited scale. These organizations can be seen as indications that the demand effect on the local economy, spoken of by Leiner Vargas, is resulting in some tangible effects on local innovation systems.

6. Conclusion

This section presents the findings made in this thesis, collecting together the partial conclusions made over the course of the report in a single comprehensive answer to address the overall research question.

This study has been carried out with the overall focus on the question marks surrounding the role of transnationals in promoting sustainability in the context of developing countries. Transnationals have been increasingly seen as the main development drivers under globalization, which has set conditions for generating greater flows of foreign direct investment. In particular, the focus has been their role as diffusers of knowledge and technology as a means to help developing countries along a sustainable development path. This study uses the specific context of Costa Rica to analyze the institutional conditions under which these knowledge diffusion processes might be able to take place. This has been formulated with the overall research question:

Which institutional set-ups in Costa Rica have helped facilitate sustainable performance of transnationals in the globalization process, and how are these applicable to developing countries in general?

A requirement that is seen as necessary to answer the research question has been developing a conceptual framework aimed at understanding of the way knowledge and technology diffusion processes can occur in a developing country, and how this relates to improving sustainable performance. These have been made explicit in the following sub-questions:

- *How can knowledge and technological diffusion processes of transnationals in developing countries be understood?*
- *In what manner do these diffusion processes determine sustainable performance?*

The conceptual framework developed and utilized to this end throughout the study is that of innovation systems theory. This theory refers to the idea of knowledge generation and diffusion being central to all performance improvements within an economy, and refers to the interactions between different components of such a system that contribute to this. What started out as an economic theory has been later developed towards incorporating sustainability issues within the same framework. The use of this theory is not without pitfall assumptions on how sustainable performance is determined, and this section will discuss how the study's findings relate to this problem complex.

The guiding sub-questions for the empirical part of the study have been focused on the electronics sector in Costa Rica, which has had some eye-catching developments, not least with the establishment of a big transnational, Intel, into the country. The sub-questions are, as follows:

- *What are the innovation system characteristics of the electronics sector in Costa Rica?*
- *How do the specifics of the electronics sector innovation system in Costa Rica affect sustainable performance?*
- *What institutional elements have been key for facilitating sustainable performance through knowledge and technology diffusion?*

This study has answered the above by first taking point of departure in the historical build-up to the current situation in Costa Rica, describing the fundamental changes that have affected the country and the entire Latin American region in the change from Import Substitution Industrialization to the current globalization era. The effects this has had effects on the national innovation systems of

these countries has been the breakdown of public sector knowledge building capabilities and the loss of initiative and control by the public sector to the activities of transnationals, to the detriment of the countries' overall development trajectories. Costa Rica is presented as a country which has appeared to have outpaced its regional neighbors through early embracing of outward-orientation policies, posting high economic growth rates and diversifying its product export base from primarily coffee and bananas toward non-traditional, manufactured goods. The study goes further into this by analyzing the specific institutional set-up of the Free Trade Zone system in the country, and the effects this has had for macroeconomic performance and development of the local economy. It concludes that the specially designed tax-exemption framework of the Free Trade Zone system has had significant bearing for improving economic performance, but has had the effect of transnationals operating as isolated enclaves in the Costa Rican economy with limited evidence of backward linkages being seen and limited channels for knowledge diffusion. Especially highlighted during this study is the single-handed importance of Intel's investment decision in the country, which is analyzed in detail. This analysis of the developmental effects specifically linked to Intel's investment decision has shown that Intel has had a wide-ranging set of positive impacts on Costa Rica, including the promotion of sustainability issues, and has contributed significantly to the national innovation system. However, as it was suspected Intel operated on different scale level from the rest of the electronics sector in Costa Rica, this study also includes a case study analysis of other companies in the electronics sector, revealing that these companies lag behind in the use of sustainable innovation types and interactions with the broader system.

To conclude, the findings in this thesis essentially break down the initial premise that Costa Rica has been able to 'harness' globalization to promote sustainable development. While Intel stands out as having contributed positively through various means of interaction with national and sectoral innovation systems, it gives a distorting picture of the electronics sector and the system as a whole. It is seen that the institutional set-up of the Free Trade Zone system in the country has especially contributed to this effect, fostering 'island' developments among the companies that have invested in the country under this regime. It has been indicated that certain institutional set-ups in the country have the potential of improving sustainable performance of companies, for instance the Costa Rica Provee program for domestic supplier development, but the effects of these designed institutions remain limited.

It is suggested that the exploratory use of an innovation systems approach on Costa Rica has shown the actual constraints of using the assumptions in the approach on a developing country context. In these contexts, institution-building occurs under weak preconditions and often governed by structural macro-conditions that hamper for instance the ability of the public sector in participating actively. Given this, the question of setting up a sustainable innovation system remains an ambitious objective.

References

- Amaya, Ana Lissette. 1997. *State of the art of the textile sector in Nicaragua*. SUDESCA Research Papers No. 19. Managua: Escuela de Economía Agrícola, Facultad de Ciencias Económicas, Universidad Autónoma de Nicaragua, Nicaragua
- AmCham (Costa Rican-American Chamber of Commerce). No Date. *About AmCham Costa Rica*. http://www.amcham.co.cr/about_amcham.php (Accessed January 29, 2008)
- Arocena, Rodrigo and Judith Sutz. 2002. *Innovation Systems and Developing Countries*. Revised and expanded version of paper presented at the SUDESCA Conference, El Salvador, May 2001
- Bardhan, Pranab. 2003. Protests Greet Yet Another WTO Meeting. *YaleGlobal Online* 8 (September 2003) <http://yaleglobal.yale.edu/display.article?id=2390> (Accessed January 27, 2007)
- Barton, Jonathan R. 1999. The environmental agenda: accounting for sustainability. In *Developments in Latin American political economy: States, markets and actors*, eds. J. Buxton & N. Philips, 186-204. Manchester/New York: Manchester University Press
- Bhagwati, Jagdish. 2004. *In Defense of Globalization*. Oxford University Press
- Breschi, Stefano and Franco Malerba. 1997. Sectoral Innovation Systems: Technological Regimes, Schumpeterian Dynamics, and Spatial Boundaries. In *Systems of Innovation: Technologies, Institutions and Organizations*, ed. Charles Edquist, 130-156. London/Washington: Pinter
- Cámara de Industrias. 2007. *Guía Industrial 2007*. Cámara de Industrias de Costa Rica
- Chesnais, François. 1992. National Systems of Innovation, Foreign Direct Investment and the Operations of Multinational Enterprises. In *National Systems of Innovation: Towards a Theory of Innovation and Interactive Learning*, ed. Bengt-Åke Lundvall, 265-295. London: Pinter Publishers
- CIA (Central Intelligence Agency). 2007. *The World Factbook*. <https://www.cia.gov/library/publications/the-world-factbook/> (Accessed July 26, 2007)
- CINDE (La Coalición Costarricense de Iniciativas de Desarrollo). No Date. *Historic Overview of Foreign Direct Investments in Costa Rica*. <http://www.cinde.org/eng-20anos.shtml> (Accessed January 27, 2008)
- CorpWatch. 1999. *Maquiladoras at a glance*. <http://www.corpwatch.org/article.php?id=1528> (Accessed January 28, 2008)
- CountryWatch. 2007. *CountryWatch Country Review: Costa Rica*.
- Cummings, Andrew R. 1997. *State of the art of the forestry sector in El Salvador*. SUDESCA Research Papers No. 11. San Salvador: Fundación Nacional para el Desarrollo (FUNDE), El Salvador
- Danielsen, Rikke B. 2005. Frihandel og private investeringer bekæmper fattigdom. *DI Indsigt* 13 (September 15, 2005) <http://www.di.dk/NR/rdonlyres/B3A34CD1-FED1-4A4C-92CB-0107050AB810/0/Frihandelogprivateinvesteringerbek%26perfattigdom.pdf> (Accessed January 28, 2007)

Edquist, Charles, ed. 1997. *Systems of Innovation: Technologies, Institutions and Organizations*. London/Washington: Pinter

Edquist, Charles. 2001. The System of Innovation Approach and Innovation Policy: An account of the State of the Art. Lead paper presented at the DRUID conference, Aalborg, June 12-15, 2001.

Edquist, Charles and Björn Johnson. 1997. Institutions and Organizations in Systems of Innovation. In *Systems of Innovation: Technologies, Institutions and Organizations*, ed. Charles Edquist, 41-63. London/Washington: Pinter

Fang, Rong. 2006. Pressure, economic competition, environmental regulation and innovation in the steel sector: With benchmark of two special steel mills. Master Thesis, Department of Development and Planning, Aalborg University

Fleck, J. 1992. Configurations: Crystallizing contingency. *The International Journal of Human Factors in Manufacturing* 3 (1): 15-36

Fortanier, Fabienne and Maria Maher. 2001. Foreign Direct Investment and Sustainable Development. *Financial Market Trends* 79 (June 2001): 107-130

Franco, Chiara. 2007. *The Role of National Systems of Innovation for FDI in Developing Countries* (Draft). <http://semeq.unipmn.it/files/prin07/Franco.pdf> (Accessed December 9, 2007)

Freeman, Chris. 1987. *Technology Policy and Economic Performance: Lessons from Japan*. London: Pinter

Fukuyama, Francis. 1989. The End of History? *The National Interest* 16 (Summer 1989)

Gordon, Philip H. 2004. Globalization: Europe's Wary Embrace. *YaleGlobal Online* 1 (November 2004) <http://yaleglobal.yale.edu/display.article?id=4790> (Accessed January 27, 2007)

Green, Duncan. 1999. A trip to the market: the impact of neoliberalism in Latin America. In *Developments in Latin American political economy: States, markets and actors*, eds. J. Buxton & N. Philips, 13-32. Manchester/New York: Manchester University Press

Gwynne, Robert N. 1999. Globalization, Neoliberal and Economic Change in South America and Mexico. In *Latin America Transformed: Globalization and Modernity*, 1st Ed, eds Robert K. Gwynne and Cristóbal Kay, 68-97. London/Sydney/Auckland: Arnold

Gwynne, Robert N. and Cristóbal Kay. 1999. Latin America Transformed: Changing Paradigms, Debates and Alternatives. In *Latin America Transformed: Globalization and Modernity*, 1st Ed, eds Robert K. Gwynne and Cristóbal Kay, 2-30. London/Sydney/Auckland: Arnold

Gwynne, Robert N. and Cristóbal Kay. 2004. Latin America transformed: globalization and neoliberalism. In *Latin America Transformed: Globalization and Modernity*, 2nd ed, eds. Robert N. Gwynne and Cristóbal Kay, 3-21. London: Edward Arnold

Held, David, Anthony G. McGrew, David Goldblatt and Jonathan Perraton. 1999. *Global transformations: politics, economics and culture*. Stanford: Stanford University Press

- Hellinger, Daniel. 1999. Electoral and party politics. In *Developments in Latin American political economy: States, markets and actors*, eds. J. Buxton & N. Phillips, 49-71. Manchester/New York: Manchester University Press
- Herkenrath, Mark and Vilker Bornschier. 2003. Transnational Corporations in World Development – Still the Same Harmful Effects in an Increasingly Globalized World Economy? *Journal of World-Systems Research* IX (I, Winter 2003): 105-139
- Intel. 2006. *Building Global Responsibility: Intel 2006 Corporate Responsibility Report*
- Johnson, Björn. 1992. Institutional Learning. In *National Systems of Innovation: Towards a Theory of Innovation and Interactive Learning*, ed. Bengt-Åke Lundvall, 23-44. London: Pinter Publishers
- Johnson, Björn, Jens Müller and Jeffrey Orozco. 2007. *Pitfalls and Opportunities in Knowledge Sharing: Experiences from a research capacity building project in Central America*. DRUID Working Paper No. 07-04
- Johnsons, Björn and Martin Lehmann. 2006. *Sustainability and Cities as Systems of Innovation*. DRUID Working Paper No. 06-17
- Katz, Jorge. 2004. Market-oriented Reforms, Globalization and the Recent Transformation of Latin American Innovation Systems. *Oxford Development Studies* 32 (3, September 2004): 375-387
- Klak, Thomas. 1999. Globalization, Neoliberalism and Economic Change in Central America and the Caribbean. In *Latin America Transformed: Globalization and Modernity*, 1st Ed, eds Robert K. Gwynne and Cristóbal Kay, 98-126. London/Sydney/Auckland: Arnold
- Lindegaard, Klaus. 1997. *State of the Art Innovation System Analysis*. SUDESCA Research Papers No. 7. Aalborg: Department of Business Studies, Aalborg University, Denmark
- López, Mario. 1997. *State of the art of the forestry sector in Nicaragua*. SUDESCA Research Papers No. 14
- Lundvall, Bengt-Åke. 1985. *Product Innovation and User-Producer Interaction*. Aalborg: Aalborg University Press
- Lundvall, Bengt-Åke, ed. 1992. *National Systems of Innovation: Towards a Theory of Innovation and Interactive Learning*. London: Pinter Publishers
- Lundvall, Bengt-Åke. 2002. *Innovation, Growth and Social Cohesion: The Danish Model*. Cheltenham, UK/Northampton, MA, USA: Edward Elgar Publishing Limited
- Lundvall, Bengt-Åke, Björn Johnson, Esben Sloth Andersen and Bent Dalum. National Systems of Production, Innovation and Confidence Building. 2002. *Research Policy* 31: 213-231
- Mabey, Nick, Richard McNally and Lyuba Zarsky. 2003. *Foreign Direct Investment and the Environment: From Pollution Havens to Sustainable Development*. 2nd Edition. WWF-UK
- Mejías, Keynor R. 2006. Costa Rica as a Learning Economy: An Exploratory Study of Competence-Building and the Significance of Labour Relations and Labour Market Institutions. Ph.D. Thesis, Department of Business, Aalborg University

Mena, Roberto. 1997. *State of the art for textiles in El Salvador*. SUDESCA Research Papers No. 17. San Salvador: Economics Department, School of Economic Sciences, University of El Salvador, El Salvador

MIGA (Multilateral Investment Guarantee Agency, The World Bank Group). 2006. *The Impact of Intel in Costa Rica: Nine Years After the Decision to Invest*. Washington DC: The World Bank Group/MIGA

Mittelman, James H. 2000. *The Globalization Syndrome: Transformation and Resistance*. Princeton/New Jersey: Princeton University Press

Mittelman, James H. and Ashwini Tambe. 2000. Global Poverty and Gender. In *The Globalization Syndrome: Transformation and Resistance*. Princeton/New Jersey: Princeton University Press

Molina, Iván and Steven Palmer. 2006. *The History of Costa Rica: Brief, Up-to-Date and Illustrated*. Editorial de la Universidad de Costa Rica

Monge-González, Ricardo, Julio Rosales-Tijerino and Gilberto Arce-Alpílar. 2005. *Cost-Benefit Analysis of the Free Trade Zone System: The Impact of Foreign Direct Investment in Costa Rica*. OAS Trade, Growth and Competitiveness Studies series, Office for Trade, Growth and Competitiveness, Organization of American States

Muradian, Roldan and Joan Martinez-Alier. 2001. Trade and the environment: From a 'Southern' perspective. *Ecological Economics* 36 (2, February 2001): 281-297

Murray, Warwick E. 1999. Natural Resources, the Global Economy and Sustainability. In *Latin America Transformed: Globalization and Modernity*, 1st Ed, eds Robert K. Gwynne and Cristóbal Kay, 128-152. London/Sydney/Auckland: Arnold

Murray, Warwick E. and Eduardo Silva. 2004. The political economy of sustainable development. In In *Latin America Transformed: Globalization and Modernity*, 2nd ed, eds. Robert N. Gwynne and Cristóbal Kay, 117-138. London: Edward Arnold

Nelson, R.R. and Rosenberg, N. 1993. Technical innovation and national systems. In *National Systems of Innovation: A Comparative Study*. Oxford: Oxford University Press

Nielsen, Marie Bruun. 2005. Food for Thought? - Local Linkages for Local Development. Master thesis, Institute of History and International Studies, Development and International Relations, Aalborg University

Orozco, Jeffrey. 2004. Innovation and Performance Improvements in the Cooperative Sector, Costa Rica. SUDESCA Research Papers No. 38; Ph.D. Thesis, Department of Business Studies, Aalborg University.

Orozco, Jeffrey, Olman Segura, Birgitte Gregersen, Björn Johnson, Arne Remmen. 2004. *Policies for Innovation and Sustainable Development in Central America*. SUDESCA Research Papers No. 33. Aalborg: Department of Business Studies, Aalborg University

PROCOMER. 2007. *Costa Rica 2007: Directorio de exportadores e Importadores* (The Official Costa Rican Export and Import Directory). San Jose: Mercadeo Profesional S.A.

Remmen, Arne. 1999. Greening of Industry: Technological and Institutional Innovations. Paper presented at the SUDESCA Conference, Costa Rica, February 1999

- Rosales, Julio and V. Gibson. 2001. *Condiciones del Mercado Laboral para los Sectores de Alta Tecnología en Costa Rica: sector electrónico, eléctrico y dispositivos médicos*. San José: CINDE-AZOFRAS-PROCOMER
- Sachs, Jeffrey. 2005. *The End of Poverty: Economic Possibilities for Our Time*. Penguin Books
- Sachs, Wolfgang. 1999. *Planet Dialectics: Explorations in Environment and Development*. London/New York: Zed Books
- Sánchez-Ancochea, Diego. 2003. *Globalization and Inequality in the Developing World: Potential Benefits with Real Costs*. Working Paper, Center for Economic Policy Analysis.
http://americas.sas.ac.uk/about/die_paperonglob.andpov.pdf (Accessed January 28, 2008)
- Schumpeter, Joseph. 1934. *The Theory of Economic Development*
- Schumpeter, J. A. 1939. *Business Cycles: A Theoretical, Historical and Statistical Analysis of the Capitalist Process*. 2 vols. New York: McGraw Hill
- Schumpeter, Joseph. 1947. The Creative Response in Economic History. *The Journal of Economic History* (Reprinted in Swedberg, Richard, ed. 1991. *The Economics and Socialism in Capitalism*. Princeton, New Jersey: Princeton University Press)
- Scott, Richard W. 2001. *Institutions and Organizations*, 2nd Ed. Thousand Oaks/London/New Delhi: Sage
- Segura-Bonilla, Olman. 2000. Sustainable Systems of Innovation: The Forest Sector in Central America. Ph.D. Thesis, Department of Business Studies, Aalborg University
- Segura-Bonilla, O. and L. Vargas. 1999. *Policy Learning and Innovation in Costa Rica*. SUDESCA Research Papers No. 25. Aalborg: Department of Business Studies, Aalborg University, Denmark
- Silva, Patricio. 1999. The New Political Order in Latin America: Towards Technocratic Democracies? In *Latin America Transformed: Globalization and Modernity*, 1st Ed, eds Robert K. Gwynne and Cristóbal Kay, 51-65. London/Sydney/Auckland: Arnold
- Sonnenfeld, David A. and Arthur P.J. Mol. 2002. Globalization and the Transformation of Environmental Governance. *American Behavioral Scientist* 45 (9): 1318-1339
- Stanley, Katherine. 2007. CAFTA Fast-Track Approved. *The Tico Times* Friday, March 2: 1
- Stiglitz, Joseph E. 2003. *Globalization and its Discontents*. New York/London: W.W. Norton & Company
- Stiglitz, Joseph E. 2006. *Making Globalization Work*. New York/London: W.W. Norton & Company.
- Strudsholm, Jesper. 2006. *Turen går til en mindre skæv verden*. Politikens Forlag A/S
- The Economist. Global trade talks: Potsdam's price. *The Economist*, June 30th-July 6th 2007: 16
- UNCTADa (United Nations Conference on Trade and Development). 2006. *World Investment Report 2006*. New York/Geneva: United Nations

UNCTADb (United Nations Conference on Trade and Development). 2006. *Trade and Development Report 2006*. New York/Geneva: United Nations

Vargas, Leiner. 1997. *State of the art of the textile sector in Costa Rica*. SUDESCA Research Papers No. 15. Heredia: International Center on Economic Policy for Sustainable Development (CINPE), Universidad Nacional (UNA, Costa Rica)

Vargas, Leiner and Klaus Lindegaard. 2002. *New Economies and Innovation for Developing Countries: The Case of Intel in Costa Rica*. Paper presented at the DRUID Summer Conference, Copenhagen, June 2002

Vieta, Jorge and Lawrence Pratt. 1998. *Eco-Efficiency in a High-Tech Cluster: A meta analysis of the evolving high-tech electronics Cluster headed by Intel in Costa Rica*. Alajuela: CLACDS Working Paper, CLACDS (The Latin American Center for Competitiveness and Sustainable Development), INCAE Business School, Costa Rica

Vorhees, Mara and Matthew Firestone. 2006. *Lonely Planet: Costa Rica*. Lonely Planet Publications Pty Ltd

Zarsky, Lyuba and Kevin Gallagher. 2003. *Searching for the Holy Grail? Making FDI work for Sustainable Development*. Background analytical paper to the meeting 'International Investment Frameworks for Sustainable Development: Framing the Debate' (London March 10, 2003). WWF International

Appendix A

Interview – Leiner Vargas, Ph.D., Vice Rector, Universidad Nacional

Submitted Interview Questions

Topics and questions:

DRUID conference paper, "New Economies and Innovation for Developing Countries. The Case of Intel in Costa Rica" Leiner Vargas and Klaus Lindegaard

The conference paper examines trends on FDI and export specialization in developing countries focused on Central America, and in particular the developmental effects of increased FDI in the electronics sector in Costa Rica following the set-up of Intel's operations in the country. Based on lessons learned from the Intel case, the paper also offers a discussion on how to promote positive developmental effects from FDI. Now, five years from the publication of the conference paper and ten years from Intel's establishment in Costa Rica, it is relevant to revisit the question.

Export Specialization and Technological Specialization in Costa Rica

The paper presents a statistical test of stability in national export specialization patterns for Central American countries, and points to a general increase in specialization. It also presents the development of a technological specialization index over time, which shows low specialization patterns in general but a visible boom in Costa Rica following Intel's investment.

- Five years on from the paper's publication, is there a clearer picture of the export specialization patterns in Costa Rica? What are the trends?
- Do you think there is evidence to suggest even stronger technological specialization patterns in Costa Rica in recent years following the branching-out into new industrial sectors such as medical devices and other high value-added products?
- Why is the research and development index low in your analysis, and how important is this factor in the interplay between trade specialization vs. technological specialization?
- In general, what conditions in Costa Rica have failed to attract sufficient research and development activities in the technologically specialized exports?
- What impacts do you believe the results of the CAFTA-DR referendum will have on export specialization and technological specialization in Costa Rica?

Intel as an island development?

Using a National Systems of Innovation (NSI) approach, you stress that is important to look closer at developmental effects of FDI such as the impacts on learning trajectories in the local economy; diffusion of technologies, new products and production processes, etc. The paper calls into question whether Intel's investment is a classical maquila island process, and it indicates this is true to some extent during the early stages of Intel's activities.

- Ten years now from Intel's establishment in Costa Rica, what is your picture of the way this multinational has interacted with the local economy? Are the interactions still primarily focused on low-tech value-added activities?
- In order to ensure increased integration with the local economy and facilitate better linkages and knowledge transfer processes, the paper calls for the development of an industrial policy with this aim. What has been done in Costa Rica since your paper was presented, and how would you evaluate its success?
 - How have local strategies in local innovation systems worked?
 - How have human resource capabilities been upgraded?
 - How have agglomeration/clustering strategies played out?
- The paper focuses primarily on the economic (i.e. local linkages) and social (i.e. high value jobs) potential of Intel's investment in Costa Rica. How do you think FDI in the electronics sector led by Intel can help facilitate technological and knowledge transfer in the environmental field? Do you see any of this happening?

The Role of Universidad Nacional in the Electronics Sector Innovation System

With an innovation systems approach, Universidad Nacional can easily be seen an integral part of the national innovation system, as an important element with which local and multinational firms interact. This can be argued to include the electronics sector, even though most engineering and electronics-related educational activities are concentrated at ITCR. As someone who has studied the electronics sector, who has a vice rector position and has used the innovation systems approach extensively, you are in a position to discuss these matters with much authority.

- To what extent does UNA play a role in the educational training of the human resource base used by the electronics sector? Do sustainable business practices in the environmental field (such as ISO 14001, Life Cycle Analysis) enter part of the curriculum?

- What research activities undertaken at UNA have importance for the ongoing development of the electronics sector in Costa Rica? Do any research activities study the sustainable performance of Free Trade Zone companies in the electronics sector in the fields of environmental management and corporate social responsibility?
- Do formal links exist between UNA and Free Trade Zone companies in the electronics sector?

Full Interview Transcript

Present: David Christensen and Leiner Vargas

D: So, I wanted to talk to you about the interesting paper you made for the DRUID conference 5 years ago, and as your position as Vice Rector I'd be interested to talk to you about the role of UNA in the innovation system.

L: Right, no problem.

D: This paper talks about FDI trends in developing countries, and specifically the development of FDI in the electronics sector following Intel's investment. So, it's been five years since the paper was published, and when the paper was published Intel had been in the country five years. After ten years I think it would be interesting to take a look at the same questions, see what's happening in Costa Rica. Now, you present a statistical test in export specialization in the Central American countries, and also a technological specialization index analysis. I just would like to ask, five years now from when the paper was published, is there a clearer picture of which direction Costa Rica is going?

L: Yes. Actually I think one of the major, you know, questions we had at that time was to clarify which were really the tendencies into the specialization pattern in the region, because there is a kind of misunderstanding in the situation. Most economists think that to reduce tariffs and open the economy will just immediately help in the process of becoming more efficient, in terms of production and getting prices right and resources well allocated. That is basically, that is exactly what the neo-classical economic theory tells you. If you get those prices right, then you will get specialization on your competitive advantage or comparative advantage situation, and then you can get resources allocation efficiency.

D: The thing is, market conditions are never always perfect...

L: Right, right. But that's the basic thing. So, if we define that... okay, let's show how the pictures. How the patterns behave in the region. And then we showed, first of all, that the countries that had been getting too far in the opening clusters were de-specializing in industry in the region. So we got for example the 4-5 Central American countries and we got the picture that for examples countries like El Salvador who have been so far, they have been very excited about this process of liberalization, all this Washington Consensus measures, so they have become more and more well-behaved according to these policies... they become less and less, what we call industry countries. Industrialized. They become, in particular El Salvador, they become de-industrialized, in a way. And we were in particular interested in how knowledge moves into the picture, so we tried to make a comparison with this index that was developed by ECLAC commission and was in the literature in the 60's, this technological specialization index, well developed by Balassa and others. But mainly what we wanted was to show that what was exactly the opposite situation in terms of knowledge and in terms of industry.

D: Right, that's what you say here, that trends in export specialization, that's been increasing, but the technological specialization...

L: Goes down, exactly. And that means that knowledge is a source, a factor that behaves in exactly the opposite way, because it's very much related to national contexts, to national innovation systems, to policies, particular policies in the country, to ways of management in the relation between the main actors in the country, the main institutional set up, the links between industry, university, government... all these innovation theory tell you about, you know how really knowledge is shared and how goes technological capabilities, are builded and spread into the economics area, which is mainly products and services.

D: And your analysis shows that this process is not happening to the same degree that you would have hoped for, or [unintelligible] from the degree of specialization...

L: From that time to know... I mean my impression is that at that time, we produced before with Klaus Lindegaard a paper for ECLAC, this is in the ECLAC review, Klaus and I produced this, and at that time we would say okay, trade specialization is moving to one direction, which is we are increasing trade, even we are increasing trade... only industry products, particular on maquila products at that time. This is good, I mean we haven't... nothing bad to jobs and to have export, that's good. But the thing is technological specialization index shows that we are exactly on the same pattern of competitive advantage that we had ten or twenty years ago before the opening process started. So the thing is, are we dealing with the right question? We are facing the competition process just to increase export or are we dealing to getting our economies more knowledge-oriented, learning-oriented, according to the new theories of innovation and so on, and all the stuff that we in Aalborg used to have... and then, we found that exactly the opposite way... and the only that we founded that has increased, just, not so much but just... I mean, in the paper we showed a little tendency, was Costa Rica.

D: Costa Rica following Intel's...

L: Particularly Intel [unintelligible], but in the new five years, maybe the next five years that we, you showed me this... I would say that this index was around 10%, maybe 12% at that time, ok? I would say that now it should be 16%. The tendency in Costa Rica is basically driven by a process of agro-industrialization, what we call it, increasing knowledge on agro-products will help to on what we call all the industries, all traditional industries like coffee, like sugar cane, like bananas and so and so. All these processes, olive oil and so on, what we have been seeing from that time till now is that those industries are becoming more and more knowledge-oriented.

D: Right, they need to innovate in order to adapt to a more globalized environment...

L: Exactly. That counts very rational. But it's not explained by fair market conditions... basically through what we call a process of knowledge accumulation, and following the pattern of competitive advantage of those industries. Because if you compare coffee situation 10 or 20 years ago with the coffee industry right now, you see there is a process of increasing knowledge particular on the second part of the coffee chain.

D: What is the second part?

L: Which is related exactly to quality control and product development. We have seen an enormous explosion of trade marks with particular increasing of organic production, with increasing combination of flavors and so on and so on. All these developments in the front of the chain of coffee have helped, and this is basically knowledge from other industries goes into coffee industry.

D: And this has been done with an innovation system approach where you've seen that universities have helped to...

L: Right. My impression is that in traditional industries like coffee, like bananas, like sugar cane and others, national innovation system is becoming more effective. And indeed it has also to do with facing those industries to global arena, I mean... most of the new agro-products, pineapple, these new national products, melons and so on and so on. All those industries, what we call agricultural based products, all those new set of products have been faced to international market conditions that have helped... and local innovation systems of the country have helped to produce kind of, I would say, increasing use of knowledge on both these industries.

D: So at the local level they have been able to adapt to these global market conditions...

L: Exactly.

D: Now the point here was saying, okay we have a high technological index a little bit in Costa Rica, but has it been really successful with the new high value-added...

L: In this picture we would probably not show all those incremental adoptions in the coffees, in these traditional industries. But in this index what we see is basically what had happened in the Free Zone activities. Intel, medical products, medical apparatus and accessories and all these things. And this probably has moved to 16 or 15% of the production, because what we have seen in Costa Rica is that the maquila, the traditional maquila... a part have gone to the rest of Central America and only basic activities have had... you know, design, develop and all... some value-added products on the maquila, traditional maquila production [unintelligible] in Costa Rica. Because we had mainly... most of the...

D: Maquila isn't that traditionally textile production... ?

L: Basically textiles, it's basically ensemble productions like, you know, classical things. You have for example woman underwear with particular problems, with health problems, all these need some design, some special management that the value added of the product is increasing... of those products we still have some production, some industries. Most of these industries have really moved. Outsourcing products and packaging here, or outsourcing directly from China.

D: So the competitive advantage that you've drawn in Costa Rica, of course, is not that it's a cheap labor force, no that's not the case, it's more... you really need to focus on the knowledge...

L: Exactly. And that's the major clarification in the paper where we try to decide... okay, look at this picture, are we competing with those countries that is getting down? No, we are competing with newcomers in the international arena. I mean we are competing with India, we are competing with some areas in China, we are competing with some areas in... Ireland, we are competing with software industries, we are competing with services support, we are competing with a new set of industries. Indeed we still have some manufacturers, like island industries. Where.. because our weather conditions and so on, we produce good melons, we produce good melons, we produce pineapples, we produce good mangoes. But those industries still there, and will continue there, but it will not help, you know, our labor force to become... to grow up, to really increase our revenues.

D: I think that's my next question, whether... okay you can see that there's high technological specialization and you mentioned that the medical devices have come into the area in the recent five years. I'm wondering, okay, has it been more established? Is there stronger technological specialization patterns, is it the picture that you're aiming for?

L: It's gonna be... it's a new way, I would say... indeed I would prefer to have an endogenous industrialization process, as many others of the 50's...

D: ISI.

L: Exactly. And most of this literature about endogenous growth tell you that for example you need to have local capabilities, you need to have investment from the government, you need to have entrepreneurs an all this Schumpeterian entrepreneurs and so on... well, you have not... I mean, if you have not those conditions, not all the conditions, you need to have, sort of, mix. And what we see here is that those free zones are getting into a pattern that helps the economy to increase the technological capabilities in two ways. It will create demand for new human labor with higher conditions, with higher technological capabilities. So for example Intel rise the level of technological capability of the engineers, and that means you have a demand effect on the innovation system. So you have an effect on the educational system to become more competitive to the cost. And the other side, you have the other process which is those companies which are getting into a cluster, that help to become those Intel linkages...

D: But in your analysis you don't have a very encouraging picture. At this moment, five years after Intel has established... most of the links are low value-added. So that's my question, are these interactions with local industries still low value added or has there been progress in terms of increasing the value added?

L: My impression is that the most effective mechanism has been the demand mechanism. The supply mechanism has not functioned as I would have liked to function, in particular because of the rules of international companies for developing those followers, supplidores [?]...

D: Why, because of the quality restrictions?

L: Quality restrictions, but those are like the egg and the chicken, what is first? The other thing is most of the companies have their own technological links with their matrix or with other technological... along the global... so it's difficult for them to become local. Those demands, in particular the technological part are very much linked to international innovation systems.

D: It's hard to [unintelligible] on that...

L: It's hard, but it's not so bad...

D: I've talked to an agency under PROCOMER, Costa Rica Provee... they're trying to make local linkages with multinationals, and they... when you look at the number they've made, it's actually not very much. In amount of dollars, it's not very much.

L: It's an industrial policy... once you have international companies here, you may consider that those processes cannot be forced by industrial policy. Those industry links become more and more important when you technological capabilities in their innovation system. In that way came the picture of the universities, because most of the technological capabilities in the research and development in countries like Costa Rica, particular in Costa Rica, is in the public sector, at the public universities. So that's make difference with respect to other countries and with respect to the kind of industrial policies that you can develop in that kind of countries.

D: I'll get back to the public sector and the universities' role in innovation systems here later on, the question is relevant. But you also touch upon research and development in general... now, I think when you, in the comments to this paper you say that the research and development index, which is part of this technological index, is quite low. So it's always sticky and low, and my question is, first of all why is research and development important in this relationship between export specialization and technological specialization?

L: I think its, well, technological and trade specialization is sticky, it's hard to change. It's not overnight changes, so you cannot value five or ten years in the same way that you value other processes. So it will take long time. The thing is, are we on the right pattern? And if you see the trade specialization pattern, it looks like the whole region, Central America, is moving to the right. But if you get just this little... it's not a good indicator but it's a least an indicator of knowledge into the production, this technological index, considering all the difficulties to measure and so on. But using this, we see that the region except Costa Rica is moving in the wrong way, and the main question is why?

D: Yeah, why is research and development so low?

L: First of all research and development in these countries is so low, but the main reason, also in Costa Rica research and development is low, as in the rest... the main reason why Costa Rica still has some technological capacity, it is plain for the demand effect, particular for the education system in Costa Rica. It has to do with a long, long, long time investment in education. And those engineers, those knowledge qualified people, have created conditions for attracting a different kind of investment and getting those investments in a virtuous circle, not exactly as in China and in India, what they have developed... but still in a manner that at least sustains or maintains the level of technological capability in the country. And the thing is, once you go into a tendency which is getting down, it will take 25 or 50 years, 2 or three generations to recover. It's not a process of... we see for example the case of El Salvador... you see for how long the country has got the point of, point 10... when the gates, they gots down, it will take a lot of effort for this country to become part of this picture.

D: But when you talked about Costa Rica you said that there's been a lot of long-term investment in research and development and in the local education...

L: Not exactly on research and investment. More a long-term investment on education systems. That's mainly the problem in Costa Rica. We have had good education system but low investment in research and development.

D: But why, is my question.

L: It's a particular policy. It has to do with the systems on the public sector. First of all, if you see how we understood research and development since 90's and before, until 90's, we understood that... black box, research and development was mainly a black box. You cannot invest on something that you cannot know.

D: So you're saying that a big missing link in the innovation system is the government's role in stimulating research.

L: Exactly. It's been very good on developing the demand part, but it has been very very very bad in developing supply. Where you put research and development. How you deal with relation between industry and universities. How do you... develop those mis-matches between the actors. Because you have good technological capabilities, you have good research departments at the universities. Completely out of link of the industry process. You have good scientists producing papers for high quality research journals related to research and development.

D: I had a question... that means you're not very impressed with the work of the Ministry of Science and Innovation in Costa Rica.

L: Absolutely.

D: What have they been doing? Why have they not been trying to make an overall strategy to involve the universities more to develop the supply part of what industry needs?

L: Because most of our politicians, most of our ministries in the major macro policies, they neglecting the role or importance of knowledge. Particular the role of innovations and innovation systems in the economy. I mean, I would say that our ministry of research and development, our ministry of science and technology, is very young. It's still very small. It most stories than results, real things. It's been too much said to little done. And also because innovation policy cannot be as it has been written in the developed world and as it has been written in most of the English papers. In general the European Commission report... innovation policy cannot be separated to the other policies, to the trade policies, to the macro policies. So innovation policies can be considered in a systemic way, and you cannot develop these... indeed you can help investing on science and technology a little bit more. We just invest 0.5% of our GDP on average, this is no good. Maybe it's underestimated, maybe, if we consider some figures it's 1.1% but even though... at least we need to increase that figure to 2.5% as Brazil and Mexico's economies are doing now. Then indeed, if we wanted that something happened from the knowledge part of the economy, we need to have those... and this is sort of a tricky thing because if you do not invest here, you do not need the demand part, will not help. If you do not have the demand you will not have this as well...

D: But the thing is, I thought, the way I look at it, Costa Rica has been very good at targeting the new high value added sectors and things, the ones they want to attract to the country. But they just haven't been good at following up on that, is that what you're saying?

L: Well we had been very successful in attracting foreign direct investment. We have been very successful in developing conditions, general conditions for those investments. We have other qualitative advantages. I would say, peaceful context, having a good geographical context, having a good telecommunications sector. The only thing is, those things will help but when you need to decide the next technological investment, the next department I will outsource if I am in a company, which is research and development, product development, I would say it's very difficult for companies to decide to put it here because first of all trained personnel, you not on the same status, and the second thing is, are we having local industries? Because those competing industries in the local countries help. If you have a good design industry here, you get a very good passion, and blablablabla... but if you do not have the basic conditions you will not have the attraction part of those industries.

D: I think in the case of Intel you had some software industries [unintelligible], but Intel came and bought them.

L: Services isn't here. Services in the near history cannot be shown in this, because services is not mentioned in this index. That's the problem on services... if that we are still on what we say second stage services in support, if we really want to have first class service conditions, we need to follow up with services with high value added. We have many many, plenty... this is the more exciting sector in the country right now, the most growing up, services, particular outsourcing services, which means you have part of the services of the international company here... usually it means basically work force.

D: But it's not just customer support, I think we have examples of high value added...

L: We have some, some examples. But then this is the tricky thing, in our traditional... "algo vendrina no hace verano", one bird does not tell you that the summer is coming. So, we have those birds but we have not the summer.

D: I think I had one last question about the big macro picture. What impacts do you think that the TLC will have? On export specialization, on technological specialization?

L: I'm very critical on TLC on what we call free trade agreement, because those are what we call... Klaus and I used a phrase that was neglected to be used for the partners in innovation theory. We are moving into the political system of innovation. It's a phrase which is basically telling you that the system of innovation is driven not exactly for the free trade, but for a political trade regime.

D: So you mean to say that people who are in power have political...

L: Exactly. We are basically saying that this system of trade is based on power and not in fair trade.

D: Could you say that this exists also in the high value, high tech sectors?

L: In all the contexts of trade.

D: I think it's quite obvious maybe when it comes to coffee production, I mean the oldest, most powerful families in Costa Rica...

L: But also in the international arena. You consider that the major export country in coffee is Italy! They import and they re-export... I mean, international trade is not a fair trade mechanism, dealing with nice people, no, basically based on power. Power that goes into trade regulation. Trade regulations are not exactly right now based on tariffs, it's more the structure on non-trade barriers, on technical barriers, on environmental barriers and all those are basically driven by big international companies. So the power on those are... the international trade mechanism like free trade agreements are basically helping on consolidating those powers for some companies, for some sectors.

D: Do you think this is actually harming Costa Rica's development when you take a look at...

L: Yeah, but this is... in one part, I would say, yes. But this is not the whole picture. I mean I would say yes, indeed, international trade [unintelligible] is not helping in general developing countries in those contexts, because we are still in a position which is we are supplying resources for the international chains. Human or national resources. We are not supplying knowledge, which is the high value source of the trade. And indeed... we know that, most people know that, but nobody told us that. Even if you consider that the definition of the system of trade in a country is basically according to the power of the sectors, of the groups of the country... you see why Europe are still producing some basic things like agricultural products, you still understand how Spain or French behaves against bananas from Latin America. Indeed it also has to do with a fighting process between the European and North American companies dealing with the trade on bananas, but it also has to do with the interest of political groups in the developed world and in the developing world. Political groups that are dealing with this trade are having power to manage those relations. From time to time there is an open window, and

from time to time some countries like Asian countries get into the picture and are able to deal with those power relations, but if you believe that everything is like a Washington Consensus picture then you would never develop in the international...

D: None of the Asian tiger economies were based on free trade.

L: No, no. Administrative trade I would say. And it's not a socialist regime... it's exactly understanding that the international picture of trade is politically oriented. And the only way you can deal with the politically oriented picture is using your political power. So why you get public companies in telecommunication? Well because you know that telecommunications is basically driven by two or three major companies in the region. So, why free trade agreement signed a parallel agreement on telecommunication for Costa Rica? Exactly because those interests of those companies, and not because it's important for Costa Rica to have a competition in telecommunications. Not because the state really needs that we have competition in telecommunications, it's because those companies' interests are going through the treatment into the... and if you go to different agreements, not the trade ones, the trade area about TLC, the basic things about investment rules, tariffs reduction, processes of adapting to a more standardized things on the way we deal with customs, all those things are basically good. I would say it's going in the right way, we need to get it international, but the problem is the parallel process, the adjustments that we need to do for getting the entrance fee, are those adjustments helping us or are those adjustments threatening[?]?

D: Well they do argue that opening up of telecommunication will lead to better standards in services, cheaper services and everything. But you're skeptical.

L: I'm skeptical for two things. First of all, we got one of the cheapest prices of telecommunications in the reason. Secondly, we got...

D: But there's been a problem with investments...

L: Right. You got right. But... goes into these oligopoly conditions, are we getting investments or are we getting, just, you know, concentration of power in two companies that will basically use our technological capabilities, our technological infrastructure for getting new profits for their investors? I mean, there's nothing wrong, I'm not really skeptical with the telecommunications and with most of the treaty agreements, the problem is this is not the right policies, this is not the agenda for development. This is... probably will just distort our agenda. The main agenda for development is going into basic lessons of innovation systems. Good human resource development, which means improving your educational system. Good investment and right incentive for research and development. Policies and indeed, getting institutions to work. I mean, [unintelligible] like property rights... and those things, when you see the debate you have been here for the big political referendum... I mean, are we discussing the right things? Are we really discussing the important things or are we just losing time on discussing.... It's not because people neglect that we need to have a reform in telecommunications, that's good. Getting competition or getting new things in that, that's good, but the thing is... we have all the steps to do that we have forgot, because we are just fighting each others.

D: Because there's not talk of an overall development plan, is that your point?

L: Yeah. And it has to do with other things. It has to do with infrastructure development. It has to do with reducing inequality. It has to do with increasing capabilities for research and development. It has to do with improving our educational, health system. We have to do the basic things, and nobody will help, and neither the States, neither Europe will help with this, I mean now we are facing Europe as a, okay new trade agreement, new trade agreement with Europe will help now because we feel not so good with States and move to Europe, or even we can face China because now we are... I mean like, wow, looking in the wrong place for the right answer.

D: You mentioned in your analysis of Intel that there's still the need to develop... and you talked about it before, the local innovation systems to adapt to the company themselves...

L: Espere un momentito... sorry...

D: You say that there's still a need to develop policies to make better linkages with the local economy and make better knowledge transfer processes better. You look at three things, strategies in local innovation systems, you need to upgrade human resources, and these clustering strategies you need to... and how do you think this has worked since then?

L: I mean... I think we have not the problem, we still have I would say... the country has long tradition on some industries and long time knowledge accumulation in some industries, and when the country [unintelligible] the opening processes, and with the, I would say, balanced process of, not so violent processes of opening... with help those sectors to become more competitive. And those sectors have specialized in some areas that we see in the economy, some areas where these clustering processes appear and develop. And one good thing of this is for example the tourism industry, the cluster of tourism in different regions. Some agricultural products are able to became kind of, clustered. And I may say that we have been also very successful in developing some new knowledge industries like software, clustering some areas where universities and industries become interlinked and developed some good histories, product and development. The problem is, those are just, like... [Spanish] ... I mean, most of those things are not exactly designed by policies, its not a policy development. It's not articulated as a strategy as it was in Asia, where you saw that governments had helped to develop most of those clusters. I would say we got it. And we got in mainly because of our knowledge stock and human capabilities, and if we help them, those clusters can get even more and more robust. That we have not policy, we have not an industrial policy in Costa Rica. We have been neglecting those from the ministry of economics and we have been neglecting to use industrial and technological policy from the Ministry of Science and Technology. I've been writing since 90 about innovations and industrial policy. Since the beginning of the 90's I have been involved in those activities on research, and I may say that it tooks a lot of time that the headaches of this Washington Consensus policies have disappeared in the brains of the politicians, and now in the context of most of the policies are prohibited for the international trade mechanisms that we have signed. Or even that other areas with short time benefits or profits for policies move the decision-making to those policies. I mean industrial policy, research and development, technological policy, innovation policy, is long term. So the political commitment is very reduced. If you wanted to evaluate research and development you need to have at least 10, 12, 15 years and governments short time periods. And it also has to do with the political system in our countries, I mean its

not happening in Asia, its not happening in China, its not happening in India where the plans for science and development have been moving towards decades or 20 years. So we have just beginning...

D: In the paper you focus on, as I see it, two aspects of sustainability. Economic sustainability, where you mean linkages with local industries that helps the local economy, and also the social aspect of sustainability when you talk about high value jobs. I'm studying environmental management, I want to look at how this fits in the environmental perspective, and that's maybe not so much clear but I'd like to ask you, do you think that FDI in new sectors like the electronics sector, would be able to help in the environmental field?

L: I have not gotten any evidence about... as remember I think in '94 a friend of mine and I, we tried to make an index for proving this dirty industries hypothesis, pollution havens hypothesis. It was... it was my work with Eduardo Gitli, and he died 3 or 4 years ago, but he had worked a lot, a lot of work on international trade and at that time we were in CINPE developing some studies on the environmental impact of industry development and we tried to put this environmental figures here, dirty industries index and then we put it... industry development and see how those two things, and we found not a correlation because most of the new jobs, new value added, comes from services and then the effects disappear. And also because we got that, first of all the opening up process helped the industries to become more international standardized...

D: Well do you see that happening, really? That's my point, really, that they can help in the knowledge acquired, with their management processes and things...

L: Yes, in particular with the new knowledge that comes when new companies arrive into the area. Knowledge on how to do it, processes mainly. And also because international companies are more in favor of rules.

D: And also because of their image.

L: Exactly.

D: But how did that happen really in Costa Rica?

L: That did not happen with the traditional resources I would say, the fishing industry became more [unintelligible] in their environmental, in terms of invalidating resources, I would say. Fishing industry is a big problem in Costa Rica. Then we founded some of the new agricultural areas like melon and pineapple products become more and more perverse, getting down on the environment, particularly because the use of technological package based on a lot of agrochemicals and so on. So the agrochemicals figures increased with the non-traditional exports. But the thing is, we found kind of, everything in there, and my impression is that it cannot be a macro, you cannot find... and I have been reading some studies in the international journals and my point is there are some other things... my impression is that this is not the right way. My figures, microeconomic figures would have helped, case by case.

D: [Talks about thesis work on the electronics sector]

L: As I may say, and Jens would probably agree with me, that it very much has to do with local institutions, supporting them.

D: What do you mean by local institutions?

L: I mean... environmental law, first of all. And all these institutional set-up related to enforcement mechanisms. Then the thing is the demand effect, develop people and NGO's and all these informal institutional set-up that create values and political power for the environment. And in countries where you have environmental law, you have a good environmental civil society and good enforcement mechanisms, no company will continue to behave wrong. It will be a punishment and a change on behavior.

D: Part of what I've found is that environmental law is often fragmented here, enforcement is not [unintelligible] because it's under-resourced. I haven't been able to find much NGO activity, I think the only NGO involved in the electronics sector is one Intel founded itself. And the demand effects are not really there, so are the institutional...

L. But this is the only way you can deal with the environment in industries like the electronics, because you have not those conditions, then why a company will behave? Only this status in the international arena.

D: But it's funny, Intel is trying to stimulate local involvement. They education schools and things...

L: Social responsibility... business in the long-term, business thought in the long-term need to create customers for the next generation of customers, and this is good, there's nothing wrong with that.

D: But can it compensate for the lack of public institutions?

L. I don't think they can compensate at all. They can help at least in getting basic rules for the partner industries. You are an industry, in an industry area where you have this behavior of Intel, you get exactly the same behavior from other companies, major companies in particular. Because it's like... looking this, I'm looking this [unintelligible] in a context... you start coming to this context without time...

D: In what sort of arenas does this happen? You have industry chambers...

L: You have industry chambers, you have industry boards, you have... your kids of the manager goes to the same schools and they say wow, my father is so nice because he is working in Intel, and Intel is helping the school, why your father is not helping the school? Exactly the same thing, is kind of social context...

D: Some of these chambers, like American Chamber of Commerce has an environmental action committee and Intel's environmental lead engineer is represented there, and the Camára de Industrias has a Center for Cleaner Production. What do you think about that part, is it working?

L: It's helping, it will not general mean such an important effort but it will help. Those collateral activities on the innovation system help to greening the industry. It can be worse if those do not appear. It will help, and that's good. But we need to have environmental policies that can be really on the pattern for those things. Because Intel is a big company and there are other big companies helping on these, but we need to have...

D: My last question, we're running out of time...

L: Yeah, I'm getting tired.

D: The questions are about the role of UNA. To what extent does UNA right now play a role in educating the human resource capability foundation?

L: I think UNA is having three major areas where we are helping on these human development capabilities. I would say more on the environmental sciences, we are helping on developing a new generation of good environmental engineers, qualified environmental people for management of natural resources and dealing with environmental problems. The other aspect is, we are helping on developing human resources on segment of people that, if UNA were not here, those people would be just traditional workers. I would say we are helping on upgrading on upgrading resources from the low income groups that helping in social sustainability of the country, and those particular students from rural areas and from poor families, it's a critical thing. And the other thing is, UNA is dealing with a group of... laboratories, and research people linked to key industries like chemistry, technology, in particular informatics and software, and biologies. Those are the ke setors that we are facing. And we are now in the process of reforming and making new departments and so on, but I would say, the best things to do is done by most of the universities in the country, nothing special in UNA more than those three major...

D: Do you have any research activities... is any specific research going on to study performance of free trade zone companies? Is that appropriate to any of your research activities?

L: We have some departments, particular in CINE we have some group of people working on trade and so on. But there are a set of research of those thing, and I will mainly tell you that it is mainly downloaded from the website, the areas where UNA is doing work, in particular the project names and industry-related... but I'm still skeptical that we are producing enough. We are having some problems with dealing with qualified research in those areas. But I would say, like, good examples of those things... but I will not tell you about the good examples, I will tell you that in average we are still having problems with dealing with highly qualified research.

D: And that's a big question of resources?

L: No, I think it's a question of technological capabilities in the research area. That's why we have projects like SUDESCA, you know, long-term capability developing project. It was tricky and unlucky situation that you had this government in Denmark, and then they start cutting out these relations... I think because what we what we had with those projects was developing a basic local capability staff, on research. In particular in SUDESCA we got good qualified professors...we probably would have liked to have mo

Appendix B

Interview – Anibal Alterno, Environmental Engineer, Intel

Submitted Interview Questions

Chairmanship of AmCham Costa Rica's Environmental Action Committee

- Why does AmCham see it as important to promote environmental initiatives among its members?
- How does AmCham go about promoting environmental initiatives, and which sort of activities are the most strongly promoted?
- How would you describe the level of engagement by AmCham member companies? Is there a difference between American and Costa Rican companies? Is there a difference when you look at the size of the companies?
- Specifically for the electronics sector, how would you rate the level of environmental engagement among AmCham members - with and without Intel?
- How would you describe the level of cooperation between AmCham member companies on environmental issues?
- Specifically for the electronics sector, how is the level of cooperation between AmCham member companies on environmental issues?
- When looking at the institutional set-up in Costa Rica including government agencies, the legal framework and support infrastructure for companies (such as universities and training institutes), what have been the most important things that have helped promote environmental awareness and environmentally friendly behavior? What role does AmCham play in this? Is there anything lacking about the institutional set-up in Costa Rica – why/why not?

Corporate Environmental Management at Intel

From the material you sent, Intel evidently has a very well developed overall environmental management program for its global operations as well as its local operations in Costa Rica. At the global level, Intel has a number of concrete environmental targets such as its carbon emissions reduction target as well as the ongoing R&D on lowering the environmental impacts of your products (elimination of halogen use, the Eco Rack, etc.). In Costa Rica, to recap, your corporate environmental management consists of:

- * Management of hazardous waste
- * Storage and management of chemical products
- * Wastewater monitoring
- * Management and recycling of solid waste
- * Control and monitoring of air emissions
- * Prevention of ground- and rainwater contamination
- * Monitoring of groundwater
- * ISO 14001

Additionally, you have in-house training of employees as well as community outreach programs on environmental awareness. I have the following questions:

General

- On what background has Intel CR decided to implement the above mentioned environmental initiatives? Which is the most important driver – corporate strategy, local authorities and legislation, customer pressure, etc.?
- The material you sent me says that Intel is beginning to notice a trend among European customers especially, and from government agencies worldwide, asking about Intel's stance on environmental matters. Is this noticeable for you in Costa Rica - Why/why not?
- Have you been able to measure concrete and ongoing improvements in environmental performance? (Data very much appreciated)
- Can you confirm that some of your most hazardous waste products are sent to the US for processing? How and why did this come about?
- Do any R&D programs exist at Intel in Costa Rica which are meant to lower the environmental impacts of your products, or does these sort of R&D activities mostly take place in the US?

Relationship with stakeholders

- What is your relationship with relevant stakeholders in the environmental area such as municipalities and government agencies? Do you believe you are proactive in the environmental area? Are the authorities under-resourced? Is there anything unique about the way authorities try to encourage environmentally friendly behavior?
- What stakeholders are involved in your environmental management programs (for example, the cooperation with SENARA for your groundwater monitoring)?

- Why do you have an ISO 14001 certified EMS, and has it proven useful? (I have previously studied Intel Philippines, and their EMS system, while functional, was actually seen as unnecessary paperwork – Intel's informal environmental management program was working fine before they decided to get certified!)
- What benefits has ISO 14001 given you?

Intel and the electronics sector/supply chain

- When looking at your environmental management programs, would you say that companies in the electronics sector in Costa Rica share the same degree of environmental engagement – why/why not?
- Do you have any local suppliers in the electronics sector in Costa Rica? How do you promote the use of environmental management programs throughout your own supply chain?

Full Interview Transcript

Present: David Christensen and Anibal Alterno

D: Who am I talking to and what's your position at Intel?

A: My name is Anibal Alterno and I'm the South American environmental engineer at Intel.

D: As well, you are the chairman of the Environmental Action Committee at AmCham...

A: Yeah. And that's a position I've happened to have because basically the committees of AmCham are composed of members or employees of member companies.

D: How long have you had that position?

A: I think I've had the position for about 4 years, if I recall correctly.

D: Do you have an idea of how old the Environmental Action Committee is?

A: I think it's about... it's only ten years old. It's been there for awhile. I don't know about that one, but my recollection since I started with Intel back in '97, I think in '98 it was an already existing committee, so maybe ten years or older.

D: Okay. Well my first question is, why does AmCham in general see it as important to promote environmental initiatives among its member companies?

A: Well it is important because you cannot separate business promotion from proper environmental stewardship. If you want to have a sustaining business in a country, if you want to make sure that you produce the positive impact, you need to do that in a sustainable manner. And by sustainable, we mean a balance between economic, which is basically the business [unintelligible] core of the company, social development and environmental protection. So basically, that's the concept which at the level of the company is what's known as corporate social responsibility. For a country, its sustainable development. For a company, its social responsibility. So a balance between environmental, economics and social quality.

D: Going into the specific activities that AmCham is involved in on the environmental area, what sort of activities do you promote, and what sort of activities are most strongly promoted?

A: Two basic action elements. The first one is to promote sharing of best environmental practices at the business level. So we normally discuss, our team, several issues, we go into waste management, air emissions control, water management and we try to bring in allies from, you know, like third party companies that offer services, or NGO's that are working on particular projects, to make sure we are able to understand, what's going on in the environmental arena in the country? And we can promote sharing of appropriate business practices that are aimed to increase environmental protection while promoting good business practices in general...

D: So you arrange formal seminars, meetings...

A: Yes, correct. So as part of that particular element, we arrange seminars. We have done a couple of... we do like one a year, twice a year, workshops on different subjects which can vary from waste management to climate change. We've gotten involved with NGO's and helped them out on campaigns that they have. We also serve as a means through our webpage, to actually post information, activities that other parties are doing in environmental protection, so we serve also as a [unintelligible] means for them.

D: What is the hot topic of the day that you're discussing most?

A: Well, several topics. In that particular element of environmental good practices, it seems that waste management is in general a pretty hot topic, because waste management covers a lot. It covers from basic solid waste recycling up to your chemical waste, hazardous waste management. So this year we have had particular lectures on co-processing technologies, that is using waste materials as a fuel in cement manufacturing, for example, which is how we do it in Costa Rica and its done also in many places like Europe and the US. We've also spoken about other, new technologies that are being actually developed in Costa Rica... I don't know how familiar you are with the plasma technology...

D: Plasma technology developed by Franklin Chang?

A: That is correct. And one of the applications of that technology is what they call a plasma melter. So this plasma melter, for example is a technology that could be used to treat wastes that are very difficult to treat otherwise. Like for example you could have medical waste, you can have, almost every type of waste you can imagine...

D: Very toxic material as well, that could be super-heated...

A: Right. Toxic materials could be managed in a plasma melter, and what the plasma melter does is basically ionizes matter into its basic components, elements, and what you have is a residue. It's gasses that can be isolated and put back into the market, and we're talking about hydrogen mainly, and we're talking about also other gasses, argon and stuff like that but mostly hydrogen that can be used in different applications. Then you have solid residue which is basically silicon solar pellets, and then you have also a metal residue, and this metal residue is basically a metal alloy which can then be refined in a regular metal melter...

D: Have you had a look at the silicon residue, whether you could use it feasibly maybe for wafer production?

A: It's like a rock. Unfortunately I don't think the silicon pellet is pure silicon... it could be used for example in the electronics manuf- in the electronics industry, or solar cell industry, that I don't know yet. Because as I said [unintelligible] technologies... still trying to look for ways of actually using the by-products. But in the worst case, it's just like a big piece of sand rock which can be put back in the environment without any problems. But hopefully it can have some kind of application as well. Then you have the metals, and the metals can be separated in a refinery, called... smelter. And you can actually separate those metals and put them back into the market.

D: Is there a refinery of that sort here in Costa Rica?

A: No, there's not. Our [unintelligible] business in Costa Rica is non-existent. All we have is regular iron meltters. That's about it. we don't have big electric ovens, high ovens for [unintelligible] manufacturing. So we don't really have a big metal industry in Costa Rica. There are some metal industries close by. By close I mean probably El Salvador, Guatemala, Mexico, and then on the south side, Colombia is the nearest.

D: So what stage are these plans at? Are they at the talking level, or... ?

A: Basically... it's pretty advanced. The only problem with that is that it's very high cost technology. Therefore what they're doing right now is that they're trying to convince the government to use this technology in biologic waste, which is basically the waste we get from hospitals. And if that goes, then they control all the investments, and by just having the machine here, they can start processing other waste. So the good thing in general, what I'm trying to convey here, is that Costa Rica is evolving into the capability of locally treating waste that historically we have not been able to deal with. So that's the important part. In that same line we have been pretty engaged in the process of management of electronic waste. So as I said earlier waste has been most of our focus this year, and in that particular aspect we have done a couple of big things. Number one, we have been part of the committee that has been developing the regulations. Secondly we have also sponsored the waste collection event that we hosted about a month ago. So that's been pretty much the emphasis on the best management practices, the pollution prevention, the clean technology practices sharing...

D: Could you sort of describe your... you were talking about electronics waste, what you've been doing in that respect. What happens mostly in the country these days is that there are certain small companies that can handle electronic waste, but a lot of it goes into burners, like there's a cement company called Holcim, some companies use that to get rid of their waste... so what is the capacity for handling electronic waste?

A: Well as you mentioned there are... you know, on the metal scrap world, things have evolved very quickly in the last three years I would say. One of the main reasons for that is because of the metal, iron and steel consumption from China. They have pretty much deployed... [unintelligible] reserves all around the world, so all of a sudden, metal scrap became a big business. And electronic waste, to some extent, is part of that. So some companies, some small companies in Costa Rica, in the last year or last couple of years I would say, have started collecting electronic waste, separating the electronic components, and some of them have been shipped to China. However as you may know, we cannot really guarantee that there's proper environmental management and proper labor practices in China. Therefore that is a practice that we do not share. It's a practice that we don't recommend, it is a practice that we do not share.

D: As I understand it, you do have a working agreement with a local company who does this kind of thing, Fortech...

A: Ah, but that's a new development, that's what I'm saying. I've been telling you about the history for the last two years. So since, several government branches, Ministry of Health, Ministry of the Environment, and institutions like ICE, and private sector like AmCham, the Chamber of Industry, the Chamber of Commerce and NGO's, we put together this committee. And the idea of this committee, which is, again, it's not like it's a new thing, it's something that has been working for about four years. But this is the third phase, if you will, of the work that this NGO has done, ASEPESA. So they got this European sponsorship in the Netherlands, and they were able to get money for different projects associated to electronic waste. So the first stage was basically to do a diagnostics, understand what the situation was. Second stage was more related to understanding the market, understanding models for management.

D: Are these documents, or are these analyses readily available?

A: I have some but you would have to ask ASEPESA for those. They have all kinds of documentation because they have to submit reports... I can just reply to your email and send you the contact information... So ASEPESA is an NGO, like I said they've been working with European sponsorship. And the third phase of their work, we were able to work on the regulations for e-waste, we were able to work on the collection event that we recently finished. And the next step on this particular work is the promotion of what we call a compliance unit. A compliance unit is an entity that is created by the regulations that we hope will be approved very soon. However in the meanwhile these regulations are applied or issued by the government, we hope to have a compliance unit, voluntary compliance unit, already working. So in order to apply the model that was developed and applied, some financial models that we have benchmarked in other countries like in Europe and the United States.

D: Would this compliance unit be part of AmCham or...

A: Actually it's an independent entity. It's an entity that is formed by private companies, as per the regulations model. This first one that is going to be formed, is going to be a private public partnership, a PPP. And the idea like I said a while ago is to overcome the difficulties of just having the private sector organized to do this. So we're trying to work them into the process, use additional resources that we have, actually from GTZ, the German entity that has been providing a lot of international support to Costa Rica. So we're now kind of migrating from something that has been led by ASEPESA to something that will be taken from this point on by the program CYMA. I hope you have had a little exposure as to what CYMA is...

D: You'd have to quickly sum it up for me, I'm sorry.

A: CYMA is the competitiveness and environment program that has been run by the Chamber of Industry in association with the Ministry of Health and also sponsored by GTZ, which is the German international aid agency, if you will. So this program has been in place for over a year, I believe, and they were... they had been working precisely on developing a new waste law for Costa Rica, and that waste law has already been developed, by the way, it's also just awaiting approval in congress. What we did is, to move this thing forward, because the Netherlands sponsorship basically ended I think in November, if I recall correctly, so what ASEPESA is doing is transferring the project now into the hands of CYMA, and help them go into the next step which the compliance and the...[unintelligible]

D: Moving on to the general questions, moving back to those, how would you in general describe the level of engagement by the AmCham member companies, and will you see a difference between the size of them and whether the American companies and Costa Rica companies... what's the picture you get as chairperson of the environmental committee?

A: Well, I would have to be honest. In general there is very low involvement. Now, that doesn't mean that companies at their own operational level do not operate in the right manner, I'm pretty sure they do. It's just that sometimes it's difficult to provide the resources for someone to participate in these types of forums. So it is difficult to keep people interested in the topics and difficult to keep them motivated to participate, be part of the group, come to monthly meetings, this is the difficult part.

D: Ok. What are the sectors that have been mostly involved and how would the electronics sector measure up?

A: In general, there's no particular predominance of any sector. I think it's pretty heterogeneous because we have as a chamber that actually has American and Costa Rican companies in it. It's all diverse businesses. We range from companies in the electronics sector like Intel, like [unintelligible] which does the photocopy machines and all that, to companies that provide [unintelligible] services, consultant services, legal services, and manufacturing companies like Baxter... well, Intel. We have a pretty large membership of the groups, probably 20 to 25 people... but to the meetings, we only have around 10 people that show up on a regular basis. However the other people are engaged in the minutes, and through email and stuff like that. But I wish I could be a better motivator, have people show up in a larger quantity to our meetings. When we have a seminar, when we have a workshop, that's much better. Normally we have 30 plus people attending. But for the regular monthly meetings a little hard to get the [unintelligible] participation. Now, its definitely... most of the companies that we have in AmCham, they are multinational companies, or at least companies that are very engaged with international businesses...

D: Most of them are in the Free Trade Zones, is that correct?

A: Not necessarily. Part of them would be in the free trade zones, but that's not the precondition to be part of AmCham. The precondition is just to do business with the US, or be a US-based company. But that's about it. The Free Trade Zone is a regime that some companies in Costa Rica do have, I think there are about 170 maybe, or something companies that are on the Free Trade Zone regime, and not necessarily all of them are part of AmCham... [unintelligible] As I said before, we have a pretty diverse membership, therefore... we have things that range from pure manufacturing and exportation to pure services...

D: I had a question about the use of voluntary initiatives on the environmental area such as ISO 14001. Do you actively promote ISO?

A: Not particularly, because again ISO is a choice for companies. There are several models out there for implementing environmental management systems. So what we try to do is more than specifically ISO... we try to promote good environmental business practices with environmental protection. So basically what we have been trying to do... this is a project that we haven't been able to finish yet but we've been working on that this year as well. It's to develop, like, a tool kit for smaller companies like PMI's...

D: Oh, SME's? Small and Medium-sized Enterprises?

A: That's correct, yeah. We call them in Spanish PMI's, Pequeña y Mediana Industrias. So those small and medium enterprises, they don't have as many resources as larger companies to implement environmental management. Therefore we are in the process of developing a toolkit that can help those companies, you know, start or kick off their own environmental management.

D: Are you cooperating with any public or private or semi-private things like INTECO or...

A: No, not yet. The problem is that this project is something that we've started but the person who was leading the project incidentally left AmCham to found their own company, so as a private entrepreneur now it's been hard for him to continue the same level of engagement that we had in the beginning. It's something that we haven't really been able to push that much farther, but it's still on our [unintelligible] list, you know. And I've learned in the last few months there are similar initiatives. There's something that the Costa Rican Chamber of Industry have that is pretty similar to what we're doing.

D: Are you speaking of the national center for cleaner production?

A: That is correct. So they have similar tools to what we're trying to build, and I guess probably we'd have to take a look at what they have and ensure that we do not re-invent the wheel.

D: Sure. My last question on the broad area of AmCham's activities was looking at the institutional set-up in Costa Rica in general when you talk about the legal framework for the environment, government agencies, the support infrastructure... you've talked to me and told me a lot about the role AmCham plays in this, but maybe you could give a few thoughts on what's lacking in the institutional set-up? What links are really missing for there to be, shall we say, sound management of the environmental area in the country?

A: Well, what we've been trying to do is that instead of going up front at AmCham to drive things at the governmental level [unintelligible]... what we do is engage through UCAEPP, and that basically... what it is is the national, it's not a union but they call it a union in Spanish, there's a different word in English, it's like the national chamber of chambers. If you will. We have a committee there that is called the Commission for Sustainable Development, which is basically the UCAEPP's environmental committee, and in that committee we have representation from a lot of the chambers in Costa Rica, meaning the Chamber of Construction, Chamber of Transporters, Chamber of Agriculture, Chamber of Coffee Producers, Sugar Cane Producers, Chamber of Plastics, Chamber of Forestry, Chamber of Commerce, the Chamber of Industry...

D: Are you personally a member of this as well?

A: Yes. I've been the rector of the AmCham committee, I have a seat. So this commission... it's a pretty important body for the industrial sector in Costa Rica 'cos this commission is like the parallel ministry of the environment for the private sector. So we are the link of all the chambers that the government... and that's the second element that I never got to, I was mentioning that AmCham has two different elements, one was the elements that we discussed about, the promotion of good practices, green technologies, all of that...

D: The second is participation in this body...

A: The second element is the tracking, influencing and participation in legal and policy-making in Costa Rica related to environmental matters. And the way we do that is through AmCham's, coming through UCAEPP's sustainable commission... and this commission is highly engaged and involved in new policy-making, new regulation, we intercept any new environmental regulation that they have out there, and then we work in task forces to review the technical aspects of those regulations. And then we speak in multi-sectorial groups in order to ensure that we can influence content and application of those regulations to make sure that they are intelligent, that they really promote environmental protection while at the same time does not impact significantly the ability to conduct business in Costa Rica.

D: Would you say you push for strict or lax environmental...

A: We push for smart.

D: Smart. What's realistic, what's...

A: Exactly. I mean, sometimes, you have to be more stringent, sometimes you have to be more [unintelligible]. So in general I wouldn't be leaning to either side, I would be leaning toward smart and balanced legislation.

D: Do you know what sort of activities, or what sort of legislation they've been talking... you were talking about waste?

A: The government has become very busy lately. You know, any word from SETENA, all the restructuring... you are familiar with SETENA, right?

D: The technical committee for the environment...

A: SETENA is the national for environmental impact assessment...

D: Yeah, I'm aware of it.

A: Great. So all the restructuring in SETENA, passing through water laws in Costa Rica, you know we have around 3 or 4 different initiatives in the water, all the initiatives in waste, we review it in that committee. We talked there about CAFTA, and a lot of what we did in AmCham this year was CAFTA as well. A significant amount of time [unintelligible] CAFTA, environmental aspects...

D: Maybe I could ask you one last question in general about CAFTA, what do you think that impact will have on, well first of all foreign direct investment in Costa Rica, and will it affect the environment. We've heard a lot of scare stories from the opposition side about how the environment will be negatively affected by the yes vote.

A: Well, in my opinion, well number one, you first question... well, that's what CAFTA is all about, right, promoting foreign investment, promoting easiest ways of making business in Costa Rica, attracting foreign investment, you know all the framework to ensure that clear the rules and clear understanding of how business is made. So there's no question about it. It should by design increase the amount of investment that is done in Costa Rica both by foreign investors and by local investors as well. Now, from an environmental perspective, most of the negative things were seen by the people that were against CAFTA really was their main argument, you know their main argument is that probably the environmental chapter in CAFTA was not strong enough. That they had loopholes that could be used by companies, there were several issues, and in our view, we did a pretty in-depth assessment of chapter 17 in CAFTA and our conclusion was... it has of course a lot of challenges, it poses a lot of challenges for Costa Rica because our biggest challenge, David, is to make sure that our diverse environmental regulations are actually applied.

D: Sure. Enforcement, that's...

A: Enforcement. So, and CAFTA actually what it does, it acts as an additional driver for companies and for the country to ensure that the laws are enforced.

D: Would you say that there's a problem with legislative enforcement in this area in Costa Rica at the moment?

A: Well, by accepting CAFTA we have to be better, to get better at this, because that's the main commitment that the country does with environmental protection is that we will define what the laws are. We have the sovereign right to define how we want to see our development of the country, what sort of laws we want to implement... that's very clear in CAFTA. But the second thing that is very clear is that whatever we define it is, we have to comply with it. And that's pretty important, like I said a very important driver that we didn't have before. The third element that the environmental chapter brings about... it's a pretty wide, broad, community and citizenship participation in environmental issues and problems, it defines channels where people can actually escalate issues, and it opens all kinds of doors and procedures that people can use to solve environmental problems. And the fourth one, which I believe is a very important one, is the cooperation part. And that I believe is one of the most significant benefits that we get as a country from an environmental perspective. Because all of the others are things that we should have done anyway, right? Things that really, as a country that calls itself a development country, or a country in the development process, all of those things that CAFTA [unintelligible] do, which is already done. But this cooperation part is something that we cannot do ourselves.

D: This would be the cooperation part between all the parties who signed-

A: It's a cooperation agreement. It's a multi-party cooperation agreement by which all the CAFTA members have access to resources and basically financial resources, technical resources that can be used for different components of environmental protection, biodiversity, preservation, pollution prevention, [unintelligible] it's a very wide, and I will recommend you to take a look at the CAFTA version in English, and you can download specifically the annex 17.1 where you will find the environmental cooperation agreement. I think you will find it particularly enlightening, because that's something that very few people talk about when they are discussing the environmental issues in CAFTA.

D: And the study which you referred to before, where you referred to an in-depth study of 17, chapter 17...

A: I have that too. I can send you that one.

D: Thank you. Alright, moving on to the questions on corporate environmental management at Intel, I've been taking a look at the material that you've sent me, and [unintelligible] that you have a very well developed environmental management program ranging from product design, eliminating the impacts of your...

A: That is not done in Costa Rica because basically we are a manufacturing site...

D: Sure. But also in your manufacturing site you do have a lot of different environmental programs as well as in-house training of employees and your community outreach programs, which is, well, innovative, I haven't come across...

A: That's right, well what I was mentioning is that a lot of what happens on the product design and the process design phase as well as what happens on the product stewardship phase...

D: I'm sorry, what phase?

A: Product stewardship phase. Most of those things are done in the corporate site, right. We don't deal specifically with product safety, we don't deal specifically with product ecology. We do not deal specifically with end-of-life electronics...

D: Would you venture a thought or two as to why it's not happening in Costa Rica?

A: Well, because we do not do the design here. That's why.

D: Would there be a research and development capacity in the country, maybe, to have a look at it?

A: Well, we haven't really pushed that hard, because we get engaged in the... you know, to make sure that we have a proper business environment, and that issue has not really come out yet. So the only one activity that I can mention we have done on the product ecology, for example, is our involvement in the e-waste stuff. All the e-waste regulations and programs that I have been personally involved into. We also sponsored the e-waste collection event. So what I just wanted you to appreciate, the way Intel is organized... we have a big world that Intel calls the technology development part. A lot of the process, of the product life cycle assessment, new chemistries, new environmentally friendly processes, material substitution, all of that, most of that happens at the technology development sector if Intel, if you will.

D: Where is that located?

A: We have several technology development sites. Most of them are in the US, basically in Oregon, California, Arizona. And most recently we have also put some of the technology development in Malaysia.

D: Why Malaysia?

A: Well it's because Malaysia's like a hub in Asia, so we have lots of sites in Asia and [unintelligible]

D: Is your Intel site in Malaysia older than the one in the Philippines?

A: No actually the one in the Philippines is the oldest one.

D: All right. I've been to the Philippines, I've visited your site there.

A: Yeah, we had two sites in the Philippines, one of them was closed, Makati was closed, and we just left open the one in Cavite. The one in Makati was the one which was located in a downtown area, we've already closed it down. So anyways, I just wanted to make sure I could give you an idea of what the context is for environmental management...

D: Sure, you're a multinational company, you have global supply chains, you put it where it makes most sense.

A: That is correct. So we don't do a lot of that part because we are a high-volume manufacturing facility. So we get the technologies already cooked, transferred to us, and what we do is that we engage in that technology transfer process, to make sure that at the receiving site, we have all the programs and systems and controls in place to make sure that technology can be developed and grown in Costa Rica without increasing our environmental footprint.

D: But that's not to say that you don't develop new things at your Costa Rican site, do you develop new patents?

A: Well... I don't know. But Intel, really, as a multinational company, talking about geography, sometimes you need to understand that things are co-developed in multiple sites at the same time. So, do we develop patents, I bet we have participated in the development of patents, but I'm not sure we have registered any here in Costa Rica yet. But we have employees and engineers who are part of process development or part of this project development because it's not like Costa Rica is just a package, right. What actually happens is we send out a whole bunch of employees to the development site and the technology is co-developed. So when they bring in the technology, there are already experts in that technology and the site is part of that transition process. So when we receive the technology, what happens is that we have a lot of... then our internal program, that are basically more media-oriented, so we have our waste management process, we have our wastewater treatment, emissions control, pollution prevention, chemicals management, all the programs that you saw through the presentation I sent to you, which are basically aimed to protect the environment while enabling business, basically to ensure that we have a means of [unintelligible] our business in a manner that the impact on the environment is minimal.

D: Alright, I had two quick questions. One is, do you send any of your environmental and safety personnel to receive training in these issues?

A: Oh yeah, oh yeah. As I said before, many of the issues that are discussed at different levels of the company, regardless of whether we are talking about manufacturing, logistics, EH&S, materials, purchasing, services, whatever... we have a virtual factory network that allows us to be interconnected with the rest of the sites, with the rest of the engineers in the world that do a similar job as we do. So this big virtual team, we call it virtual teams because we actually, we work as a team located in different geographies. So we operate through the email, through telephone conferences, through media conferences, most of the time. So those virtual teams... normally we have the capability to receive training, sometimes we send people all over to the different sites to receive training, people come over to Costa Rica to receive specific training or coaching or to learn how we do certain things, and they take that. So we have at Intel what we call BKS, Best Known Methods. All the things that Intel does best, is to proliferate, if we can... if for example in Costa Rica we develop the technology to control air emissions from isopropyl alcohol, that technology we have to proliferate that methodology in other sites. Share it. And if it becomes a BKM, it has to be adopted by other sites. And then we have to go through the process of ensuring that the documentation and the analyses and the statistical... whatever process that we've followed to create that methodology is well documented and shared with other sites like the one we have in Costa Rica.

D: I see. In general, when you look at your environmental management programs in your Intel site in Costa Rica, what is the most important driver for that? Of course obviously corporate strategy plays a very strong role... do you feel customer pressure? What is the main thing, why are you so developed in this area?

A: I think large companies like Intel have come to the understanding that the only way of making business is sustainable business. I mean, there's no other model that can ensure that you're preserved in the market, other than doing things in a sustainable way. And there are, of course, other drivers that can help you in that direction. The market is one of them, right, the consumers nowadays, they want to make sure the purchase products that are green, shareholders in the companies that are public, like Intel, we have stock in the [unintelligible] market... investors. They want to invest in companies that are green.

D: Right. You state in the material you sent me that you're beginning to notice a trend, especially among the European customers, that environmental matters are important to them...

A: That is correct. So in order to keep up the market trends, and again to ensure... because we have come to the understanding that protecting our people, protecting the environment, protecting the intellectual property, those are key to ensure the existence in the market of a company like Intel.

D: What about the local engagement with civil society here in Costa Rica, I know you've started up, actually, you've sponsored a civil society NGO, "Industry – Friends for the Environment"... is there any pressure or anything you can feel from the local, from Costa Rica itself?

A: Well, at the beginning. There was a lot of fear from the Costa Rican people, [unintelligible] because they didn't really know what to expect from Intel. It was a large company, there wasn't really a lot of semiconductor industry in Costa Rican area that you could benchmark from to understand what was Intel [unintelligible] to Costa Rica. There were lots of scary stories about Intel. Of course most of them exaggerated... exaggerated by NGO's that are totally against the semiconductor industry in Silicon Valley and all that. So there's a lot of activist that, regardless of what we do, they don't like us.

D: That was in the beginning. Today-

A: In the US, mostly. Therefore those... I would call it extremist activist groups, when they heard we were moving to Costa Rica, operations to Costa Rica, first thing they did is they came to Costa Rica and started talking to organized groups here, filling their head with all kinds of... you know, scary stories about how bad Intel was. So we had a lot of work in the beginning, to ensure that we could start talking to people, show them what we had, bring them to the site, show them our operations, show them our wastewater treatment plant, show them our [unintelligible] for waste, show them our protection mechanisms for chemical storage, show them how we manage air emissions, show them all kinds of things. We spent a lot of time at the beginning sharing with the public society, the public in general, how we did this. And then, we have engaged in many, many several different projects that range from going out and cleaning a breach to planting trees, improving environmental awareness at schools, that's one of our greatest programs we have...

D: You have free internet centers that you put in the far-off places...

A: Oh yeah, but that's more leaning to the educational part. Because when we talk about Intel and its outreach to the community, there are several layers. We have technology, we have environment, we have education, those are like our main branches. Quality of life. So we embrace a community, or basically we are raised by a community. The way Intel responds to that is by bringing in to the community all kinds of programs and projects intended to improve their quality of life. Like I said, we focus a lot on technology and education and environmental protection. A lot of things we do are along those lines.

D: You're unique among the companies in Costa Rica who do that, aren't you?

A: We are probably one of the best.

D: Well you're the only one I suppose who do these community outreach programs...

A: Not necessarily the only ones... I mean, lately... and I think thoroughly what I can say is that when Intel came to Costa Rica we brought in a new model, because before, community outreach was more like, okay so we're paying for a little thing here, here's this check, here you go. Do a fair, a tourno[?] as we call it. But we brought in a new model which consists of a lot of employee's engagement into the community. So we have a very strong volunteer program that is called Intel Involved, and we do all these activities that I talked to you about, the technology promotion, education and environment, using Intel employees as volunteers. They volunteer their time even if, you know, weekends and nights, whatever, to participate in all different programs that we implement in the community. So when you say for example opening of a computer center, that is a program that Intel has worldwide, and when we did that in Costa Rica I think we opened a couple of them in Costa Rica, we do that in very marginal areas. I mean we're not just saying that we open one in Belén, we're saying we open one in south San Jose...

D: Going to the next question on your environmental performance, and the results of the environmental management program, have you been able to measure concrete and ongoing improvements in your actual performance?

A: Oh yeah, oh yeah. Because one of the things that... Intel is an engineers company, right. So we try to measure everything we do, and one of our areas, we have a lot of metrics [unintelligible] environment. [Unintelligible] But environmental is particular, we have a set of indicators that we have to submit to corporate every quarter, and a lot of those indicators measure what our performance is, and all the programs that I talked to you about, what's our recycling rates, what's our treatment performance of wastewater, how much chemical waste are we recycling, how much chemical waste are we generating, are we reducing our emissions, are we improving our efficiency in resources management like in electricity, water...

D: These are the environmental indicators?

A: Correct. We have [unintelligible] overall indicators that are associated with environmental goals that we set as a corporation annually and those are tracked very closely.

D: Are these also your significant aspects?

A: Well, it's part of it because the significant aspect is something we needed to define mostly for ISO purposes, right. Although, you know if you want to implement an environmental management system that's a very logical step. Then you go first and then to find... you know, what your main aspects are. And you pretty much build your environmental management system around that platform. But in our case, like I said... It's pretty straightforward, you know... I guess you might have seen something as simple as I sent you to something as complicated as a big matrix where you qualitatively, or quantitatively go through a series of scores and find what your aspects are. We have a pretty strong environmental management system way before ISO became something that was important for the world.

D: That's interesting, that's one of the things I got out of my interview with the environmental management head at the Intel plant in Philippines. She said that ISO 14001 didn't actually contribute to anything different...

A: Yeah, well it didn't contribute much because we already had systems in place. We did not build ISO 14001 from zero, we actually adapted ISO 14001 as much as we could to our existing environmental management system.

D: That is the same case here in Costa Rica. When did you start with your ISO?

A: Oh, 2001. Actually we have a corporate registration. So what we did here was simply what se did in other places. That is a new approach to ISO that we proved successful because you know we have lots of companies that can be audited, and the burden of auditing and the cost and everything else... it seemed to be more smart as we really had a pretty standard performance all over the world, to get a corporate registration.

D: So that means you don't get audited every year, one random site gets audited...

A: Lot of sites get audited per year, but not every site gets audited every year.

D: Who is your auditor? It must be an international...

A: Oh yeah, yeah. It's an international firm. They audit all the sites in the world, they are what we call the registrar. So the registrar in our case audits all sites, but not all of them in the same year. It's probably a three year span through which... they go through all the sites in a few years. Like every three years we have a ISO [unintelligible]...

D: I see.

A: And then we also have our corporate audits, which are a means of assuring that... actually the corporate audits are much, much more in-depth than the ISO audits. Because ISO audits, what they do is they take a look at your system and they audit you against your system. They do not audit you for things you did not define as part of your system, whereas the corporate audits, they are really improvement opportunity audits, so they come in and take a look under the rug and make sure they take all the skeletons out of your closet, and they really turn the [unintelligible] upside-down on environmental performance. They're to make sure that we're doing the right thing wherever we are.

D: Going back to overall environmental performance, have you ever had or have been close to getting a notice of violation?

A: No. Never. Not here in Costa Rica. In other locations we've had NOV's... you know, a special agency comes into the site and there's a drum that doesn't have the right label, poof they give you an NOV. So it's not that we have had severe [unintelligible] if that's what you were kind of...

D: No, I didn't imagine it would be that severe with Intel.

A: Its typical small things like our training record, you don't have this drum label, small issues that [unintelligible]. But in Costa Rica, personally, no we have not had an NOV. We have not ever been close to having an NOV, because every time someone comes in, they see things that they've never seen anywhere else.

D: What are the aspects that you have identified as they main... what are the significant aspects at the Costa Rican plant?

A: Well, for a site that does what we do, which we call at Intel ATM, that's Assembly and Test Manufacturing... for an ATM site, similar to the one we have in the Philippines, there were major aspects is, you know, waste generation. So not in all geographies that we operate, there are proper waste management facilities, and this is back to how we started our conversation a while ago, right. So when we came to Costa Rica, one of the greatest challenges was to ensure that the waste that we generated here was managed according to US standards.

D: Could you confirm, that's the next question, that in the beginning some of your waste products had to be sent to the US.

A: Oh, we still do it.

D: You still do? Why is that?

A: No, because we don't have means to manage everything in Costa Rica yet.

D: Well, what is it?

A: Oh, some of the stuff, like for example, you'll probably laugh when I tell you this... you know, batteries.

D: Batteries? For...

A: Batteries. You know, just regular batteries from your pagers and your radios, laptop batteries, everything... your [unintelligible] batteries from your generators or from forklifts that are battery-operated, we have [unintelligible] lamps, we have metal varied waste, so we do soldering processes in Costa Rica, and originally that solder paste contained lead.

D: Are you totally lead-free?

A: Right now, I think we are just about there. I don't know if we still manufacture a product that contains lead. I would have to verify that, but we are 99% lead free. I'm not sure if we still have older products that use lead solder paste, I believe we do, I believe we still do. But most of the solder paste that we use now its eco-solder paste that has replaced lead with silver. That's basically the greenest change. So some of those metal varied waste, we cannot manage those in Costa Rica. I mean, there are companies that will manage it for you. There's a lead recycling facility in San Jose. They've been there for thirty years. But Intel takes very seriously who we manage our waste with, and they have to undergo a pretty in-depth validation audit...

D: So you did a validation audit of this company in San Jose, and you didn't find it up to scratch?

A: That's correct. I don't mean they're in not compliance, I don't mean they're ruining the environment, I just mean they are not performing up to these standards that Intel requires for managing chemical waste.

D: What are these standards specifically?

A: Well, we want to make sure that we do not bring in any liability. You know, for a company that has been operating there for thirty years, they were not as good as they are today thirty years ago. Nobody was, right. So there's plenty of risk of utilizing a facility that is pretty old, that may have past contamination events, that still does not have safety standards in a similar way that we do... so it's pretty

stringent. I wouldn't be able to list to you all the things that we go and audit... if there is anything that will bring in liability of risk to Intel or [unintelligible] practices that we believe can still be proved significantly, we just don't work with them.

D: I had a set of questions... the next subject is relationship with stakeholders. The local stakeholders such as the Belén municipality and other government agencies... now I know that you really seem to be pro-active in the environmental area. Would you say the authorities are under-resourced? Can they match your level of engagement? And is there anything unique about the way authorities try to encourage...

A: Sometimes they can, sometimes they can't. I believe that in that regard what's [unintelligible] been done is work in partnership. To give an example, just last week, the Belén municipality was organizing an environmental fair. So they had all these nice looking booths in the area near the municipality where they had companies present their environmental programs and promote their environmental good practices and all that. This was organized by the municipality, and they invited us to participate in it. So it was an example of where we partnered with the municipality to help them accomplish their environmental objectives in projects of common interest. We've done a lot of recycling campaigns, we've done a lot of support to NGO's that work, like, water, on waste management...

D: What NGO's?

A: Oh, there's one called... H 2 O, it's on the tip of my tongue. That is one that has been working with students in high schools to promote environmental monitoring and water protection and all kinds of things. And along with the municipality we have been working hand in hand to promote those things. There's also a big project that the municipality has... that hopefully they will be able to get the resources for. We are committed to help them on the technical side, of being part of the team that moves this forward. They want to build an eco center here in Belén.

D: What would that entail?

A: It will entail a big recycling center, you know, rooms for environmental teaching, recreational facilities... this is kind of a big center where they promote environmental protection and good quality of life. It's a facility that they want to build.

D: Do you think Belén municipality is unique in the way it goes about this? It seems to be a very innovative...

A: Well, it is. And we are glad they are because we speak pretty much the same language in terms of environmental, and they are a very stringent municipality, and sometimes they use us as a benchmark for other companies, and they've learned a lot of things with us that they've been able to proliferate also to other companies.

D: Besides the municipality, I know that you had the cooperation with CENARA for groundwater monitoring... do you have examples of other outside entities that you involve in your environmental management programs?

A: Well, as I said before, through AmCham... even though when I sit in those groups and do not represent Intel specifically, I'm still an Intel employee, right, so I sit in those groups and have the opportunity to interact with SETENA with CENARA, with the Ministry of Health, so it's a resource to the company, I am a resource that the company has put to the service as well. I can collaborate with the technical expertise, I can serve as a link to our corporate resources who would be even more resourceful to get technical information and provide all kinds of technical expertise on certain things that we do in Costa Rica. So basically my external engagement serves as a means to be in full connection with those entities.

D: Are you a member of any other chambers besides AmCham and UCAEPP?

A: No basically that's it. I am a member of several task forces however, the e-waste task force, the one... there's another task force working on air regulations that I'm working on as well. That's about all I have time for.

D: I'm interested in the way you work with environmental management in your supply chain. Would you say that, first of all, in general, the electronics sector in Costa Rica, do they have the same level of engagement, and why and why not?

A: Well, that's a very interesting question. To be honest with you I'm not very engaged to other electronic industries in Costa Rica. I am engaged at a level... they are engaged in the groups that I belong to. But it's not like we have a semiconductor association like in the US, but one of the reasons is that there are not that many.

D: I know, I've been having a look at them, they're very, very small companies...

A: Yeah, very small, very specific. Some of them manufacture a very specific component that they put into the market and that's about it. So there is... it isn't really a big sector in the country so there isn't much interaction with them.

D: However it is the sector they promote most at CINDE for example...

A: Well it's a sector that is very clean in general, we're talking about clean technologies, we're talking about sectors that actually requires highly trained personnel, so it's a kind of industry we like to have in Costa Rica, no doubt about it. I mean, it's a clean, good jobs, you know, high tech...

D: Do you think... this is a specific problem I've come across, or a specific risk of a problem... a lot of them work with soldering of their components and none of them have ever had an NOV with regards to lead emissions, 'cause some of them still use lead...

A: No that's because of the enforcement [unintelligible] that I talked to you about. That's the greatest challenge for Costa Rica... if every company understood from day one, no not even day one, understood this from day minus three hundred... we moved to Costa Rica, we needed to have a means [unintelligible] lead varied waste. It was the first thing we learned, we needed to have a process by which we

were able to export that waste from Costa Rica so what Intel did is that we promoted the development of an agreement between the government of Costa Rica and the government of the US to do a bilateral agreement under the terms of the Basel convention... out of Costa Rica. And the greatest thing about this agreement is that it was renewed back in 2002 I believe, or 2001 I don't exactly recall the date, and now it doesn't have an ending date until the US signs Basel, if they ever do, because...

D: It was signed in 2002?

A: It was signed before in 1997, before we started the operations, so before we started generating any waste, we already had the agreement in place. The agreement was good for five years, so it needed to be renewed somewhere in the 2002, 2001 frame, I don't know. And so we pushed for the renewal, and this agreement, the good thing is that it is not an agreement for Intel, it's an agreement between the governments of Costa Rica and the US. Any company can use this agreement to send their waste out to ask for proper treatment and disposal.

D: I think I have one final question on my paper, and that's... do you have any local suppliers in the electronics sector in Costa Rica?

A: Well we have many local suppliers for many things we purchase in Costa Rica.

D: Components, do you buy any of your components or any of the raw materials you use for production in Costa Rica?

A: That I don't know. I would think that probably most of the things that we do, that we use directly for the products, I don't think we buy any of those in Costa Rica.

D. So it's mostly...

A: Indirect materials. Indirect supplies, indirect materials, services. Specifically raw materials for our processor manufacturing, I'm pretty sure that 99% of that is purchased overseas. That's the benefits of having to import materials without having to pay certain taxes and all that.

D: That's part of the Free Trade Zone regime. Do you promote the use of environmental management programs throughout your supply chain, whether it be from abroad or from Costa Rica?

A: Well that's something that we do a lot at the corporate level, when we engage corporate suppliers we make sure that they have good environmental stewardship as well. On local suppliers, what we do mostly when we engage in contracts is that we include some provisions... it's basically like an amendment in the contract, it's like an annex where we ask our suppliers to behave by Intel's standards, our safety standards, environmental standards in general. But I think that is an area where in general I think there are some improvement opportunities. That said, environmental performance is part of their score card, so we have supplier score cards and this element is included. In general their EH&S performance is included in the evaluations that we do for suppliers. So we put it in the contract and we use it as a tool to evaluate whether those are suppliers that we can keep working with or not. But can we do more? Maybe yes, maybe yes. I guess that's an area where... specifically, I don't have a lot of involvement in that area, for example.

D: It would be the purchasing, logistics department?

A: Exactly, that would be over on the purchasing, materials part, they would have it over at the tools development part that they use for assessment...

D: Could that be integrated, that part, into your ISO program... that could be one of your environmental action programs.

A: It could be, but it's not. Like I said, I don't have much visibility of that. That part of how we engage with suppliers is mostly considered in our corporate manual. Because we have this corporate certification, right. So by using the corporate certification we explain to our registrant how we manage our suppliers in general, and at every site at the local level we have some degree of engagement with the suppliers using the tools that [unintelligible] before.

D: Do you think that local suppliers tend to have a better chance of doing business with you if they are ISO 14001 certified, or that's not maybe a make or break thing?

A: Well I think it is. If you are engaged into using your supplier, and again we are talking about suppliers that can range from just someone that gives coffee to people that would come and do construction at Intel... so when we do the pre-screening processes to choose companies, to choose suppliers, environmental is one of the criteria that we use. So definitely, if they have good EH&S practices that have a better chance to work with us. There are, like I said, areas where that's more relevant than others, but in general yes.

D: I see. You mentioned that supply chain management, green supply chain management, had some improvement potential. Would you see any other improvement potentials in your own environmental management in general?

A: Well, not... I wouldn't have any one that I think would have a large opportunity. I think in general we're doing pretty good in our environmental performance. We do lots of things that not may people do in Costa Rica. There's of course, as a company, as the size that we are, we consume a lot of energy, we consume a fair amount of water, so I believe that resource conservation is an area where normally also have opportunities.

D: Just a technical thing, do you have an RODI system and do you reuse all of the water there?

A: Oh, we have an RODI but not all of it gets reused, because unfortunately, the RODI... the reject part of the RODI contains a high level of salt. So you cannot use that water for irrigation for example. It's very salty and to use it into a cooling tower, you cannot do that

either, then you have lots of deposits in pipes... It's kind of complicated. That's why I say that I think the two areas where we have some opportunity there would be the supply management and on the resources consumption.

D: Alright. Well Mr. Alterno, thank you so much, I don't have any further questions, thank for your time...

A: Well I hope that replies have been of benefit to you.

Appendix C

Interview – Hector González, Investment Promotion Coordinator, CINDE

Full Interview Transcript

Present: David Christensen and Hector González

D: So I have some specific questions about the specific work you do in the pre-establishment, establishment and post-establishment phases of a company establishing itself here. And in the pre-establishment phase you offer information services, and you do specialized agenda...

H: That's right.

D: So I'm curious to know, what are the main points of interest for these companies before they come here, and what are your main selling points?

H: Well, the way we sell Costa Rica, specially in electronics and medical devices as well as services, we first look for the companies. We narrow the field, we do a targeted approach. We look for companies where quality is of the utmost importance, where the cost of labor is not the driving force, so basically we're looking for niche players. As a matter fact that's how we define ourselves, as a niche country. We don't consider ourselves competitors with let's say China, in the large scale assembly. We're more focused on high dependability products. Our main selling points would be our educated workforce, especially with US companies, we'll be in the same time zone, and the cultural similarities, and the short flight from the United States, basically no jet lag. And again, stemming off from geographical location, we also have the fact the flight from the US... you don't get jet lag, and conference calls, there's not more than a two hour difference.

D: In the customized agenda services, you arrange trips to different support institutes and organizations like Free Trade Zones, you arrange visits with companies and government officials, and also universities and training centers. I'd like to know how important are these education support organizations for the labor force needs of the transnational companies.

H: Well they're very interested, for instance with Intel, very important... the Costa Rican Technological Institute, TEC, we call it in Spanish, they were instrumental in getting them here, there was some changes done to the engineering programs as well as the technical education programs.

D: CINDE was directly involved in this...

H: Yes, it was directly involved in this, in the process....

D: How does this happen actually?

H: Well actually, the president at the time, José María Figueres, he got really involved in the project, fully committed to the project, and helped push along some of those things that were need...

D: Is there a continuous follow-up on that?

H: Yes. Still, we follow up on Intel, Intel has its own government and public information department, how they work you would have to ask some [unintelligible]...

D: What is the level of educational support, would you say, that universities such as TEC, UCR... they train the exact kind of work force that the companies need or is there still a gap?

H: The way education is done here at a collegiate and a technical level is to provide a very solid, very good base. A very broad base. So for instance you have somebody coming in like Intel, they will have to do some training but it's not as critical, it's not very expensive, for an extensive period of time... if another electronics company comes in, something similar... for instance I'm thinking Triquint, a semiconductor, they're also here, they're in telecoms, it's similar, again the broad base, solid base, provides the company with a very flexible work force. And the same thing applies for the technical people, the mid-level technicians and so on.

D: I've read that the electronics sector employs directly about 11,000 people. How many of them would you say are highly skilled jobs?

H: I would say all of them.

D: There's no manufacturing, basic, low-skilled jobs at all?

H: The most, no... the most... well I wouldn't exaggerate, but with a little bit of an overestimate, I would say 500 of those. The rest are technicians and of those people that are not highly trained, they get specific on-the-job training, so they might be able to say how a PCB works, but they know where to put the things that they work. And they may know why something will not work, but they don't know all the theory behind it.

D: I suppose a lot of companies spend a lot of time retraining and investing in their work force.

H: Yes they do provide, however it's not as, let's say... retraining costs here in Costa Rica is not as high as it would be for instance in Mexico. This is because we have a low turnover rate in Costa Rica.

D: Turnover rate?

H: The employee turnover rate is much lower here in Costa Rica.

D: What explains that?

H: Basically people like stability, they like to work for a large multinational company, and they like the challenge of always building new products every so often. And of course people get treated fairly.

D: Talking about the Free Trade Zones, obviously they're important for companies establishing themselves, the Zona Francas, but what do you think the future outlook is for attracting FDI... the World Trade Organization is closing the system down but there's an exception for Costa Rica for a couple of years...

H: That's right. I think that's just... well, we'll continue to be attractive, it will have to be changed somewhat, basically, and in order to comply with WTO standards income tax will have to be levied on the companies. However the advantages of being inside what will be industrial parks I think will outweigh by far being a stand alone company for most of the companies. For instance you can come into a park, and the way I see it, the way it's been done, is that you can either rent or buy the lot, or have something built there or built to suit, but basically the companies get a plug and play package. They come in and in an excellent amount of time you will have your building, just plug and play an that's it.

D: How many electronics companies are still under the Free Trade Zone incentives? Intel has been phased out, it's passed the 8 years...

H: Well see no, the law says that any company that reinvests between years 2 and 7, they get an extension as well.

D: And that's interesting because I read a statistic saying that a lot of it is reinvestment.

H: Yes it is. 83% of our investment, foreign direct investment. They're expanding their operations, and the Free Trade Zone law gives 8 year tax holiday and then 4 years at half the prevailing rate, but again if you invest from years 2 through 7, you get 4 more years without income tax.

D: What about those who have left? There were some...

H: Well for instance Remec, they left Costa Rica, they were in microwave and telecoms. They did some tuning, it was a very very nice company. Unfortunately they did leave because the company was broke, not because Costa Rica did not meet any standards or any reason like that.

D: What about CAFTA. Now it really only affects tariffs, so I'm not sure about it will influence anything about the way Costa Rica can attract FDI. I could be wrong, but in the event of a no, would that be a barrier?

H: It won't be a barrier, but it will definitely be a serious step on the brakes. As you said CAFTA will lower tariffs, so if CAFTA is not approved, [unintelligible] will have to be that much more efficient than they are right now. It'd demand increase in efficiency to compensate for that.

D: I was under the impressions that many of the products were already under the Caribbean Basin Initiative, so that they enter the US market...

H: Yes, they do, with no tariffs. But there's two things to consider about the CBI. Number one, it's a unilateral thing, concession, so if the United States government or president at any time tries to end it, he or she may end it. And the second thing is, since it's again, a unilateral concession, the WTO is against that, the WTO prefers free trade agreements. So if we don't have CAFTA and CBI is eliminated, which... everything points to that it will be eliminated, we would have to pay [nations] to do this.

D: So, it's more than just an image thing, it really does...

H: That's right, it does have a serious impact.

D: My interest in my thesis is to uncover how FDI contributes to sustainable development, and in this sense I'd like to know if environmental standards at any time comes up during the pre-establishment phase. Do companies ask about that?

H: Yes they do ask about that and it's part of the processes for being approved, they have to go through an environmental study by SETENA... it's National Technical Secretariat for the Environment, they're on the web, it would be setena.go.cr if I'm not mistaken, and that's one of the advantages to parks provide. So when you set up your park you get the SETENA permit so companies can come in and... it's much more streamlined, if they decide to be a standalone company then they have to get the SETENA permit for that lot they choose and so on.

D: And what is the level of environmental standards?

H: It's high and it depends also on the project. That's another thing. We do not like highly contaminant or highly polluting projects.

D: I was reading when Intel came here they were negotiating for their waste to be shipped abroad? [unintelligible] ... and also when Intel came in, they decided to use the Californian standards for their emissions, for their wastewater, so they were actually using that until Costa Rica had its legal framework set up.

H: Well actually we did have a... water treatment or water levels, compliance levels, that all companies must meet, and for instance construction code is much more strict than California. The construction code is for all buildings, if you've noticed all buildings here are short, you won't find a building above... well now there's one about 15-16 stories, but that's the tallest, and all of that has to be on [unintelligible] cement, and cinderblocks. We're in a seismic area so our construction code is very strict.

D: A question about intellectual property rights. How important do companies see this aspect when they establish themselves. Would you say that a fair amount of research and development happens in Costa Rica with these companies?

H: Unfortunately, R&D as an active part is not being done in Costa Rica as high or as intensive as we would like, mainly because we lack Ph.D.'s. Remember we are 4.3, 4.4 million Costa Ricans in the whole country, the largest 20 cities in the US and the largest 20 cities in Europe have much more people than that.

D: So going back to the question about the educational set-up, it's not really because it's lacking, it's the numbers that...

H: That's right, it's the numbers for Ph.D.'s. We have seen they have started on a campaign in the government as well to guide more students into engineering from other areas that may be saturated. So they could find good paying jobs, challenging jobs.

D: How do they go about this?

H: Basically just show them the... you know, these professionals, the employment rate, we need X amount of engineers. People can do the math.

D: I had a question for the establishment phase, the building, construction works... now obviously these multinationals, they subcontract a lot of the building to local contractors. So is there any difficulty matching the requirements of the companies with these local contractors, especially in terms of occupational safety...

H: No, there's not. Again, like I said, the construction code here is very strict. So that's not an issue. And then on the companies negotiate... we do not take part in that, we introduce them, but then they negotiate, and the companies say they want this, this and this. They give them the list or the conditions under which the companies should go, and that's the way they do it.

D: A lot of multinationals have strict safety regimes they're very concerned about...

H: That's not an issue here.

D: Alright. Now the post-establishment, after-care, and this is quite interesting for me, this is where you come in and you support expansion work and you do promoting of product diversification, network support, information seminars. Of course it takes time, but how successful do you think this has worked in the electronics sector with product diversification, maturing the...

H: Well it has worked beautifully, we have... again, going back to that statistic that over 80 percent, 83-84 is reinvested. Companies are happy here and they like the results they're getting. Now regarding the electronics, we are seeing some companies that are starting moving from manufacturing or repair into design. So companies are... indirectly, or even, you know for example assembly processes, you see it's very important software development, they look at what software does all this, and Costa Rica provide them with a small software program, less instructions, same result. For even production processes, you see that Costa Rican companies find ways to, companies would work in Costa Rica find ways to reduce time, reduce re-work, that sort of thing.

D: How does that happen? We're talking about technology transfer here...

H: Well some of it is technology transfer, and then when people are familiar with the process, they say well why don't you do this, it would be faster, it'd be shorter, it would be... it's internal in each company how they go about it...

D: In the post-establishment follow-up phase, what are the company's main concerns?

H: Well right now, in the current situation it would be CAFTA, definitely an issue. We do expect that it will be approved, but we're not resting on our laurels either. So that's the main one. The second one is what will happen to the Free Trade Zones, which... the extension took care of that. It gives us a three year window to set up a new tax plan, so basically right now the big issue is CAFTA, and we want to move people, you know... to balance the supply in the work force. We want more engineers, more math-oriented people. So going back to that example... basically coming up to the people and saying look if you [unintelligible] all this, there are X amount of people without jobs, and we need X amount of people here in engineering, or for these countries, or bilingual people, whatnot. An then.. you know, this is how much you would make, and this is how much you make on this end... let people do the math.

D: I think one of the most important things in the post-establishment phase is the way that companies start working with suppliers, and I know that there's a government agency working with strengthening that, Costa Rica Provee, but on your website it says this process isn't... hasn't become a generalized process yet.

H: Well, look, the Costa Rica Provee program is starting they're having a national suppliers fair in, I think it's November, and that's working along very well. Another thing is that some of these are so big that they have worldwide procurement. So when Intel first came

here people said that it's putting a whale in a fishtank. Now those negative people are saying putting a whale in a swimming pool, so at least they recognize we are growin...

D: Well, so you see something happening, you see the local supply network improving...

H: Yes.

D: In what ways?

H: Quality, delivery time, people are investing in their companies, growing, but unfortunately at this point it'd be very difficult for the Costa Rican supplier to be a worldwide supplier. It would have to be for the site, but then again depending on which company you are talking about, you have different procurement strategies. Some companies would rather do it on a worldwide scale, regional scale or even countries.

D: When I talked to Costa Rica they explained to me that when they take a look at their costs, 90% of their raw materials are stuff that are simply unavailable in Costa Rica. So there's like, maybe only a 15% window they can work with to find local suppliers. But you still see that in the electronics sector companies are getting stronger...

H: Yes.

D: Are they investing off-shore?

H: There's one electronics assembler, a CEM, a contract electronics manufacturer, they have an office in Silicon Valley, small design office. And then they also have another assembly, they have registered a company in Nicaragua. And they do plan to take out some of the work over there.

D: Alright... so you talked about improving the production processes, standards, commercial practices, these are some of the main positive effects of getting productive linkages between local suppliers and transnationals. What about improving environmental standards? Have you seen that happen?

H: Yes we have, we've seen that happen. The best example would be in the tourism area. When the Marriot opened their marina back in '99, 2000, when they came in with their project there was basically no marina law. So they sat down with the government and helped them write up the new law, get it approved, that's the law we're using right now. And it's again, based on California law. So you now it's very strict, it's very environmental, and in part thanks to our standing, our position through tourism, companies go to Costa Rica... go south, they know they have something special, something environmental about it. In an unofficial sort of way and a quote-unquote, it's like a green seal, it's like we're producing this thing, we're complying with every environmental standards in Costa Rica, and a lot of companies are also going into ISO certification.

D: I was thinking of that specifically, ISO 14001 in environmental management systems. Do you see some of that diffusing from multinationals to local suppliers? Do they put these demands...

H: Well they, demands as such I'm not sure. I know for example that ISO 9000 became a requisite and then a lot of companies started going into ISO, either with help from their clients, because it may be a bit too expensive for some of them. What some of the smaller companies have done is that they have an ISO 9000 compliance system. Their customer goes in and evaluates them, and then certifies them as a supplier, and then down the road they would certify.

D: You don't know about ISO 14001, or eco-labeling?

H: Well I know some of the larger Costa Rican corporations are going into that so you see some trickle-down effect of that. And again people here are quite conscious about the importance of the environment, and... we won't bite the hand that feeds us. You know, tourism last year was almost one and a half billion dollars, which is one and a half billion out of eight billion that were our exports.

D: How much was electronics?

H: Electronics was about two and a half billion, you know the whole electronics like RF, microwave and so on.

D: How much percent of that is Intel?

H: We don't know, statistics are not... up to about 3 or 4 years ago they were published that way and now they're not.

D: In general how do companies in the electronics sector work with... we've talked about environmental but how about corporate social responsibility issues?

H: A lot of them work with that. Not only do they provide time for their employees to go to school and do social projects, but they also encourage them and even the people are starting to get involved in this. As people go into these companies and they then move on to another company, or the few who have started their own, they put that in. They always let their employees do that, and so you're seeing an expansion of corporate social responsibility.

D: Why do they put so much importance into this?

H: Well number one, it's a matter of solidarity with those less fortunate, so there's a humane side to it, and then if you want to put it quote-unquote, the business side of it, not only will it help the company's image, but it will also help your people feel better about where they work.

D: Do you see any criticism directed at the electronics sector from labor unions?

H: Yes but you have to remember that labor unions are legal in Costa Rica but you will only see them in the public sector and in banana companies. By law they're allowed, but private companies especially manufacturing and services sector in the private sector as a whole, they frowned upon the unions, especially after what happened in Golfito in the late 60's early 70's.

D: What happened?

H: There was a big strike, the companies left Golfito. So you had all these people who were unionized, left without a job, and the unions did not provide a solution for them. Soon a lot of people in the private sector began thinking, why do I need to give part of my salary to a union, for in the end it will make the company go and leave you without a job. That's the first one, the second thing is, are against CAFTA, and they have done strikes and taking over some streets for a couple hours, that sort of thing, and that has created a negative attitude.

D: What are their main points of criticism, the labor unions? Is it on principle or do they have specific concerns?

H: Some of them are basically principle, I would personally, I would personally... this is not CINDE's opinion, qualify that as the communist's last hurrah, last chance at relevance. We were really big here, our labor law, which was written in the early 50's, really has a lot of socialist view on it, not communist but socialist. We have a social security system which works really well. Public education since 1870, we're the first Latin American country to have that, so as you can see we have certain elements of socialism, but getting back to the question of why they oppose CAFTA, we do have some ideologists, very few. Another thing is, CAFTA, unlike any other of our free trade agreements, includes Costa Rica will open up some of its telecoms services, basically internet, cell phones and point to point connections, device. The INS people are not against it, the INS people cherish the opportunity, they want to see how they stack up. The ICE people, unions, those are the ones against it.

D: I think I saw somewhere that when you take a look at the mandatory things that companies have to do to protect their work force such as pensions and stuff, they actually have a good track record...

H: Yes. And one of the other things is that in order to maintain the free trade one incentives, companies must comply with that. They add up to about, rule of thumb 50% it's 42-43, and then there's the insurance depending on what thing you do, and the insurance is a weighted average so let's say they put all your blue collar workers, all your white collar workers, your messengers and so on, they say okay the risk for messengers is such amount, and they account for say 1% of the total payroll. Blue collar workers have X risk amount and then they just weigh it out. And again those things, especially for blue collar workers, it's very important, it provides them with social security, basically pensions, disability, maternity leave for women and in case of accidents, you can retire early.

D: On the section on technology transfer on your website, you say that FDI generates benefits in transfer of technology and training, where they invest time and funds on training, where they invest time and funds on training. It's shifted to the academic centers that function in other areas such as environmental and occupational health. We've been into a little bit of this before, but I'm really curious about this technology transfer and the new things coming, the environmental and occupational safety and health aspects. What role do transnationals play in strengthening this.

H: The free trade zone law allows companies to donate any equipment they don't want or they don't need or they don't use, so basically what you have, especially the electronics companies as they have a short product cycle, the production equipment is obsolete, they donate it to technical schools, to universities. So what you have is a very interesting labor force that is only two production systems or maybe even one production system behind, so the learning curve is sure and it's easily, people are easily trainable. Now that's important in production. Regarding environmental standards, as you said international standards have been adopted into law. And the third thing is, these companies, going back to the example of the marina, they've helped point the way, they said look we want people in this so academically things have been improving, and of course people like working in a safer environment. I don't know if you've ever been to a precision tool shop... at least in the US, they're very dirty, but here you will see that people, if a piece of scrap metal falls down they'll pick it up, put it in the bin at that moment. So it's actually very clean, very neat, very organized, they take great pride in that. And another thing, as soon as people start realizing they could have that they start asking for someplace else.

D: A follow-up question, I was going to ask later, but what do you think the close relation with China will bring to the FDI landscape, and specifically do you think there could be concerns in the social and especially environmental side when it comes to these companies?

H: No I don't think there's be any concerns, because basically companies know what they have to comply with up front, and they know what the penalties are.

D: So basically you're saying there's no difference in behavior between the US and Chinese companies.

H: There would be no difference on behavior. You know even if a Chinese company comes here and starts disregarding the laws, from experience I can tell you in a very short time people will notice and they would lose the incentives...

D: Has that happened? Say, from experience, have there been instances where, you know, a wastewater treatment plant doesn't work any more...

H: Yeah, we have had that, and you know, companies have been shut down at least partially...

D: Which ones, and how?

H: Well I'm not at liberty to say any names right now, but it has happened, and we're working on a case where there's been a misunderstanding between the people involved, and we're working to get a result but companies know that, that's one of the things we tell them up front. You have to comply with environmental standards.

D: I had a question about community development work. I've looked at the way this is done in Intel, and they have a really good community outreach program where they fund equipment in schools and they even do technology center, I think they call them, even in faraway places, they have a lot of focus on that, but is that the norm?

H: Large electronics companies, it's becoming the norm.

D: Are there any other companies besides Intel that do the same thing?

H: Yes, Proctor and Gamble does some of that. There's some big names out there... I'm not sure if HP does some of that... larger companies do that, and the employees actually, as I said before they like it.

D: Are there any formal linkages with educational institutes? Companies and universities.

H: Well as I said they donate equipment and that is part of the educational process. Technical people have to do an internship, so that internship is done in companies and most of the people tend to stay in that company.

D: On your 2006 report, the one you have on your website, you say that the electronics sector is the oldest, most established sector, but you're also focusing on new sectors right now, I can see the numbers, is on the call centers, and the new [unintelligible] sectors coming up, so why this shift, is my question, what made Costa Rica change its focus to targeting medical devices...

H: Oh no, we haven't changed our focus. The promotion side of CINDE is divided into four sectors. We have electronics and precision metalwork, we have medical devices and services. Services started taking off with Western Union and Proctor & Gamble in 1998-1999, but now Costa Rica's no longer... well I wouldn't say no longer, but now you see in, especially in call centers, that.. or services sector, it's no longer inbound or outbound call center operations, now it's data processing, its risk assessment, that sort of thing...

D: So these companies have just been drawn to Costa Rica more?

H: Yes they started coming here and then they realized that the labor force is capable so they started branching out... globalization trends. Again, you get a better, forgive the colloquial expression, you get a better bang for the buck. We've had a new subsector, services sector, we also have some architecture companies doing office work here.

D: I was under the impression that it could have been because of the dot com bust that no other big companies followed Intel, as Costa Rica had hoped.

H: No, you have to go back to one of the first things I said. When you think of large corporations, Sony for instance, the big production site is assembly, manual assembly, and that's where we're not competitive.

D: I really don't have any more questions, I'd just like to say thank you.

H: No problem.

Appendix D

Interview – Roberto Calvo, Director, Costa Rica Provee

Full Interview Transcript

Present: David Christensen and Roberto Calvo

R: Okay, so we shift from agricultural basis, you know, to the high-tech, building a capacity of more than 250 companies that are actually operating in these sectors. You know, the electronics, the medical, the services. We have, for example in the medical sector, we don't have as many companies as for example Puerto Rico, but we have the main companies in the sector. So we have companies such as Hospira, Baxter, has operated here for fifteen years. We have Boston Scientific. You know, we have, like, the first tier companies in our country. Not only they are, I mean, not only we are receiving an amount of companies interested in developing new projects in Costa Rica. But nowadays these companies are now creating a bigger base. They are re-investing in substantial matters.

D: Is that always the case? Some of them have pulled out at some point, some of the big ones as well...

R: It really depends, I mean, on the competitive issues, I mean if you're competitive, it actually depends on costs, labor costs, you know the place to go. If your costs... this is why the concept of total cost of ownership is so important, you know. Many American companies are shifting desperately to Asia in order to create this matter of competitiveness in the labor issue. But when you see in the big picture that you must wait two months to, you know, to your lead time, that you must have inventory, your inventory control just has a lot of problems. You are receiving many of... you know that many of the logistics that happen with China happens in the East coast of the United States. That's the side of the United States that receives a lot of hurricanes, for example. You know, so then you don't have the same time zone. You must stock yourself more than you do ever because you're not using now Mexico, now you're using China. So in the big picture when you make your balance, there is a lot of risk within the issue, and your country must decide if you have the capability to compete in that same landfill.

D: You're saying that Costa Rica still has a good chance of competing because you have a good work force and because there are problems connected with-

R: -Yeah, what I would say my best answer would, for you, would be it really depends where the competitive issue of the company is. If you're competitiveness relies on your cost of labor, you know, we... even in Central America, we are the... we have an income per capita bigger, and somehow that relates with the cost of living. What is very important is why companies make the decision to make a near shore operation, and what criteria they have when they go to Latin American countries or Asian countries. There are many issues. They are looking for a political, or a healthy place, so they try to have political stability, social stability. Costa Rica somehow has a non-military structure that actually gives you the confidence that we don't have the tools or the toys to start a war. Neither we do have enemies checking if Costa Rica's actually a hazardous enemy. The other issue is that they are looking for facilities, and...

D: What does that mean?

R: Facilities means that we have availability of electricity, power, power supply, water supply, living conditions. I would say that it would be a very long list. But in the short run, what it means is, is it a feasible place to live? So we are making important decisions in this government, Costa Rica, in order to be in the list of developed countries. It must continue to develop its decisions, especially in infrastructure. Port infrastructure, the roads, the airports, many issues there. Right now it's in the direction of taking decisions. Another ... is important, is the subsidies that the country is able to give. So, you know that WTO has somehow regulate the conditions in which a country can give subsidies, specially those that are related with export activities.

D: So you have a problem now with the Zona Francas. Now that they want to phase out the incentives...

R: Now that actually is a world condition, it's not a Costa Rican condition. So many of the countries with an income per capita which is in the middle tier, they must take decisions. But this is not a problem, this is part of your development, so you must create different conditions to remain competitive. So although they are very important for the final decision... again, if your competitiveness relies on cost of labor or cost of your operation, that is a very important issue. So Costa Rica is building different conditions. What type of conditions are different than that and somehow difficult to replicate, the supply chain. So what we have built as a government is a program that eases the multinationals corporations to create their supply chain inside their country, so that they could create more competitiveness as a country, you know, and their operation... it has more of a strategic meaning.

D: How much do you feel that a local supplier base is important for foreign investors, foreign companies, coming into the country, because some of them, Intel.. a lot of it is not supplied from Costa Rican suppliers because they don't have the capacity to produce what they need? How important is that issue?

R: Well, it actually depends on sectors. Because your thesis is about the electronics, I would say it is very important. Now, Intel is a case... I mean, for example, you know that when we reviewed the exports of Costa Rica we actually did it five years ago with or without Intel, so you should give onto more type of companies different than Intel, because they would give a perfect picture of how important our suppliers... and what are the things that they are doing. Now this matter of suppliers has been a competitive advantage that the country has present... for example have you already had a visit with CINDE?

D: I'm in contact with them.

R: They are the promotion agency, and they are... CINDE, when they had to make a presentation to foreign direct investors about the benefits of the country, one of the benefits they presented is actually the supply chain basis, and the support that they get from the government in order to build a supply chain that is important for them?

D: What kind of support would that be?

R: It's our program...

D: The only one?

R: I would say that it's a program that actually triggers an important issue for them, it actually gives results in the short run for them so you don't need a complex subsidizing program, they just need answers. In the landfill of business, there is no blablabla. There are opportunities. You either take them, or you wait, and if you wait, there will be someone else far, far away that will take that opportunity. And that is somehow that is how I wanted to introduce this presentation.

(Shows Slide 1)

Now, many multinational corporations have made important decisions about how to create a supply chain that actually gives more value. The word value has many meanings. You can relate it to economics, you can create value as your social value, you can create value as your country, and if you can confer the value from an American corporation with this different aspects, you can see that this value, it actually has been replaced in different forms. For example the matter of employment level of the US because of the relationship with China is so important right now that the American people is now very, very sensitive about closing, or let's say... not closing, but opening a factory in China. For them, it's actually saying less American people have jobs. Now in the matter of economics, and if you see your turnover investment, right now companies like Motorola, they are building their software in India, and they're manufacturing in China. China will be the biggest market in IT that will ever be. So this is very important. How do you create value?

D: But when it comes to adding value... you talked about that you could measure it in terms of economic value added or other ways of measuring it, but how much are foreign investors interested in the other aspects of it?

R: Well actually, the first thing you must understand is when you make business, business is for making money. So the other matters is part of a... you can either decide yourself to check it as philanthropy, or you can create conditions to make you more competitive but somehow on a win-win relationship, that you can sort of wrap some of that benefit to you by bringing benefit to the whole system?

D: Is that the kind of feel you get from the companies that you're working with? That they're interested in doing that, win-win... ?

R: Yeah, sure. For example, If I can tell you, is there companies that they feel challenged to go outside, look for suppliers, I would say yes. I mean, they have purchasing departments, they have materials departments bigger than my area. But do they have time to sit down with the small and medium businessman, and tell him in 200 hours what he has to do to be a better guy, and challenge him to make a better product, and then try to make him to sell to a multinational? Could you imagine what it is to visit... we have [unintelligible] 1200 companies, and we always keep doing this. Do you think that a company... I mean, you are the purchasing manager, they don't pay you to find, they pay you to low your cost of product. So if I bring you suppliers as I have, you know, go with them as a school, you know, they are kids. I am going to school with them, I'm going to college, and giving them what they need. And they'll say, wow, they're giving me answers. I don't have to go outside.

D: It sounds as if it's a hard job to do. But it actually works, the way that you facilitate yourself as a middle man...

R: Exactly. It's like mentoring, you know. So, like, in this process-

D: -How many companies do you...

R: I will show you in one of the charts. So multinational companies has, some of them has decided to include this as a social responsibility issue. But working with suppliers is not a charity matter, it's a competitive issue. Companies just need to understand how could they optimize their total cost of ownership. If a country like Costa Rica for example was doing right now, well let's say ten years ago was doing the manufacturing that right now is done in China, and we have stepped up and said 'no', instead of using a human resource to assembly a piece, let's use it to think. Let's use him to make decisions. In call centers, for example, it's very interesting. You can see call centers like Sykes. They have 2000 employees but they could have 8000 of them. The only requirement is English. And if you go to UNA in Heredia, you have seen many of your pals maybe, working in...

D: Yeah, my sister used to work in one of these, Language Lines...

R: Language Lines is kind of different, you know? Now if you think of Language Lines for example, you need a special... what you have to do in Sykes is check the manual, check the problem and give the answer. In Language Lines, you have to hear and translate.

D: It's a bit more advanced.

R: Okay, so you see how different is that. You have to make decisions. They are giving you a communication part and you don't have time to see what is the best. Now, if you... how many employees has Language Lines, 200 right? 300?

D: I think it's more, I'm not sure.

R: Okay, 500. But not the level of Sykes. Think about, let's say, Amba, Amba Solutions. They are an Indian company. And do you know the type of guys they are hiring? MBAs.

D: What do they produce? What are they?

R: They are a service company. So, what actually these guys, they have a masters as operators. But instead of translating or giving customer support, they are analyzing financial reports from their customers, which are mainly American companies, and they are giving advice. Stock investment, risk management, bonds and mortgage issues on investment...

D: So you're saying that there's a lot of opportunities and Costa Rica is making use of these opportunities in different sectors...

R: Exactly. Somehow the creation of value, you can see different profiles of people, and somehow Costa Rica has been going upwards of the level of things we can do with value. Now, how we can build [unintelligible] supplier relationship in Costa Rica. The approach of the supply chain, this is very important, this is more important for your thesis. This is the company's problem. This is one company.

(Shows Slide 3)

Do you think the CEO actually... he understands that this is his world, this is his layout. He's not checking the map of Costa Rica. This is his business.

(R answers phone)

This is how they intend to become competitive. In the process of making decisions, they just have to know where is the raw material, if the raw material is in a developed country, in a developing country, where are the sourcing of the sub-parts, where is the packaging, where are the third-party logistics companies managing... where are the final customers? So supply chain is a matter, is a global matter for companies. So they are not just thinking about, okay let's see how we can create Costa Rica in a profitable hub, and not making our Philippines, Malaysia, not so profitable. They have to look in the big picture. So that's very important. The biggest 100 US corporations are relying more on suppliers. Do you know parts have an automobile from Toyota? They have 38,000. And do you know that the easiest part of it, Toyota has it? The assembly part is the easiest part of it. What's the [unintelligible] of Toyota? They are the director of a supply chain, first tier of 450 companies that... they are as themselves, multinational. I mean we're talking about Benz [sp?], Continental, Bridgestone, they are huge. Now, on the second level, they are as much 45,000. That's the second tier worldwide. If you go, and if you drop, drop, drop, drop, maybe you'll find maybe fifth, sixth tier. So if you add this problem plus levels of your tiers, that actually... your suppliers have... it's a real issue. So when you come up with answers on that, you're not only touching their pockets, but you're really creating value, not only for them, for your country. But specially for that small company. So the scope that this corporations have, 100 manufacturers in the United States... they don't just see the suppliers as someone that knows my business and I just want cheap. I now ask him for cost, I now ask him for quality, and now I ask him for innovation. So the role of the supplier has changed deeply. Now, I am just imagine that maybe Toy-ota, let's say light bulb, or the electronic matter of music... let's say the car of 2012. I'm sure that Benz[sp?] already have many proposals for them. What Toyota has to deal with is to actually be sure the whole music of the whole product harmonizes. So this is very important to understand, because for us it's not about cheap, it's doing it right, and how the supplier can create more value. Now, on the developing suppliers and local markets, some of the benefits... now when we put a magnifying glass into Costa Rica, why is this business so important for local suppliers? I just tell you that for multinationals, which are our customers... that's very important, they are our customers. My customers are not small and medium enterprise. I'm not doing pushing. I'm doing pulling. Otherwise I will have 45,000 suppliers. I'm not trying to include their products. Remember the teaching process... now why is it so important for them? This is real, not as the theory academics has build, and some of those technical studies have tried to convince us that technology transfer just is by looking and that's it. You cannot learn about technology if you don't have the proper conditions. First part is teach it, but then you need the practical way.

D: So how does that happen?

R: Actually it happens when a multinational gives you for example this bottle, and you have an injection machine, and your products are actually this (points at something else)... they are challenge you with this. I will give you my mold, you have to learn by yourself.

D: They don't give people with expertise to help the local supplier?

R: There are many of them that actually have this relationship with them, but many of them, they don't. They must teach... how to walk by themselves. Now, what we have in our program, so we have... I have a staff of engineers. We have an electronic engineer, we have a materials engineer, we have chemist engineers, we have 3 industrial engineers. They are experts on how to do this, and how to negotiate. That's very important, that's the other part, the management part. Now in that technical issue, that's why we receive layouts, we receive technical information. We just don't receive this bottle, you know, we receive technical... that's how we... that's our language.

D: Are you fully equipped to handle that sometimes? Is it not a bit over your head?

R: Well there are many... well, in some of the projects, we have made queries outside, we have asked for patents, any resource we have, we actually deal with. Now you can see how technology transfer is actually happening, so the small and medium enterprise... he gets.... It will be a tremendous job. Now, how many, how much we need. We have projects that we have closed in two weeks, 6 months, we have one still open, 3 years. It's so specialized.

D: What type of project exactly are you talking about?

R: Well, several, in the electric, electronics... for example, the longest of it is a, for example, what we call a... it's called die-casting. Die-casting is a process of injecting metal. But for example it's so difficult to have that process inside that we are deciding to bring a foreign direct company to do it. Now...

D: So, hang on, your job as a middle man... you have the engineers and they take a look at the specs that the transnationals need. Are you doing the work of this company for them?

R: No, we can't. We don't give them the fish, we show them how to fish. We give them the cane, not the fish.

D: So you give them suggestions?

R: Well, in the technical part they are the experts. Remember that someone that has... I mean, we're dealing with businessmen that... I mean, the plastic guy, he is the man of plastic. I cannot teach him, I have to see 200 companies. We have to see 200 different visions, products. It's very tough. We are not... I cannot tell you that we know everything, we're not omnipotent, but we certainly know how to do... now, the important matter that these guys actually, I mean, put a hand on them is how to make business. You can have the product, but it's very tough to have a relationship with a multinational. Conditions are different.

D: You have to deliver, so...

R: It's very, very different. I mean when this guy says it's 4 o'clock, it's not... I have a company that actu-ally, he called me and said you know, I've been trying to deliver 2 hours ahead of my commit time, and I told him, and why are you doing that? Well, you know, it's better to be at 2 pm rather than 4 pm. What do you think?

D: The transnational would be very happy to have it early?

R: It's a big problem. You don't have a truck ready on your dock. You still have product flowing. You're expecting it at 4 o'clock because you just know that in that time, the dock will be free. Now you have a truck outside waiting for one of the trucks that are still, you know, putting product, and in that moment, 2.55, not 4, that truck is out and the guy that has been waiting for 55 minutes goes into that free dock, and that truck that was supposed to be at 3 will have to wait. It's a problem. I mean it's simple, if they tell you 4 it's because they know that they have a schedule. They have like 100 suppliers locally. So, what I told him, that believe me, he told you at 4 for one reason, otherwise they would say evening, morning. That's very impor-tant. How do you for example... have you ever in your school gone through Wal-Mart's case about...

D: No. I've read Thomas Friedman's book, have you read it?

R: Well I mean, again... yes I've read him, but what's important... in the business practice, in the business practice, if you wanna be a supplier of them... for example... I just want to give you real cases, things that I've seen. One in January, I got to one of their facilities in the United States. Wow, this is a very big ware-house you have over here. It was a friend of mine, at Wal-Mart, and then he... then four months later I just came and said wow, man but how did you... you have actually half of the warehouse I saw in January. And this guy told me, well you know, I've just made important improvements in this warehouse, I don't want any unused space now, so I just made my strategy and I just asked my suppliers to manage my inventory. So I say wow, man... I mean, you got to the point, but tell me something. When you have this big warehouse, maybe the supplier was delivering every Monday or Wednesday. Could you tell me about that? Well yes, I told him that... I mean, he's working with Wal-Mart, we are an important customer, and Wal-mart every day is a... every day low price, it actually depends on suppliers. Now, when you tell a supplier to manage your inventory, you're not creating a solution, you're creating a problem. The supplier is good at manufacturing. You're telling him to create a new core business which is logistics, so could you imagine someone that truck, one big truck, to deliver Mondays, and now he must have 3 trucks, 2 motorcycles, to start delivering every Monday, Wednesday, Friday, and you know, every...

D: So they're putting more demands on the suppliers like this...

R: Exactly. It's very important when you work with multinationals that you are ahead of these issues. Now, I was saying about working with multinationals and in many sectors, what'll happen is that for example when will they pay you? Is it in the time that my truck is in the dock? You know that many multinationals are now asking their suppliers to wait 20 more days or when the product is shipped from their facility.

D: That creates a problem for local suppliers because they need that money when they...

R: Of course. But this type of examples, I have many of them, but I just wanted to show you how different is it to work with multinationals. And these are the matters that we go through with them. Things like quality, things like certifications and many of these matters that are different.

D: Do they often put demands on ISO 9000 and 14000?

R: Some of them. Some of them, yeah... Okay now of course they become a part of a supply chain network bigger than they can see...

D: When do transnationals start to cross the line and start investing in their suppliers? Try to have more con-trol, more direct control of the supply chain?

R: You mean like I as a multinational decide to put money on my supplier?

D: Yeah.

R: Yeah, well it's very tough. It actually... it's tough. If you see... you can see for example in the banking system. You can see that a bank is doing well in Central America. Regionally, it has gone well, and then someone that big just came and buy it. You know, but you mean like... they are, I mean... it's funny, I was in Japan and one company [unintelligible] and this guy was like this, when he talk about market, he was like, okay we need to get corn into Brazil. And we need to get, to move energy from Japan. So, they are not talk-ing

about neither regions... they are talking big. So, when they are talking about banks they are not looking for the small... these guys actually make a decision, now if you check for example Microsoft approach on this, in innovation for example, it is a different strategy but it creates more value for them because they foster small and medium ideas and they pick up winners. They pick up winners, pick up from that selection, pick up, pick up, and then you can see in Windows Vista. It's the first time I see that these guys have, actually have partners in the frontline. And they say okay, the burning technology of CD's, Roxio... so their approach...

D: But you're saying is that Microsoft is a bit different compared to most. Most of them don't have that eye...

R: I would say that every company has a different approach, but if you wanna get control of your supplier it's because he is doing very... it's either making your intellectual property and you must own it, or some guy in Venezuela has found for example a mine of, I don't know, a lot of semiconductors, and Intel says that's our business, we should buy that. Many of that happens...

D: Here in Costa Rica? Have you seen that happening a lot?

R: Financial services. I mean just in banks we have seen that. Last year HSB... Hong Kong and Shanghai Banking Corporation, bought Banex. Scotiabank bought Interfin. In the real estate business. Still not that much in industrial. There has been cases, you know. Maybe not buying, but maybe joint ventures, I would say. Buying is a real matter. Now what's the supply development in Costa Rica Provee? We promote high value added products that are related to the export activity and that they incorporate small and medium enterprises into this network. So we don't want to create a small network of companies that we know that they can, but we go outside and teach them how to make this business happen. Now, how we do it.

(Shows Slide 8)

So, there is the demand over here. We have... many other multinational companies, we analyze their demands and then we go to our supplier base. For every supplier we have a profile, like a resume. 7 points that are critical for a multinational, so they are not trusting us, they have papers that say, okay I can see that this company has weakness on the environmental treatment, or it has strength on management, marketing, okay this is very good, it has capabilities in production, it has good infrastructure... and that analysis is made by my guys.

D: Question... how do you define small and medium size enterprises?

R: It's a formula that the ministry of economics have... for manufacturing I think its about 105 million dollars, but you should go and check with them. Our systems actually made this calculation. Now, so in the business development, so we go and pick up these opportunities, so we engage in detecting the needs that they have. We analyze that, we go to our supplier bases, and we make sure that it complies with every issue they need. So it's not a matter of the product. I mean you can tell me, look Robert can you go and... I need this product in Costa Rica. Okay well yes...

D: Do they go to you or do you go to them?

R: No I go with the multinationals. My multinational is my customer. I either pick it up or he tells me look I need this, this is my wish list. Then I'll say okay, you know I think we have this... okay you need this, specs, how much do you need? Okay, this is another question, different than the product. Okay, do you need to have the company environmental system? Oh that's another issue different than the product. So they give us a long list, or the list that they have. Volumes, they gave the target price. So many of that information is pretty confidential. Now, we give follow-on in every stage of the process, so we just don't... we do more than introduce them, we actually go step by step making sure the supplier is developing this right, is manufacturing this right, and we actually, for us, the closing business is the...

D: Closing business?

R: Yeah, when they make the first business is what we count as our statistics. When they have the first purchasing order. So when that happens? That's the real business?

D: What mechanisms do you have if something goes wrong?

R: What do you mean?

D: Say, when you follow up and what happens when you detect several things wrong with the way they are trying to meet the transnational's demands...

R: Well I mean if there hasn't been a purchasing order it's easy, the guy from the manufacturing gives me a small log and I will check it. There is no way you can... the products you're talking about are infusion devices are electronics, quality has to be 100%.

(Answers phone)

Yeah, so they must comply... now... the problems, actually, and this is part of our job, it's a phase we call after care, which happens when you close your first business and six months later we ask the multinational how's the process. Has it been a happy process, what type of problems do they have, are facing... and then we go into detail, try to correct what we think is in our hands, or if not...

D: Who pays for your services? It's the Costa Rican state and nothing more.

R: The local suppliers don't pay anything, and the multinationals in Zona Franca they pay a fee monthly for many services they receive from PROCOMER, so I would say that it's included. But for them it's actually for free. Now how we move over this promotion process, so we foster activities like this ones...

(Shows Slide 11)

... and I'm quite interesting... the university that you're now on, in order to participate in this event, which is called the supplier exchange forum. This event will have 140 companies from the supply chain of Costa Rica, and it will have... on the fair part we'll have the presence of the most significant companies in every sector we have covered. It is...

D: What happens here? They showcase their products...

R: Exactly. They will have their products, they will have what type of jobs they are doing for multinational companies, and we are trying to create an interest for investors to come up to our country, investors that want to create a new operation, so that they could see what the neighborhood looks like. What's the supply chain they will have. What's the services they will receive from the government, and specially... every new FDI company that comes for us, for me, for our suppliers, it's positive. We know that there will be more than just exports, than employment. I work with indirect employment, which is more suppliers, so that's why we are so eager to bring new investors to Costa Rica.

D: You mentioned a good subject there, indirect employment. What does this mean for the Costa Rican economy actually, with these backward linkages in terms of employment?

R: Well suppliers are so critical for the operation of many of these multinationals that it's quite, very important. I work for them. Now...

D: Maybe a bit of a question from the side, but if CAFTA doesn't pass, would you see there is a risk?

R: Of course. Oh, yeah. High risk.

D: Do you do risk assessments? No, the companies themselves, they hire foreign consultants to do risk assessments for the Costa Rican market... or do you do any kind risk assessment for...

R: For FDI companies? For these new ones? No, when you work with promotion agencies, you show... we try to give them information, data that they could either hire it or subcontract it... so what I'm trying to do with universities is that we're going to have, in the conference, we've already confirmed 13 speakers. We are going to close our final event with a speech of Dr. Franklin Chan, he's an astronaut...

D: I know, he started his business here...

R: Astro Rockets. Exactly. So he's going to give a presentation to Costa Rica's supply change approach to innovation, science and technology. So this is somehow the path that we are looking for. We want to create jobs that actually creates more value. We wanna touch the strategic matters of a corporation. I mean, going ahead of assembly, we want to touch the science processes.

D: How much are you in dialog in institutions that help set up the Costa Rican labor force, and I'm talking about universities here.

R: Sure, we have a close relationship for example with Tecnológico, but we are trying to speed up the process of integration with the industry. They are very good at teaching but we just need them to be closer, as in the front line of where things are happening. I have a friend, and every time I see him, I... look, look at this, this is the real matter of companies, I need you to think like this. So when you think about teaching logistics, don't teach your students about just three types of logistics, truck air and port. Think of trains, think of third party logistics companies, think of helicopters... think of the things you need to know about this.

D: Are they behind?

R: Well, we're trying to... their speed is different than the business. In every part of the world. Now, what we're trying to create is a relationship to webcast every conference, so I want to invite foreign universities to be in touch with... we have it on the web, I could give you the...

D: Do you know of any Danish companies in Costa Rica, big ones? I know Maersk is here...

R: Well you know we haven't invited yet, we're trying to do work with the embassy, but... now, we create training programs for them. We have to go and look for new suppliers, and what we do for them is we get them to know by the same supply chain managers of this multinational, the issues... they have to know if they want to have any commercial relationship with a multinational company... but this is on primary stages, but the teacher is the business man.

D: It is from the company?

R: Exactly. And different from them, we have the supply chain manager of Suttle, for example, which is an electronics company, this is one of the biggest contract manufacturers for Bell South, in the US. Then you have companies like Sytech in the medical business, we have a guy from [unintelligible], we're talking about big companies going to the ground and teaching small and medium entrepreneurs what they must know if they one day want to have a relationship with them. Now, what has been our experience? Well, from the day we began... this is like a snowflake, every time it runs, there has been more interested about... I mean, companies has seen that the country has creating this capacity, and this that this job of Costa Rica Provee has given them a facility, good conditions to fish. So we've been closing contracts for substituting many, some imports they have, doing from outside and now they're doing locally. This is the number of contracts, purchasing orders they close...

D: Is this the full picture? How many of them go around you? Do you think. Some of them do it without consulting you...

R: This is not the whole picture of the transactions that happen. This is just what goes through us. I don't want a small company behind me, telling me, could you help me... nonono, you don't need to fish, I just teach you how to sell to Baxter. Look up for Hospira and tell Hospira that you are now a supplier of Baxter. This is what makes companies real. I am not an extension of the marketing or sales department of small and medium companies, I am an extension of the purchasing department of the multinationals.

This is the amount of those contracts. Right now we closed, last year we closed with 3.2 million dollars. Right now, half the year, we checked that board, we are 4 million dollars, just half a year. So this has been a process that has been speeding up fast enough to make it an interesting case. This issue that you see over here... remember that I told you that when we know that the purchasing order is delivered, this is actually what we're putting over here. That first business is always, usually, the smallest one. So we just...

D: So what we're seeing here are the same linkages that you've established maybe several years go, and they're just getting bigger and bigger, or are they new ones?

R: This is just the new ones. We have statistics... we build this case just for last year but you know be-cause... we have to trace this data case by case... I don't have data, like exports, someone came with a form, we don't have that facility yet. We have to go and ask the two guys, and it creates more job for data pur-poses. But we know that in one year, one company, a sector, grew 85% in the first year.

D: Which kind of company?

R: The sector, the metal mechanics sector. Just by asking them how are you... from the first business you closed with that company that we actually helped you, how is the business right now? It has grew 85% in one year. So that gives you some of the stats of how good the suppliers are, and our job is actually checked in that process also, because if one of my guys, he didn't review the whole specs in a small and medium enter-prises, maybe in the short run any of the actors will see it, but in the long run it will be... the evidence will be pretty obvious.

This is the number of the suppliers we have, this is an accumulated...

D: Do you have more information about what kind they are?

R: Sure... these are the sectors...

(Pause, change in sound file)

... value added, more technology, more science, more innovation is created by this [unintelligible]

D: Why is metal mechanics such a big sector?

R: It's very important.

D: For what kind of transntions?

R: Electronics, medical sector...

D: (points) Services?

R: Metrology, engineering...

D: Does it also include maintenance and repair of the buildings, and lawn...

R: Nononono. Nothing like gardens, security, nothing like that. Remember my challenge, promoting high value-added. That is a supporting... remember that the multinationals have a staff of buyers...

D: (points) What is Others?

R: Oh, you know... things that are not like that. We also work in three sectors... metal mechanics and agro-industry, so many of that will be chemistry or something like that. Which is very important is that I've been told that the level of linkages is very low... although the theory is quite good, there is many misconceptions about that.

(Draws)

This is a bar that will show the supply chain cost, the value of your supply chain. For example in a company like Intel. 95% of the costs in the bar represents semiconductors. Chemistry... chips... others... but let's talk about raw materials. 95%. Now tell me where are the mines of the semiconductors in the world

D: Korea, special places. I worked in a solar cell production company in Philippines, and they have bottle-necks with high competition because there's so few of them.

R: Okay so you don't have 100,000 companies doing this. It's on one hand. So if 95% of your raw material, you have to import it...

D: That leaves only the 5% where you can work with lowering the cost in the country.

R: So, when you see stats they will say, yes Costa Rica has a very low linkage, but what picture are they looking? At the 5% and they'll say we're covering the 3%... well, that's almost half of it. Or they are looking the 3%.

D: Who says you have a low linkage?

R: Well it's very interesting because the economics miss this part. So, for example our level is somehow 11%. And this is not a justification, this is a reality. If you want to buy resin, look at this. In the medical business, 70% of resin came from oil, is a sub-product of oil. In Central America, we don't have coal mines, we don't have copper, we don't have gold. So you don't have... in the manufacturing process, this is just for manufacturing, of course the value of the product research and development is a big deal of course, but this type... the investigation of new products is happening in developed countries, not in... this is a process we're trying to catch, and this is why this event is so important for us, because in this fair we want to show them we are building a plasma motor for rockets. We want not only new sectors, we want companies saying... in Costa Rica we can do just more than assembly, we can do investigation. Now just to finishing...

(Runs over the figures on the second to last slide.)

Appendix E

Interview – Ana Quirós, Director, Eco Global

Full Interview Transcript

Present: David Christensen and Ana Quirós

D: Just for the record, what's your name what is your position?

A: Ana Quirós, and I am president of Eco Global, founder also of Eco Global. But I also work and assist the committee on social responsibility with AmCham, and I also am part of the National [unintelligible] body of Costa Rica, as a member of the board of directors representing the college of engineers and architects of Costa Rica.

D: Alright. Can you tell me a little bit more about Eco Global? You started out in 1994 under the name KPMG. And then you became independent, autonomous in 1997, as I understand?

A: Perfectly, you've done your homework.

D: Its information on the website I just wanted to confirm. What sort of activities did you start out doing in the beginning, because right now it says you're expanding into different fields.

A: It has a lot to do with my background. I'm a civil engineer, and I have a graduate degree on earthquake engineering and seismic retrofit and risk evaluation. My preference was always, as a graduate, I did my emphasis on the hydraulics and sanitary, and so my interest was always to environmental issues, but at the time I wanted to my post-graduate there were no scholarships for environment in Costa Rica, everybody thought I was crazy to ask for that. The main issue in engineering for graduate work was the risk with seismicity, so I went to Stanford and I worked on that because there was a scholarship for that but I also took other courses that would assist me and help me in developing the environmental aspect that I wanted in my profession.

D: Did you have to undertake the training abroad?

A: Abroad, yes, I lived in Palo Alto for several years. And when I came back, the KPMG office which at that time was Pete Marwick[?], they also went through a transformation, were called by the government, this is interesting, they were called by the government in 1994. The government was starting to take office and they had in mind to develop a sort of, like an eco-label that would differentiate products in the European market mainly. And they thought that a independent, well-established and with credibility auditor firms in the traditional field of financial auditing would be good partners to develop the environmental audit that this, sort of field, would require. And so that's why KPMG called me, knowing that I had always been interested in the environmental issues.

D: So you were the pioneer firm, environmental consultancy...

A: Yes, and the way I also got linked with the national standards bodies was because at that time, and it was very interesting because KPMG was betting at the time on EMAS scheme without understanding that EMAS was mainly for the European countries. And we had a big sort of argument and issue with them to change their set of mind for Latin America to the ISO standards that at that time were drafts... And it was my doing actually, and we proposed also to make a linkage with the national standard body because I was pushing for the ISO standard, and when we went to the ISO they didn't know what was coming here in terms of the 14000.

D: So when they finally made the first draft, you were already established and ready to offer these services.

A: We actually participated, and with the first draft that we participated... it was finalized, it was the final draft, but we started working with the life cycle draft, which was the one that was least developed, and our advice was, let's participate with the ones we could incorporate the most of our information. And that's why also I have been following up so strongly with life cycle assessment.

D: I'll come back to that... but in general what are the services you provide?

A: Right, that's a little bit about the genesis. Another service that we have provided, and it's not so strong now, but very interesting at some period of time was all the valuations, traditional and non-traditional valuations, we did a lot of that because also of my engineering background. So we did due diligence and we worked with the Dutch government and with other governments in one of the first cleaner development mechanism technical evaluation in Costa Rica, evaluating landfills and valuating hydroelectric plants for this field to emissions reduction, which was very interesting and as I tell you, it sort of fell as a practice and we would love to pick it up. Just to tell you, and then we started seeing that in order to make a change with environment, the country was at a stage where everything was ISO 9000, was quality, and we said well let's look into quality, and we will bring as part of the total quality management the environmental management, and as soon as we started coming with that we started proposing integrated systems. We thought that it made much more sense to do that. We worked with several companies on that line, and when we started with integrating systems, it became natural to look at health and safety and community work, and while we were doing that we started encompassing a broader approach to the management, and social responsibility came very natural.

D: So that's the most recent field you've actually started taking active part in, that's the social responsibility?

A: Actually not, as I tell you the Am Chamber committee, ten years ago in 1997 established, when no one was really talking in Costa Rica about social responsibility, an award that would incentivize the member company to look at what they were doing with the communities. So the community service award was established in 1997, and has been operational... actually in 1996, has been operational, this is the 11th year, imagine. It is very pioneering in Costa Rica, Central America and actually most parts of the world because nobody was really talking about standards or guidelines on social responsibility at the time, and we were already having an evaluation tool and giving awards. Last year we were commemorating our 10th year and we launched an additional award which is very nice. It's an award for the best media communicator that throughout the year puts into light what others are doing in terms of social responsibility.

D: What others are doing?

A: What others are doing. He's a communicator and so he will be evaluated, he or she of course, in terms of how they convey messages that bring to light social responsibility.

D: This is also an AmCham initiative.

A: This is an AmCham initiative. But all of this is AmCham doing with the direct support from Eco Global. That's why I tell you, those part of our services, because we have been supportive of the national standards body, of the Chamber of Industry in Costa Rica, with the Chamber of Commerce. With the Chamber of Industry, we work with them in developing and evaluating in the first stages the excellence award, the premia excellencia, at that time the whole chapter that dealt with environment was incorporated to Eco Global, at that time KPMG because we were still part of KPMG. But to tell you, our services encompass a very broad line of management.

D: The bread and butter of your day to day services, what is the sort of thing that you do most?

A: Mainly, and through time, it has been management systems for both private and public sector organizations, but currently we work a lot with everything that deals with environmental assessment, not only management but studies, the environmental impact assessment. For permissions. Companies in Costa Rica cannot establish operations... this is very important...

D: They don't have the expertise to do this themselves?

A: No they have to contract a special consultant that will assist them in going through the process with the government to get a permit, and we deal a lot with legal issues. Eco Global has developed a whole area that is called Eco Legal because we find that there is a huge lack in that both for the government sector as well as the private sector, and we have been able to take a niche.

D: Is this finding out what are the legal requirements or how to interpret them...

A: How to interpret it and how also to argue upon the decisions that certain government agencies impose on developers, so we've gone to litigation during the past years with several of our clients, and it's something that we do on a regular basis now.

D: But these assessments, are usually one-off, or are they also follow-up?

A: These assessments are one-off, and the client and the government has the choice to continue the follow-up through what they call rejencias[?], which is a sort of like an inspection service that is offered also by Eco Global, and we do that. Most of the clients that go through the initial assessment, we take on the rejencias.

D: What sort of companies ask for your assistance? They're usually the ones with a lot of resources, or are they very broad in spectrum, small and medium sized enterprises to transnational corporations?

A: Depends on the service. When we're talking about management advisory and when we're talking about strategies for change and better performance, they're generally what you would understand as international corporations or large companies in the country, also large government organizations. When we're talking about the legal advisory and when we're talking about the permit aspects of our services, we're more in the medium and small enterprises and when actually litigations, generally it's the very small or even communities and associations that feel they need to raise a voice because something is happening in their communities and no one is providing the legal assistance, technical aspects of the environmental...

D: What kind of community would go to you?

A: Well actually at this point in time we are evaluating how we can assess because they generally cannot cover our fees, and so Eco Global has been working with them sort of like as a contribution to communities. Right now Tambor, a community in the area of... I don't have a map but I will show you later where it is located. The peninsula Puntarenas, in front of Puntarenas, I'll show you. Their concern right now is that there is a wetland, there's always been a wetland in that area, it's been very controversial. And the community's very concerned because the developer wants to construct over the wetland, for tourism destination, so they're seeking legal support in how to go about.

D: How do companies in Free Trade Zones in the electronics sector, that's my focus... how is your experience with them?

A: Our experience with electronics started actually with the environmental impact assessment with Intel in 1996. It was a whole issue because the Intel corporation had brought consultants from abroad and joined forces with consultants in Costa Rica that had not the expertise, not the knowledge on environmental issues and on permits. They became a huge problem for Intel and so they contacted KPMG to see if we could assist them in changing what had been done and to get the permit on time, because this was a very political time. The government that was going out of office wanted to have the glory of Intel being established in Costa Rica, and also they didn't want to have problems with permits with change of government. So we came in abroad when the process was already in there, and had

to change a lot of things. In fact I would say the way environmental impact studies were being made prior to Intel changed completely from the moment we came in, and we established a new baseline on how to do those environmental impact studies. Mainly, at this is important, consultants and developers think the environmental impact study is just one more step in getting a permit, very much so at that time. And we established a new paradigm, which I think is the correct one, and have kept it. And actually, whether the developer pays or the government pays, this is not the case it's always the developer, that is independent of the consulting group. The consulting group is responding to society, not only to the developer, and has the obligation to communicate and convey to the whole of the society, especially the community, what that assessment is. And that was a bit controversial at that time, but it changed. And now the environmental impact assessment again has changed, I think for the better, new improvements...

D: More independence?

A: No that aspect has not still been addressed. And we face very much a practice in which the consultant is actually always most of the time responding to the developer, and has not the best interest of society but the developer's interest when doing this assessment. It's a weakness in the system... what else have we done with electronics after that, after that we worked with several companies that respond to the electronics sector in the maquila process of doing part of things that they export or embed in other systems with management systems, mainly on quality, but some on environment too. It has not been our sector focus for maybe the past for, five year.

D: The electronics sector?

A: Yes.

D: What is your main focus?

A: As an sector, agro-industry, we deal a lot with them. And we also have just one company that you would maybe not qualify on electric per se, but it's a company that deals with the electric sector, Eaton Schneider, I'm sorry Eaton Kuttler[?] Hammer[?], company in Costa Rica, which we have developed with them environmental management systems, quality systems, and we are currently working on performance and alignment of systems with their own internal evaluation of performance. We also give assistance to another sector that may fall in that broad line of electronics, they make switches here, and it's the former ITT company.

D: ITT...

A: Now it's C and K again.

D: So... questions about your position as the social responsibility representative of AmCham, you were appointed for this position back in...

A: This... the committee is fairly recent. I helped found and was president for several periods the environmental committee of AmCham, and working with the award which was not under any committee, and has been kept very independent, but working with the award for ten years and [unintelligible] with the environmental committee, it became very apparent that we need it, as the world was shifting towards social responsibility, to develop a committee on social responsibility for the companies that were associated with AmCham. So in 1995 we started the committee and at that time it was a pilot that I took over, and was appointed then in... I'm sorry not in 1995, in 2005, and was appointed in 2006 for the period that is done, the group that wants part of the committee elects a chair and a co-chair, it's their choice, and then again in 2007 was again appointed by the group and have been working with them throughout this year.

D: How does AmCham concretely work to promote social responsibility issues? They have the prizes...

A: They have the awards, yes, and we meet every once a month at least, the committee meets. There are over 40 companies that have expressed and follow the work of the committee and about 23 company representatives that are consistent in assisting to the meetings, and what we do is we give lectures, we invite different groups and associations and also enterprises, to talk about two things. One, their needs in terms of social responsibility, and two, their availability to contribute to social responsibility changes. This is organizations that require assistance as well as organizations that have expertise in different fields, and then they coordinate their work...

D: So you facilitate some kind of knowledge diffusion...

A: We facilitate through yes, diffusion, facilitate on linkages and we follow up, there's a database also that is developed with the experiences, with the lectures and with the needs. So if there is social, if there's need for social investment, AmCham is the facilitator. That is something that we do to foster. Other things that we have done to foster this is, as I tell you, the award in communication, to make it publicly known, the general public knows that these things are happening, and AmCham has recently opened another office in Guanacaste, and so a committee maybe on emergency response and a committee on legal affair and maybe also social responsibility will be formed specifically in Guanacaste to follow up on the touristic sector mainly.

D: How would you describe the level of engagement in general when you talk about corporate social responsibility in Costa Rica, is it still in its infancy or... you mentioned that you facilitate diffusion so does that mean there's a lot to be done?

A: I would certainly say that in some areas, because you know social responsibility is such a broad term, and it's good to bring it down to the components of this big concept, and then you can sort of make a baseline and say this is where we're out in this and this areas. In terms of community work, I would say it's the strongest area of social responsibility that has been developed in Costa Rica. Of course Costa Rica has a very large wealth throughout its history on labor issues and labor standards, so in general without even knowing that it's part of this now globally understood concept of social responsibility, Costa Rica has a good baseline in terms of first labor issues, and second the community work of companies.

D: It's not top heavy? When you take a look at sectors, for example the electronics sector I know Intel has a well-developed corporate social responsibility initiative. They won the prize last year?

A: Last year. This year it's open again and November again we will be giving awards.

D: But are they unique, as one of the biggest players in the sector, these initiatives, do they usually come from the bigger companies or are there any community outreach programs lower down?

A: That is very important. Throughout the years, consistently, it has been the large and medium, very large companies that have been able to be distinguished by an award like the AmCham award, and I must tell you that AmCham award only looks at the community service award, and only at one part of what we understand community support. Under the ISO guide, there are many other issues that need to be addressed, and that is why the committee on social responsibility was formed. Our impression was that we needed to migrate from something that started 11 years ago and now is not sufficient to show the change towards a more ample concept of social responsibility.

D: What are the other aspects that ISO mentions?

A: ISO mentions 6 or 7 areas that are very important, and on communities specifically there are 3 main issues that are addressed, and not only education and cultural aspects and environment as such, which is the focus of the community award of AmCham, are addressed there. It's quite an ample, very large scope, guide. I don't know if it will remain like that. I saw that with the last draft that was approved for circulation within the members around April or May, I think it was, the last one, of this year, it will pretty much stay like that. But one of the issues that we keep stressing in Costa Rica, and when I say we it's Eco Global, mainly, and Eco Legal, is the transparency and the corruption prevention, which at this time globally is being addressed mainly as a code of ethics and not with the systematic approach for management, transparency and prevention control.

D: So you're fighting for concrete safeguards to ensure more...

A: Yes, maybe following up the same scheme, and we have already developed, and this is interesting, Eco Global is very innovative, you know, we're very small so we have the great challenge of bringing to light things that are innovations in management and in everything that we do. Because otherwise we will be consumed by the market. We wouldn't have an edge, we wouldn't have something different to show and to bring to light. So we developed about three years ago a system for management transparency which goes beyond establishing a code of ethics or establishing your main goals of zero corruption, and everybody signs and says 'we are against corruption'... yes, but how do you control that? How do you improve that? How do you show, how do you report on that? So we took an approach like the ISO standard and developed where you identify all those areas that are prone and have critical points of control for corruption. And from there we developed a system where implement actions, improve and make less critical those areas, and where you can report and also show how you are managing your...

D: And has it been used?

A: Yes, that's a very interesting question. We offered it into several enterprises as well as to several government organizations, and of course everybody says yes, it's so beautiful, we'll call you.

D: And they haven't.

A: Not really. But we have now one small corporation that has gone into policy, and through the policy system we have said, as well as we did with environment, we have said why don't you address transparency as part of your quality system, in this way of doing it? And they're very thrilled, we're doing it, they like it, I could tell you what the company's name is but maybe I should consult with them first and let you know later in the interview. But it's very interesting, you wouldn't imagine who wants to do this. In addition, the college of engineers has expressed interest in supporting this system, either to implement it in their own organization, and then to propagate, disseminate the application through the construction sector, which has a very large interface, and has been identified as one of the sectors that is more prone to corruption, in the world, through contracting of government agencies. So we envision this as...

D: Tourism development, that's also...

A: Also, also a problem. But it's more related to concessions of infrastructure, roadworks and buildings for government and airport and port, marines, etcetera. So we feel that it would be a very good way. It appears that the region, because we want to bring it to a regional level, the region, also of engineers, is interested in adopting this. And we have worked also, talked with Transparency International because we think that they would be a key player in certification... there is no systematic evaluation for the companies to improve a process and how they go about it, and this is where I think we bring in a nice innovation.

D: I had some questions focusing on the difference between American companies in the way they approach sustainability issues, especially social responsibility. You say that there is a difference.

A: There is a big difference. And also not only social responsibility but also on environment, and in general, this is an argument... of course, these are general comments. If we talk about specific companies, I would have to tell you that it's different, and I could comment on what their strengths and weaknesses are, but in general terms we face, not only in Costa Rica but in most countries of the region and even in Latin America, this dual agenda that I call, for management. You have big enterprises, not only North American but European, based also in Costa Rica because we have European companies that are quite large. And they have these incredible statements and also implementation of systems under the social responsibility that also covers environmental as well as quality of course, looking at suppliers and all this, and I don't know how they go about it in the US or in other countries in Europe, but I can tell you how they are going about it in Costa Rica and other countries in Latin America. And it's not the same, it's not the same. The managers are not committed, they are requested to report and inform, and perform under standards that are not the same, that are being performed or reported or indicated at corporate level in other instances. They... their priorities are different.

D: Is this because legislation and the level of enforcement is different in developing countries in Costa Rica, and they take advantage of that?

A: That... it's not advantage, let me tell you this. In fact it's not even an advantage. Legislation is so cumbersome, so cumbersome, in Costa Rica and in other parts of the region, that it is a real challenge to know what legislation applies. You are faced here with companies that want to comply with a certain aspect, and when they look at it that aspect is addressed in three or four laws that have no relation to each other, and each of those laws is managed by three or four government organizations that are different, that don't talk to each other and are contradictory. So it's not, you know, saying they don't want to comply or they're using the legislation to do underground things and that are not correct, it's actually such a mess that it's hard to address and to comply with to start with.

D. But why are they not generally taking the same proactive approach, if they have a proactive approach, in Europe and the United States?

A. Okay, I will tell you something in fact, talking about legislation. When you come to talk about legislation, you have to be proactive in order to also bring a change in this legal structure. And two things happen when you are an enterprise that comes from abroad. The first one is that these countries in Costa Rica will immediately yell and complain and say, 'they are infringing on our sovereignty, on our way of doing things'. Why would they want to lobby, why would they want to come... it's mainly because a very particular interest, and it's generally equated to saying it's exploitation, you know. They want to change the law or they want to address this in a different way because they want to take an advantage of us.

D: So you're saying that it's wrong and that actually they should be more open to that because they have the knowledge...

A: Yes, yes, and they should give capacity here but they don't.

D: What's missing?

A: What's missing... I think that two things are missing here, one comes from the corporations. I think that to some extent they are afraid. They are afraid to come and be open and state what their interests are. And businesses in general I find, feel guilty that they produce wealth, that they make money, that they're lucrative. And I don't understand that reasoning because actually that is what makes an improvement in quality of life, and if you make money and are able to transfer this wealth to the rest of the community, that is great. But in general we have looked at companies and say 'oh, you come from the private sector, you are productive company'... if you say you are a private enterprise, you start wrong. If you're an NGO, you start right, which is not correct, we are all human beings, whether we are in NGO's or in enterprises. It's the person, and of course the philosophy those persons bring into the company that projects to what will be done and achieved through the process they do. So the first is that. I feel that as a corporation, as an organization, the managers have an attitude, they are fearful, they want to keep a low profile, you talk to them in AmCham, everybody says we want to keep a low profile. We don't want to make news, not even the good news, we don't want to. So that is part of the attitude that I think needs to change. And the second part is that the Costa Rican, the locals, seeing this, maybe, I think, we don't want to make news...

D: An admission of guilt?

A: An admission of guilt, or an admission of saying, maybe we're not doing the things right, and so we want to keep this low profile also, we don't want to participate... and so also, this is a combination of fear, and you know fear paralyzes people. Let's not change things, and if I'm working for this company, which is a transnational, and if I come forward, I am going to be labeled as saying I have the interest of transnational first and not Costa Rica, and they're always linked. The interest of the transnational and the interest of the community for that transnational is basically, are always linked, otherwise it's not a sustainable business. So I think that's part of it, and of course, having told you everything about transparency and corruption, I also think that there is a lot in terms of the interaction between the individuals that are in government agencies and individuals that are in private agencies. When everything is so cumbersome, you tend to go through the informal mechanisms that are very prone to corruption, and that is very sad. We have to change that cycle, and the only way to change it is to address it up front and put your interest up front. Why can't a company say yes, I'm interested in making more, in bringing wealth to the stakeholders, including the community. That is my interest. And if other enterprises have other interests, they should come forward and say it.

D: On to the question on corporate environmental management in general, you talked a little about it. But I'd like to know, how widespread are the use of tools such as ISO 14001, and you've been working with LCA and so on, and all these voluntary initiatives that companies can choose to put into motion. How widespread is that in general?

A: I'll tell you, when we say widespread, I'm talking about the companies that are already involved in this. If you look at the total market of companies in the private sector and you took also look at the total market of organizations in the government section it is actually very small percentage that is really addressing the environmental management in Costa Rica and in the region. That, in terms of number of companies. If you look at the, because you always need to have some criteria and parameters, how to compare, if you look at the companies that produce or contribute to the growth, national income in Costa Rica and in the region, then you have a larger participation because we're talking about these large production companies that are all looking, or most of them, looking at how to improve their businesses and it makes business sense to look at environment, it makes business sense to look at the community and at your responsibilities with all stakeholders. And they have understood that, they are pioneers in that, so it's a larger market. What are the main tools that they use? Environmental management systems, either the ISO or a lot of the regional or national schemes that have been developed as part of the production chains. This is for example, in the agroindustry, you see a lot of Eurogap interests, which is a certification process that looks specifically at the way you have your management practices and your agriculture practices and everything in that sector. So, sector specific, tourism, you look at the certificate of sustainable tourism in Costa Rica that is also spreading through the region because when you have those schemes that respond to a sector, the sector adopts them, it's a way of differentiating from the rest, even from the rest of the standards that are more global in approach. My preference is the more global, not the more sector specific, but that is a whole different issue that deals with barriers to commerce, but I understand we're not going into that. Now, in terms of those two agendas, or the standards that are used in some place or another, it is very apparent for me on environment issues, even more than on social responsibility, for companies that are transnationals, most of them are using life cycle

assessment at their headquarters or abroad. And it's been twenty or more years and they have not been able to transfer that knowledge and that technology of management to their subsidiaries in Latin America. There've been very few exceptions. No one knows here what Life Cycle Assessment is, let alone how to apply it, let alone investigate, do research and development for the specific issues that are needed to address Life Cycle Assessment in regions and in countries.

D: Why is that?

A: They are not willing to invest on research and development.... Maybe it's not big, they're just not willing to do it.

D: But if they do LCA of their products in their headquarters in the States, and it's a product which is made by global supply chains, including developing countries, isn't it included already?

A: It should included. But it doesn't come down to what would be my interest. How does that knowledge transfer to Latin America? It stays...

D: So why is research and development not such a big thing here? Is it because, as I've been told, by speaking to companies, it's a small country and there's not enough of a knowledge base in terms of people, simply, to draw upon?

A: I don't know how you would sustain that, saying that it's a small country. I don't think, it's not the size of the country that would... in terms of population, look at Sweden. Look at Denmark. So that is really an excuse. What is the main problem? The main problem is that education levels, and now we home into education, education levels in this parts of the world have deteriorated greatly, greatly. And research and development needs an investment on education as well as other resources, but I put first education, you know all this, the equipment, all the additional support infrastructure that you might need for research will come later, it's not the figuring point, it's the people in terms of the education that you will assist you to raise the bar. But education here first responded mainly, and I'm talking about many years ago, to a production system. It has become utilitarian, education has become utilitarian. You study to produce something out of that, not you study because of the love of learning, truth, beauty, tolerance, respect and whatever comes out of that, well...

D: Don't transnational countries encourage that? I was reading, when Intel established themselves, that they needed an upgrade of certain aspects of the education system.

A: For what purposes? In here, first to have the people to operate their plant, not to go into research and development. It's utilitarian. I pass the bill to the transnational and to the national companies and everything in that very important aspect... of course, it also goes to society, to government, which has failed to continue investment of our social resources into research and development.

D: How would you rate the performance of the Ministry of Science and Innovation? Haven't they been doing things to encourage education to be more innovative?

A: I think that it would be very pretentious of my part to evaluate the because I have not done that, but what I see from the outside is that there is not a good articulation in terms of research and development or innovation or education of well-educated scientists per se. It is always focused on a result, saying okay, Intel is here, okay, so let's see if we can promote education on how we use... I'm not saying that's the case, but how we use computers. There's always a focus on how it's going to be used, the end product is already on their minds. Just good quality education.

D: Let's go back to the use of ISO 14001 in companies, quickly what's they way they use it? Is it simply to conform to the ISO clauses or do they use it for image...?

A: Again we would have a difference here in terms of the transnational and the national corporations. In terms of whether we're talking about international companies, or whether we're talking about national companies. Most international companies have already seen a value of addressing environmental management as a part of this good business sense...

D: They don't really see it as a part of quality management in terms of lowering costs...

A: No, unless you go into other tools like the Life Cycle Assessment or the decision tools for addressing environmental issues. I think most companies, both international and national, see it as a passport to keep doing business in the world right now. It's important to tell your client and convey to your consumers that you have management systems in place.

D: Is there evidence that that's happening in Costa Rica? That they put these demands on their sub-suppliers, if they have them?

A: Yes, they do that. Most of the companies that export are asked whether they have environmental management systems in place.

D: It's a different picture I get when I talk to the smaller companies in the electronics sector. None of them are really ISO certified, basically, and they don't have the pressure from the customers to be ISO certified. If anything, it might be ISO 9000, which isn't a requirement really, it would just help them... their bureaucracy go quicker.

A: Are they suppliers to companies here or are they exporting?

D: They export to the States.

A: Interesting. They're not asked for the environmental... well, I was more thinking about European companies but I don't know...

D: I was at an internship with a semiconductor company in the Philippines last year, and there you see the pressure from Japan because they work with Japanese companies.

A: It's interesting. I think that mainly, and of course I'm also not talking about your sector because as I told you I've been out of that sector for several years, but the agroindustry sector is very much pressured to comply, not necessarily with ISO 14000, but with the Eurogap which includes a whole chapter on Environment, so actually it's like incorporating a part of the environmental ISO into the Eurogap, in addition includes quality and social responsibility so it's an integrated sort of approach to those agroindustrial sectors, and yes they do feel that pressure.

D: A question here I have is the general level of environmental awareness in Costa Rica?

A: You mean in terms for the productive sector or in general society?

D: I think society, they do a lot to market Costa Rica as...

A: I agree, you know it's just lip talk, you know... well maybe just.

D: Is that the same case, once you go into the companies in the production?

A: To a large extent.

D: But they do have training programs, once they do have a focus on the environment, do they really try to encourage awareness of it within the company to all levels?

A: Yes, they have to, as a matter of fact it is something that if they are being followed by independent certifiers, which is good, you know I have my issues also with the certification process, but if they are followed by independent certifiers, my experience has been, with serious certifiers, you have some that will not... but renown and well known certifiers, they require this improvement, and they will come year after year to see improvements on their performance, and this is one of the parameters that they measure.

D: One last question for this. Do you see a lot of informal, non-certified environmental systems in place by companies who either don't have the resources or they don't really need it but...

A: That would be great, but I think that when you have companies that don't have resources and are on the survival side of production, they generally don't even address environment, unless they are supported by chambers. I think that chambers have a role here to play, and if they support these initiatives giving transfer of information and experiences and assisting in doing small things like the 5S, then they're very willing, these small companies, to improve because a very small thing produces a very high impact in the improvement of their product and processes.

D: Costa Rica, I've always seen it as a special case because of obviously its history and its current standing among developing countries. So is there anything unique about the way they try to encourage companies to promote sustainable development in terms of their institutional framework?

A: Besides the lip talk? [Laughs] No but there is... a lot has to do with it and it's good, you know, a lot of people in the area of psychology tell you that if you talk yourself into something you end up believing it, so I'm not against that you know. If you talk yourself into believing you're very environmentally conscious and socially responsible, and we're very proud of what we do... it may be... maybe that talk, if it doesn't have the backbone, even that is not bad. It is bad if it only stays at that point and people don't act. But I think that in general, Costa Rica would like to have a better environment, would like companies to comply with laws and promote better conditions, and anything that is put forth in that context, society will support. The big concern is that if society is not informed, if education does not address sustainable development as a systematic approach, then the piecemeal decisions based only on perception are very dangerous when added the ingredient of corruption. So this is very dangerous, we have many people willing to say 'oh, we have to work for the environment' and someone comes and says 'you know, climate change is all due to CO2 emissions, we need to reforest the whole country' and people will say 'yes, let's reforest the whole country' and you know, priorities and people and good or bad decisions in terms of that is very dangerous.

D: So the biggest barriers is the level knowledge...

A: The level of knowledge and education and the application of decision tools that have improved so much, so much, in the world and are really lagging in Latin America and Costa Rica, for example green procurement. The largest buyer that we have in our society, and sometimes the largest producer, is government in our society.

D: There is no green procurement system at all. They just want to get the cheapest...

A: Yes, that's right.

D: I was actually thinking more of certain special institutions that Costa Rica has managed to set up which are unique... specifically on the business side, they've developed a culture of promoting foreign direct investment and really accommodating them, they have CINDE helping that and they have PROCOMER and Costa Rica Provee underneath that.

A: Are any of those institutions that you mentioned using any tools to promote and to look at social development and environmental development with this approach of sustainability.

D: Not beyond what you would call lip talk.

A: That's right, the main issue. And if you go to other Latin American countries except 2 or 3, that is mostly the case.

D: I have no further questions. Thank you!