The T &T Foresight Project

NIHERST

Sector Foresight Project:

BIOTECHNOLOGY

Chapter 4:

T&T 'Best Bet' Investment Cases

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NEXT™

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1 Introduction

The challenge for Trinidad and Tobago is to develop and grow export niche businesses which can provide economic growth and social benefit in the medium to long-term. The aim of the Sector Foresight project as been to develop 'best bet' investments which offer significant growth opportunity.

In Chapter 1 of the Sector Foresight Projects, a big picture view of the sector on a global scale was developed. This overarching framework provided a context within which potential opportunities small countries such as Trinidad and Tobago could exploit were able to be identified.

In Chapter 2 we identified the capabilities and enablers that Trinidad and Tobago already had available and which were relevant to the global sector foresight framework of opportunities. The capabilities and enablers assessed included existing commercial expertise, research and development expertise, skills availability, resource availability, government policies and support programmes, and infrastructure.

During the July 2006 sector workshops, various key T&T stakeholders identified 35 possible 'Best Bet' investment opportunities for the country that matched both the global foresight sector opportunities and the capabilities and enablers T&T had to offer.

In Chapter 3 the initial 35 potential investment opportunities were short-listed into 'Best Bet' investment opportunities (four in the case of the creative sector).

The structural format for building each 'Best Bet' revolved around the following focus areas:

- **The Best Bet Title**
- **The Best Bet Description** – an overall summary of the 'Best Bet' opportunity
- **A Rationale** - for selecting the 'Best Bet' opportunity
- **The Target Markets** – who would the 'Best Bet' be aimed at
- **The Market Offer** – to target market customers
- **What We Have** – the capabilities and enablers available within T&T
- **What We Need** – the gaps that need to be filled and measures that need to be taken for the 'Best Bet' to become a commercial proposition
- **Key 'Best Bet' Roadmap Considerations** – an example of what a five-year roadmap for commercial realisation of the 'Best Bet' might look like.

In Chapter 4, each 'Best Bet' investment opportunity has been taken through an in-depth review and research process in order to build a business case for an investor audience. This needed to include supporting evidence, comparative justification, a roadmap, and a set of indicative financial projections.
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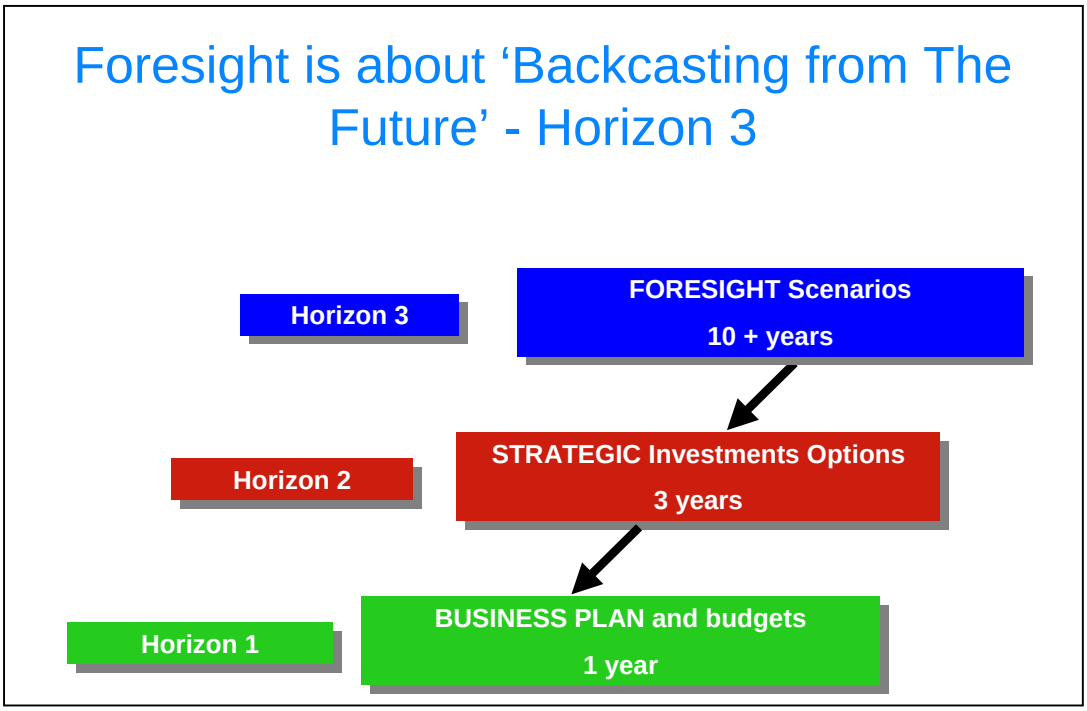
2 The Foresight Context

At this point it is worth re-visiting the context within which these sector 'Best Bet' investment cases have been developed during these projects. Figure 1 provides an overview of that context in terms of the '3 Horizons'.

Figure 1: The 3 Horizons for business and organisational strategic planning and development



This foresight project uses the Three Horizons model which shows that there are three different perspectives to consider when identifying best bet investments in a sector. The long-term view (Horizon 3) identifies broad scenarios for the future of the sector, the medium-term view (Horizon 2) identifies the investment options, and the short-term view (Horizon 1), describes the immediate business plan.

The sector Best Bets are developed by combining Foresight insights from the future (Horizon 2 and 3) with opportunities in today's marketplace (Horizon 1). In the project we worked with many of the 'innovation champions' working in the sector today. These include entrepreneurs who are already working with a wide variety of innovation projects today that have the potential for growth in the future. The context for these sector projects is shown in Figure 2.

Figure 2: The T&T Best Bets Context

An example of a 'Best Bet' that has been phenomenally successful international is the launch of I-Pod and I-Tunes by the Apple Corporation. Apple did not invent MP3 players or the downloading of music on the Internet. But it did look into the future and saw that there was an opportunity to dominate in a growth market by making the technology easy to use and by adding great branding and design. Before the I-Pod came on the scene, the technology was too complicated for the average person to use.

The Foresight Project has unearthed a considerable number of entrepreneurs and innovators in T& T who are not well known today but who have the potential to grow innovative businesses because they have the potential to satisfy growth niches built around key global market trends.

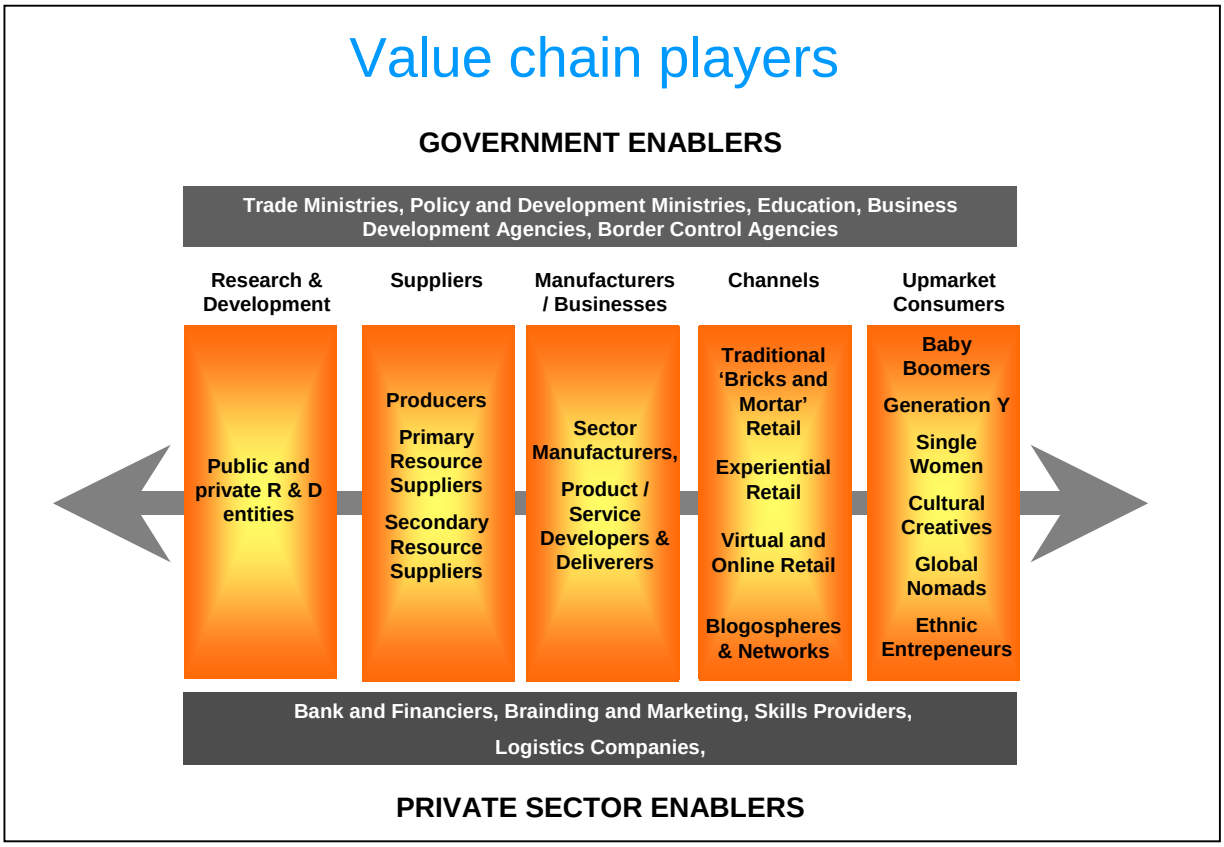
Our research suggests that the sector is at a 'tipping point' where a cluster of interconnected innovative businesses, such as these three 'Best Bets' could grow rapidly and transform this T&T business sector to a level that would make a significant contribution to achieving the economic growth and social objectives associated with the Vision 2020 project.

3 The Value Chain

Global value chains are changing rapidly. Digitalisation and advances in global logistics are opening up a whole new range of opportunities, especially for small

country players. Figure 3 illustrates the types of stakeholders typically involved in commercial value chains.

Figure 3: Examples of stakeholders in value chains



Policy setting and enabling agencies fundamentally support the effectiveness and efficiency of the value chain between the production sectors in one place and the end-customers in other places.

The intermediaries between the producer and the customer ends of the value chain are changing rapidly. Door to door 'packages for one' delivery services now span much of the globe. Online marketing is growing rapidly. Virtual networks and communities are determining what is 'in' and what is 'out' at an increasingly rapid pace. We have moved from an age where markets were production driven to markets that are now customer driven. Customers are now 'kings' and 'queens' and failing to satisfy their increasingly specialised demands – 'customised solutions for one' – will lead to business failures. Many traditional players have been forced to urgently review their business models in the face of the rapid changes occurring in global value chains.

The emerging customer-centric value chain model offers far more opportunities for small countries and commercial entities within those countries. This is because individual businesses, even small and medium sized enterprises, can more readily link directly with end customers on a global scale and so they are no longer limited to supplying small niches within a local market.

A tiny global niche can thus build a substantial business in a small country. But it does require a radical shift in thinking and a highly customer oriented approach. It

also requires accessing and developing strong networking and network management skills. It also requires being able to work more closely with customers to better understand what it is they need.

4 The Chapter 4 Approach

Each of the sixteen ‘Best Bet’ opportunities selected in Chapter 3 has been researched in greater depth by specialist T&T based researchers. Their brief was to interview selected key stakeholders whose experience was relevant to each ‘Best Bet’ opportunity using a template supplied by NEXT.

This template posed a series of questions that would similar be those asked by a potential commercial investor if they were looking to invest in a ‘Best Bet’ opportunity area. It also included a 10-year financial projection template which would provide an estimate of what could be achieved if the right mix of people and resources were put together to back a particular ‘Best Bet’.

In addition, both the T&T researchers and the NEXT team looked for additional information and examples, within T&T and offshore, which would provide supporting evidence that would strengthen the justification of each ‘Best Bet’ Investment Case. These examples included, for example, new emerging businesses that had focuses relevant to the business case, advances in science and technology that opened up new opportunities, new and innovative high growth channels which connected producers and customers, and other reference sources that were of special relevance.

As in any process such as this, it is not possible to find answers to every question. The following ‘Best Bet’ Investment Cases are built upon the best possible information and knowledge that was available at the time of their development.

In the following sections we have built business cases that can be put forward to attract both public and private sector support. The two need to work in tandem for the development of the sector. The private sector provides its vision, organisational, financial and managerial experience in areas in which it possesses the required expertise, and the public sector provides the supporting administrative and regulatory environment.

5 The Biotechnology Sector ‘Best Bets’

The following three ‘Best Bet’ investment opportunities were identified in Chapter 3 as offering the greatest opportunities for the future of T&T’s biotechnology sector.

In the process of researching and testing these ‘Best Bet’ opportunities with industry stakeholders, it became clear there is a considerable resource base in T&T, particularly in the country’s research institutions along with several key entrepreneurs, that would enable each of these ‘Best Bets’ to be developed into quite fascinating and unique businesses that satisfy specific growth niches internationally.

Each provides a more specialised opportunity within an overarching more focussed approach to developing T&T’s biotechnology sector in a way that in future it has the greatest economic, social and environmental benefits for the country.

5.1 Best Bet 1: Cocoa – 'Brown Gold'

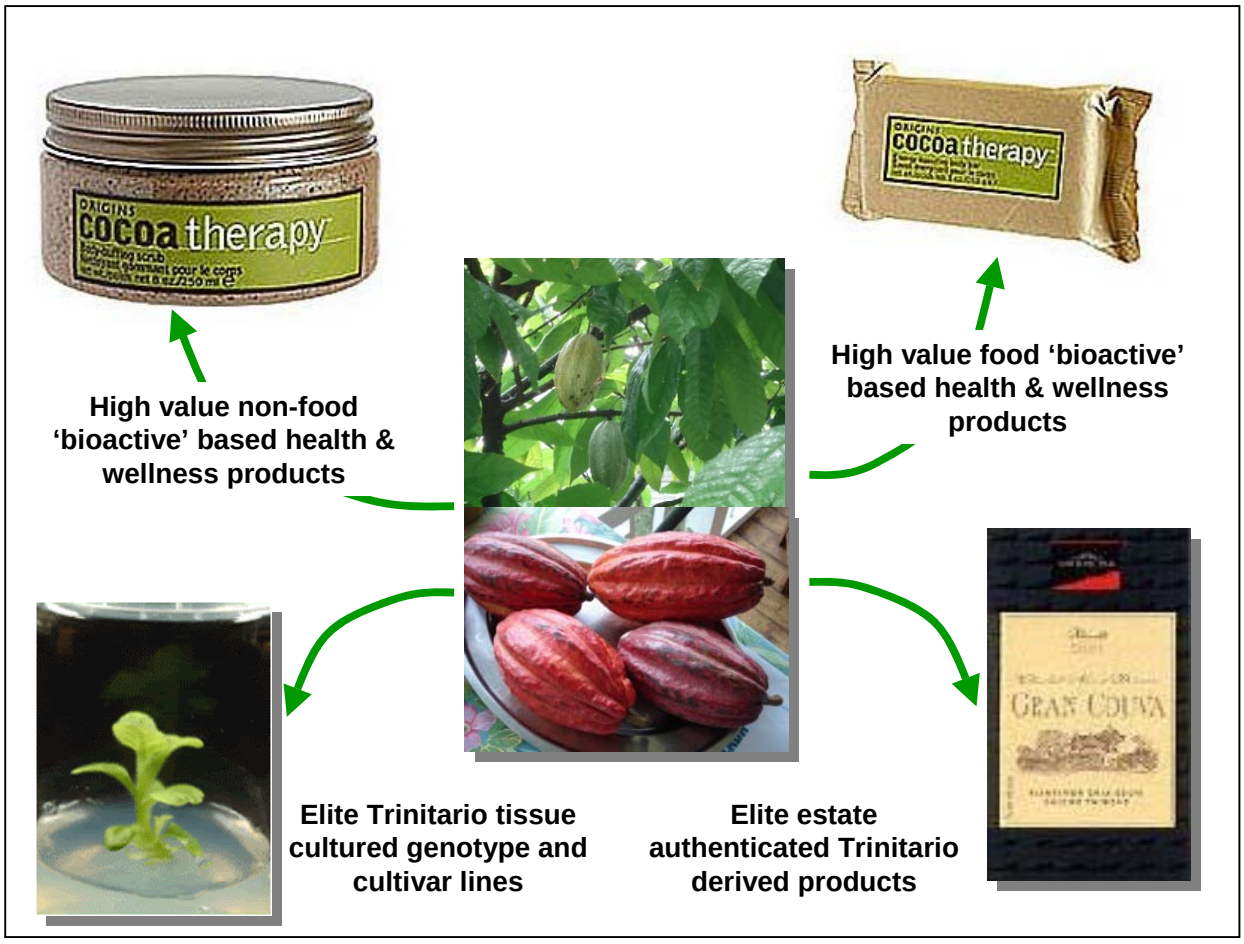
The Investment Opportunity

- T**here is an immediate opportunity to develop a 'X-factor component'** scale that can be used commercially to add value to the currently static or declining T&T based Trinitario cocoa production sector. Trinitario cocoa is recognised internationally as being a premium product with superior flavour and characteristics. Cocoa has at least 5 components (such as phenylethylamine) that have been identified and which could be a potential 'X-factors' and which have applications in the human health, wellness, virility, and pleasure/enjoyment areas. The key is being able to develop a verifiable way of measuring the levels of these components in different lines of cocoa, in particular premium lines such as Trinitario cocoa, developing a simple scale that connects with end-consumers, and gaining a substantial (at least 300%) premium for producers of elite lines.
- **There is a longer-term opportunity to develop elite clones of Trinitario cocoa** through both selection and genetic improvement programmes. Initially, selections could be made from the existing range of genetic material and improved cultivars supplied in the interim prior to longer-term breeding and improvement programmes beginning to yield results. T&T could be a lead provider of plant variety right (PVR) protected cultivars and a leader in high technology tissue culture plantlet production – either through production in T&T or international licensing arrangements with units in countries with a high level of skills in this area such as Sri Lanka.

The Customer Offer

- Cocoa, chocolate, and derivate products which have a defined measure of the beneficial component(s) within the product and which has a connection with consumer's perceived or real needs in the health and wellness, virility, and personal pleasure areas.
- Development of a range of high-value non-food products that have perceived and/or real benefits – such as cosmetics, 'age defiance' products, and supplements, which are built around the 'X-factor' components of cacao and for which there is a science backing
- Access to a range of PVR protected elite cultivars of Trinitario cacao which have been bred and selected for superior 'X-factor' content, improved disease resistance, better productivity, and easier production management.
- A global supply of high health tissue cultured guaranteed true to type improved Trinitario cacao plant lines from either T&T based tissue culture laboratories and production units of units located in key tropical centres offshore which operate under licence to the T&T owners of the PVRs.

Figure 4: The 'Best Bet' Offer



The Foresight Context For This Best Bet

- The growing global health and wellness trend.
- Satisfying the growing need for 'constant fascination' and more intense pleasure experience
- The growing international trend towards product traceability - where products are sourced, grown, and handled.
- The success of new 'appellation' areas – such as new world wines.
- Growth in solutions for increasingly ageing populations in areas such as reduced libido in men, healthier diets, supplements, and outer body-care products.
- The growing international trend towards 'age defiance' in all age groups – the search for products that will help people look and feel young.
- The growth of sales in the higher end organic, gourmet, and elite product market areas in wealthy and rapidly growing economies

Target Markets

- High-end consumers in wealthy market niches in both wealthy and rapid growth economies.
- The personal pleasure (in all its senses) and the health and wellness markets

- Women - who are particularly conscious of health and wellness factors as well as enjoy the 'sensual' pleasures of cocoa derived products such as chocolate.
- Men who suffer from reduced libido – there are several studies which indicate various compounds in cocoa appear to have a similar stimulatory effect as Viagra
- The high end developing markets in China and India, plus Singapore, European countries, Japan, and the former Soviet Union (particularly Lithuania).
- Cacao plant propagators in key offshore locations who can grow on and market PVR protected Trinitario cacao derived cultivars under licence.
- Cocoa plant producers around the world who are looking for mew cultivars to improve their production and earning capabilities.

What We Have

- Recognition internationally that Trinitario cocoa is of superior quality.
- A global demand that far exceeds the current supply of Trinitario cocoa.
- Plant material, including the Trinitario strain and a germplasm bank along with an ongoing programme to boost mother stock quality and disease resistance.
- Expertise in the growing of cocoa that has been accumulated over many years
- Strong research skills
- An existing marketing plan for the sector – although traditionally focussed.
- Banding, which could be developed further, and some initial experience with estate-related marketing (similar to an 'appellation' system)
- Knowledge of at least some of the key biochemical components that make cacao/chocolate an 'essential' for many consumers.
- Some innovative product developments based around cacao in the non-food sector.
- The Cocoa Research Unit and associated high quality research organisations which have a wealth of relatively untapped 'intellectual capital', some of which could be commercialised relatively quickly.
- A capability to produce higher value cacao-derived products within T&T for export overseas.

What We Need

To take this 'Best Bet' from where it is today – a relatively unsophisticated commodity type of offer that is still largely focussed on traditional thinking – to a point where it makes a significant and valuable economic and social contribution to T&T, a number of areas need to be addressed.

From the Private Sector

- Making T&T number 1 in the world with regard to Trinitario cocoa and extracting far greater value form the base product – a minimum of 300% within 5 years – through a more innovative approach
- More involvement and a greater show of entrepreneurship in exploiting the obvious global opportunities associated with the Trinitario cacao strain.

- Involvement in public private partnerships that aim turn the country's cacao related intellectual capital into commercial ventures in both the plant production and export area as well as the product development areas
- A desire to 'go global'
- Developing, branding, and marketing products which have a high degree of connection with emerging global consumer niches
- Building a modern 21st century value chain between producers and end-consumers and bypassing traditional inefficient marketing and distribution systems.
- A long term branding and marketing strategy
- Developing and marketing a greater range of non-food cocoa-based products
- Identifying and entering into beneficial alliances and partnerships
- Setting up tissue culture propagation units to supply offshore producers under license.
- Securing, managing, and monitoring PVR licensing with offshore alliance partners to ensure the maximum commercial benefits are attained and the IP is protected.

From the Public Sector

- Recognition that Trinitario cacao and the associated genetic material, accumulated knowledge, and expertise are valuable assets that can contribute significantly to T&T's future economically and socially.
- A new strategic focus in the way the T&T Trinitario cacao-related offer is presented to the world through government agencies built around foresight-based growth opportunities.
- An integrated approach within a national growth and innovation framework that provides a long-term direction for the biotechnology sector and which has a clear, harmonised strategy of development with the dedicated resources of manpower, finance, institutional supports, private sector involvement, and community involvement.
- Identifying opportunities for IP protection in areas related to Trinitario genetic material – in particular plant variety rights – and securing the rights as an intellectual capital asset for the country.
- Funding new areas of research that have a strong foresight focus and break away from the traditional 'academic' focus.
- Accelerating the commercialisation of IP that currently exists in many state and regional research institutions as well as the commercialisation of research project outcomes with potential through public/private partnerships.
- Improved infrastructure such as roads and the quality and cost of telecommunications – in particular Internet access and speeds.
- Speeding up and improving the effectiveness of the cross-border authorities.
- Increased capacity and investment in training specialist people for the biotechnology sector along with an offer of higher-level degree and diploma qualifications.
- Better collection and more speedy processing of statistical data.

From R&D

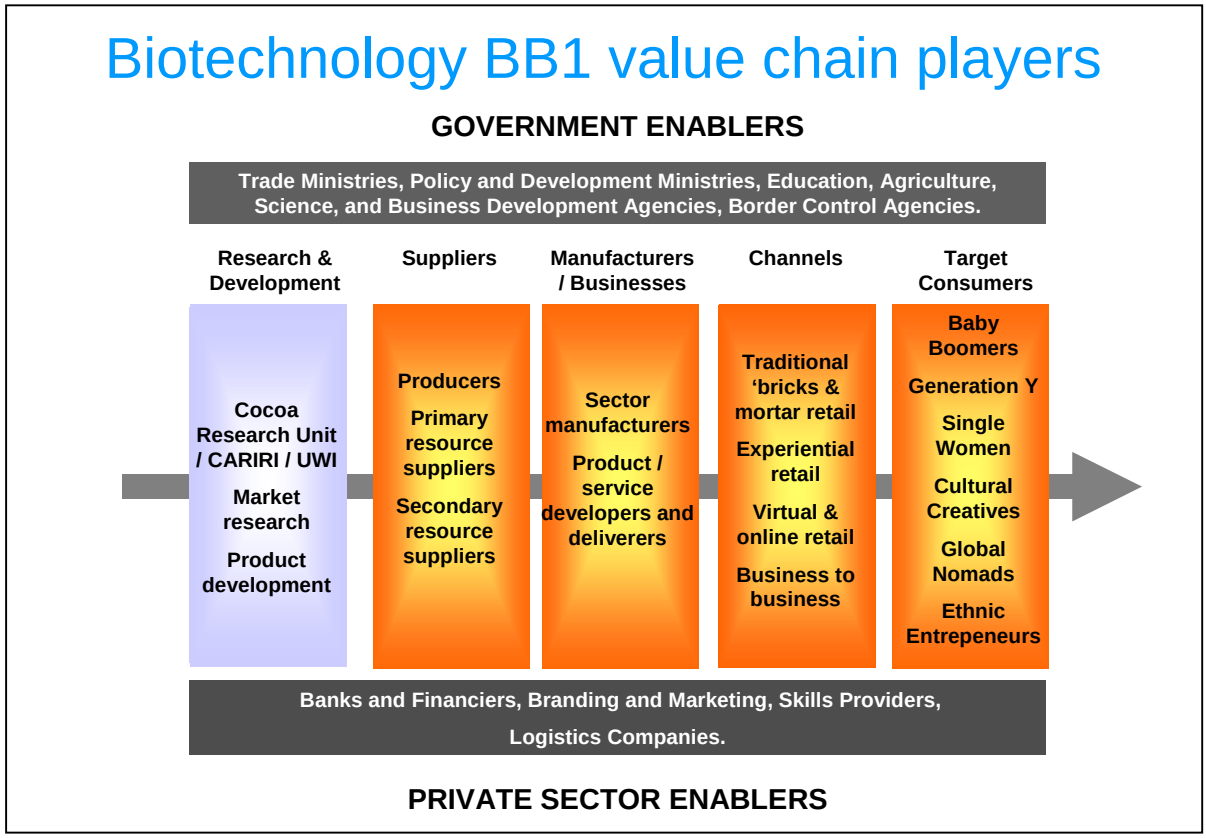
- Undertake foresight research on a regular basis to ensure emerging market trends are recognised before it becomes too late.

- Clarify which 3 – 5 ‘X-factor’ areas in cocoa are of greatest benefit to consumers in real and/or perceived ways though both scientific and market research.
- Research into developing scales for the ‘X-factor(s)’ in Trinitario cocoa, which can be linked to personal health, wellness, age defiance, and pleasure needs and then used to leverage substantially greater value for the base product.
- Link the ‘X-factor’ research to different genetic lines and production locations as the first steps to developing an ‘appellation’ type quality related system that leverages extra end product value.
- Select a limited number of elite Trintario cultivars that can be accorded international PVRs.
- Continue a breeding programme to improve the performance and disease resistance characteristics of the initial selected cultivars.
- Apply for PVRs for any cultivars that emerge from that programme.
- Apply for IP protection for any uniquely ‘home-grown’ processes that arise in association with the breeding and product improvement programmes.

Best Bet Value Chain

This Best Bet centres on the ‘Research & Development’ component of the value chain with the prime focus being on using research to leverage greater value from the existing Trinitario Cacao resource. However, this component is of little value unless all the other value chain components are aligned in the same direction towards a common medium to long-term goal.

Figure 5: The ‘Cacao – Brown Gold’ Value Chain

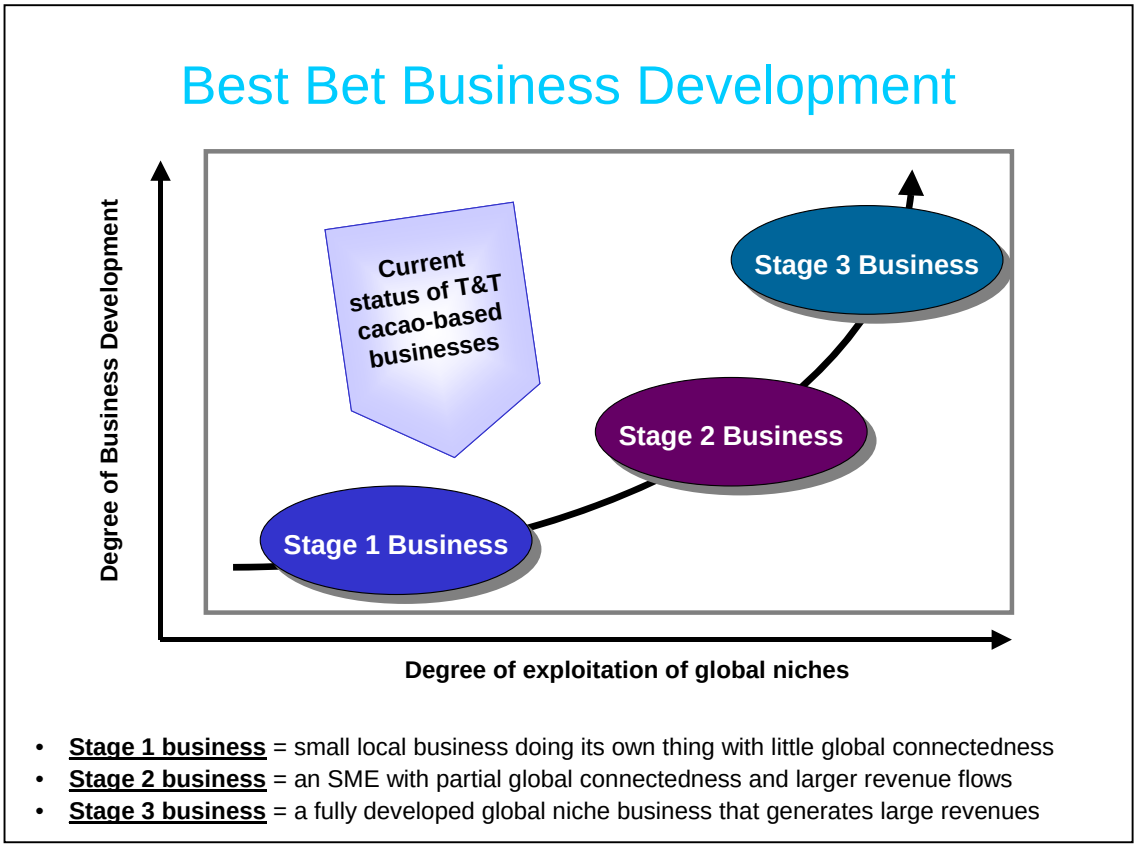


Key Local Players, Entrepreneurs, and Offshore Examples

There are a number of businesses already set up and operated by local entrepreneurs, most relatively small scale, that could contribute to leveraging the potential value of a T&T 'Best Bet' investment built around leveraging greater value from Trinitario cacao.

At present, in spite of a considerable amount of research and investment, the level of commercial development of high-value opportunities associated with this 'Best Bet' is at a relatively low level as shown in Figure 6.

Figure 6: The stage of development of businesses in T&T associated with the 'Cacao – Brown Gold' Investment Opportunity



- **Stage 1 business** = small local business doing its own thing with little global connectedness
- **Stage 2 business** = an SME with partial global connectedness and larger revenue flows
- **Stage 3 business** = a fully developed global niche business that generates large revenues

Local biotechnology players and commercial entrepreneurs include:

Key research organisations that have a high degree of importance for developing this investment opportunity include:

- The Cocoa Research Unit (CRU).
- Ministry Of Agriculture.
- CARIRI.
- The University of the West Indies, St Augustine, Faculties of Science and Agriculture (research), Engineering (processing machinery), Food Science and Technology (microbiology and research).

Key T&T-based researchers in the cocoa field include the following

- Professor Dyer Narinesingh -The Dean of the Faculty of Science and Agriculture, UWI, St Augustine.
- Margaret Tailor – CARIRI.
- Haroon Mohammed – CARIRI.
- Sadiah Mohammed - CARIRI
- Professor Clement Sankat – Faculty of Engineering, UWI, St Augustine.
- Patricia Maharaj – Centeno.
- Camaldeo Maharaj – Centeno.
- Daveonat Ramnat – Centeno.
- Lauren Walldropt - CL Financial.

Potential sources of alliances, technical assistance, and joint venture funding (although most of these are quite traditional in focus) include the following:

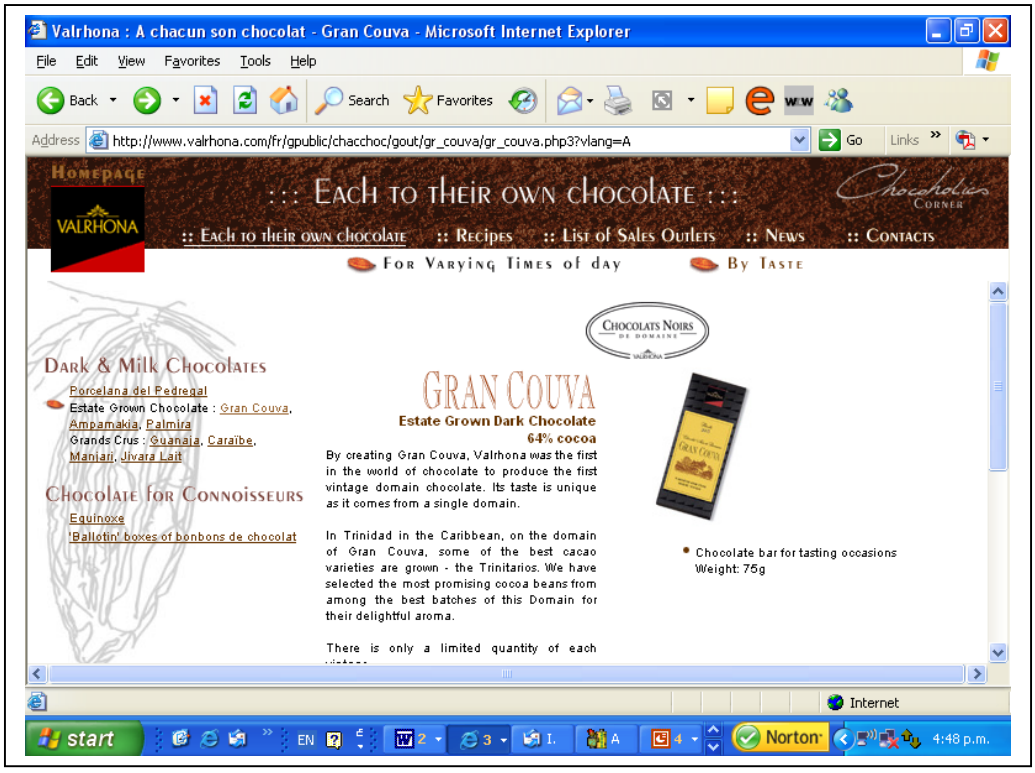
- World Cocoa Foundation, USA .
- Lindt & Sprüngli International AG, Switzerland.
- Masterfoods, UK.
- United Nations Common Funds for Commodities.
- The Biscuit Cake, Chocolate & Confectionary Association, UK.
- Cadbury Ltd, UK.
- United States Department of Agriculture.
- The University of Reading.
- The University of Hamburg, Germany.
- Guittard Chocolate Company Burlingame, USA.
- Centre de cooperation internationale en recherche agronomique pour le developpement (CIRAD), France.
- The Cocoa and Coffee Industry Board.

Several entrepreneurs identified, plus a source of finance for such entrepreneurs, are:

- CL Financial.
- Mr Varmer – the owner of an estate.
- Mr Manichan – a producer.
- Mr Paul Marry, manager of the Stollmeyer Estate, Santa Cruz.

Gran Couva Chocolate
http://www.valrhona.com/fr/gpublic/chacchoc/gout/gr_couva/gr_couva.php3?vlang=A

High quality chocolate produced and marketed using a regional ‘appellation’ type of approach. It is produced by an offshore manufacturer but marketed as a T&T sourced specialist high quality product.

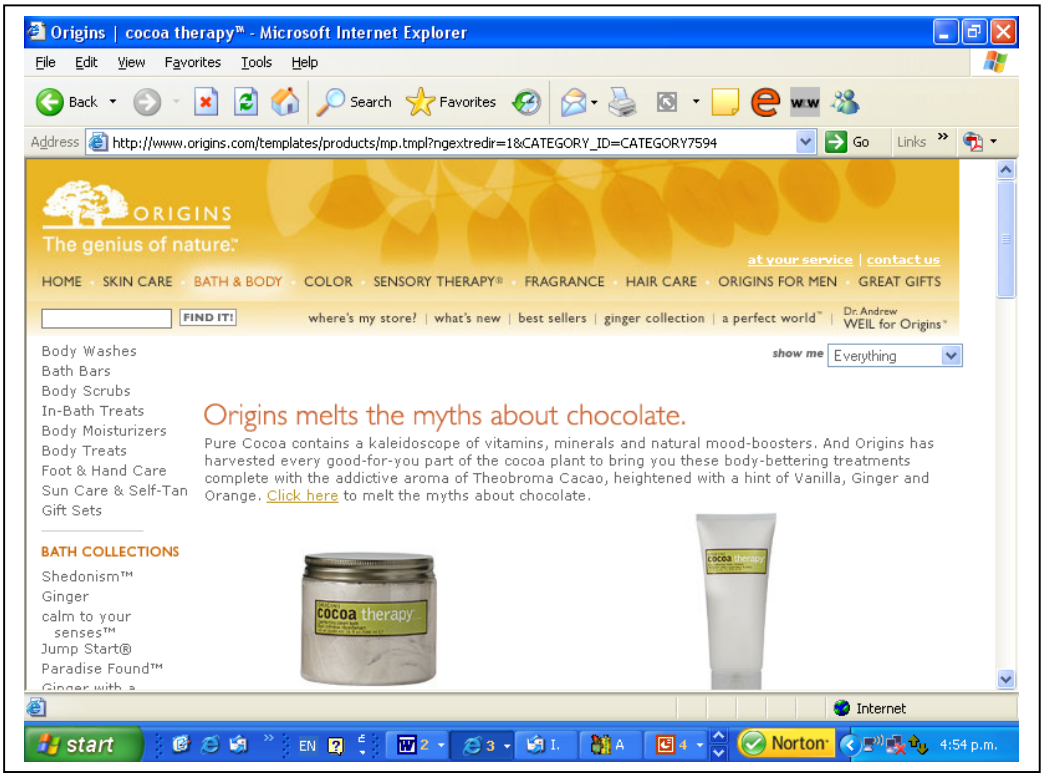


Offshore examples

Cocoa Therapy

http://www.origins.com/templates/products/mp.tmpl?ngextredir=1&CATEGORY_ID=CATEGORY7594

This is an interesting range of cocoa based products in the health and wellness and 'age defiance' areas that are predominantly non-food. It illustrates what can be achieved through innovative thinking. 250 ml of the 'Cocoa Therapy body buffing scrub' sells retail online for US$ 25.00 – i.e. US$ 100 / kg!



New Zealand Manuka Honey ***http://bio.waikato.ac.nz/honey/special.shtml***

- This is a fascinating story about a researcher at Waikato University in New Zealand, Professor Peter Molan, who had a passion about the healing qualities of honey. All honey contains an enzyme that produces hydrogen peroxide, which has anti-bacterial activity. However, the enzyme is not heat stable.
- Molan found that honey derived from certain regional genotypes of an indigenous tree, manuka (*Leptospermum scoparium*), contained a second anti-bacterial factor. This factor was heat stable and the anti-bacterial activity found in some lines of honey derived from these regions was especially high.
- Molan developed a unique laboratory based testing approach which could measure the level of this 'Unique Manuka Factor" (UMF) and rate it on a scale from 1 to 20. Anything rated over 10 was considered to be highly active.
- Trials were run in hospitals in the UK, Australia, and New Zealand on bacterial infections in human patients that were difficult to control because of antibiotic resistance. The initial results have been quite spectacular.
- Traditionally manuka honey, as a food product, retailed at about US$ 5.00 / kg. Today, as a health and wellness product, high active UMF 16+ manuka honey retails for over US$ 120.00 / kg. Most of the current added value is based on end-consumer perceptions of the potential value of this product to their personal health and wellness.
- This story illustrates how much value can be added to a basic food product by applying science that identifies and provides a quantifiable measure to components that benefit end-users – whether those benefits are perceived or real.
- Exactly the same approach can be applied to Trinitario Cacao to add considerable value. It's a matter of identifying an 'X-factor' that clicks with consumers – and not necessarily in traditional use areas.

The 'Best Bet' Roadmap

An indicative roadmap of targets set, how they will be reached, and who is involved, in order to achieve the desired outcomes of this investment opportunity is shown in Table 1.

Table 1: Indicative road map for implementing the 'Small Country Big Passion Portal' Investment Opportunity

Timing	What?	How?	Who?
Initial	• 'X-factor' definition and measurement plan	• R&D	• S&T community
	• Plant improvement plan	• R&D	• S&T community
	• Commercialisation roadmap	• Consensus	• S&T / commercial / govt
	• Funding needs and sourcing	• Consensus	• S&T / commercial / govt
1st 6 months	• Have an 'X-factor' scale and secure IP	• R&D	• S&T, commercial, govt. IP agency
	• Identify alliances and partners	• Market research	• Market researcher / commercial
	• Clarify potential PVR cultivars and long term breeding objectives	• Stock-take and goal-setting	• S&T, commercial, IP specialist, govt
	• Market research to ID value add opportunities	• Develop branding & marketing strategy	• Marketer / brand agencies / commercial
2nd 6 months	• Most estates have been 'X-factor' tested	• Sample taking and testing	• S&T, producers
	• Initial Trinitario release cultivars identified	• Evaluation process	• S&T / commercial
	• Agree pricing strategy for 'X-factor' scale	• Consensus	• Commercial
	• Expand production base using PVR material	• New plantings – on and offshore with tissue culture derived plants through licensed partners	• Public /private JV
Year 2	• Branding /marketing strategy launched	• Smart networks and clever alliances	• Marketer, commercial, branding agency
	• First sales of 'X-factor scale based product	• Through elite channels	• Premium buyers
	• Built 'best value' value chains	• Marketing and coordination	• Marketing, commercial
	• Expand production	• New plantings –	• Public /private JV

	base using PVR material	on and offshore with tissue culture derived plants through licensed partners	
Year 3	• A doubling of revenues from all activities	• Control the market for high end of the cocoa market through 'X-factor' related grading, marketing and elite plant production with PVR protected material which is controlled globally	• S&T / Commercial / Government
Year 4	• A doubling of revenues from all activities	• Control the market for high end of the cocoa market through 'X-factor' related grading, marketing and elite plant production with PVR protected material which is controlled globally	• S&T / Commercial / Government
Year 5	• A doubling of revenues from all activities	• Control the market for high end of the cocoa market through 'X-factor' related grading, marketing and elite plant production with PVR protected material which is controlled globally	• S&T / Commercial / Government

Financial Summary

The summary in Table 2 provides a 'best-guess' estimate of the potential revenues, expenses, and EBIT figures that could be achieved over a ten-year period based upon the value adding from an 'X-factor' rating scale on Trinitario cocoa from existing estates and new production (not necessarily in T&T but brokered through an 'X-factor' accredited T&T marketing group) and royalties on PVR protected Trinitario cacao planting material.

Note that these figures relate to the value added component only, not the gross sales revenues or associated expenses.

Table 2: Indicative financial projections for the 'Cocoa – Brown Gold' Investment Opportunity

	By year 3	By year 6	By year 10
Gross revenue from 'X-factor rating' and PVR royalties	US $ 100,000	US$ 1,500,000	US$ 5,200,000
Basis of revenue figure	50,000 kg X cocoa – US$ 2 / kg premium No PVR royalties	400,000 kg X cocoa – US$ 3.5 / kg premium 100,000 PVR plants at a US$ 1.00 each royalty	800,000 kg X cocoa at US$ 4.00 / kg premium 2,000,000 PVR plants at US$ 1.00 each royalty
Capital expenditure	US$ 50,000	US$ 20,000	US$ 10,000
Operating expenditure	US$ 84,000	US$ 960,000	US$ 2,328,000
Earnings before interest and tax (EBIT)	US$ 16,000	US$ 540,000	US$ 1,872,000

Note: This financial overview has not been subjected to detailed scrutiny. It is intended to be an example of what could be achieved in an optimistic scenario. Before making an investment commitment, it would need further development and to be subjected to due diligence.

The NEXT Star Rating for This 'Best Bet' Investment Opportunity

- T&T has a real asset - the germplasm bank for cacao including the internationally highly recognised Trinitario strain.
- There is also a considerable pool of expertise associated with the crop in T&T.
- Global demand for Trinitario cocoa exceeds supply and there are already components which have been identified in cocoa which lend themselves for adding greater value – if coupled with innovative marketing.
- There is a considerable research and knowledge resource on hand.
- There are opportunities opening up in the non-food area that offer opportunities to leverage greater value.
- There are challenges facing the cacao growing industry in many parts of the world and the need for improved cultivars has never been greater.
- The biggest challenge is the time frame that might be required to develop an 'X-factor' rating scale acceptable to consumers and channels.
- The same applies to the development of new PVR protected cultivars.

5.2 Best Bet 2: Novel Tropical Flowers & Seeds

The Investment Opportunity

- The primary investment opportunity is **a global business built around new strains of Anthurium** developed by Dr Pat Umaharan at UWI, St Augustine, using indigenous genetic material to create new cultivars that have resistance to major bacterial diseases that have decimated production of this cut flower product in the tropical regions. There is a shortage of this long-lived cut flower globally. Dr Umaharan holds a patent over a process that speeds up the screening and selection of new cultivars – from several years down to just three months. A number of new cultivars with excellent production characteristics and unique new qualities are candidates for Plant Variety Right (PVR) protection. All are being tested commercially through a unique public-private partnership. This opens up a major opportunity for generating substantial revenues from a royalty based business alone. There are other associated opportunities in the plant breeding, cut flower production, and tissue culture production for export areas.
- Secondary investment opportunities are in **new and novel cut flower, live plants, and seed lines, particularly those with aromatic properties** suitable for the rapidly growing living aromatherapy market niche, as well as the breeding and development of non-genetically and genetically modified unique plants that have the potential for PVR royalty generation. Another growth opportunity is supplying unique plants and derivatives to the rapidly growing tourism sector for decoration in rooms and facilities at resorts, hotels and spas.

The Customer Offer

- A source of new and unique PVR protected Anthurium cultivars with resistance to the two major bacterial diseases that have decimated tropical production of this cut flower.
- The potential to develop further new and unique cultivars derived based upon the unique inherent properties in a number of indigenous plants in T&T, and imported species – in seed, plant, floral, and end product forms.
- The potential to genetically engineer new and unique cultivars.
- The opportunity to access these new varieties under a licensing agreement.
- The production of high health certified tissue cultured plantlets to commercial growers in tropical countries from either within T&T or licensed propagators in key parts of the world.
- The availability of new and unique colours and forms of Anthuriums from cut flower producers in T&T for discerning international buyers.
- Unique new, patented S & T processes that speed up the identification and selection of genotypes which have the potential to form the basis of valuable new cultivars.
- A supply of unique tropical plants, flowers and derivatives to resorts, hotels, spas and associated facilities on a contract basis.

Figure 7: The 'Novel Tropical Flowers and Seeds' Best Bet Offer

The Foresight Context For This Best Bet

- The global trend is for more people to live within city environments and this means they buy in more plants and flowers to complement their urban living environments.
- Ageing populations are also associated with an increasing interest in horticulture as part of lifestyles.
- Personal health and wellness is also a driver as people seek a closer connection with natural products.
- Flower and plant production has become a global business with volume production moving to more competitive parts of the world such as Columbia, Kenya and Sri Lanka. However, the development of new cultivars and unique new plant products tends to be in more advanced economies. Holland is the world leader in many fields.
- However, the tropical regions are becoming more important as development centres because much of the breeding work done in temperate climates does not produce the right type of material for tropical regions – so a shift in breeding centres is likely to occur.
- In addition, the major rapid growth markets in the world are China and India. Their growth will stimulate the growth of supply sectors for flowers, plants their derivatives in that part of the world.

- Another driver that is highly favourable to this 'Best Bet' is the rising cost of energy in major temperate producing areas.
- The point is coming closer where the total energy equation (the energy costs associated with production plus the costs of transporting to market) will come under increasing scrutiny and countries that have the most energy efficient value chain will benefit.
- There is also growing interest globally in herbal and aromatic plants and their derivatives in terms of oils, dried forms (e.g. pot pouris) and essences.
- A final trend is the growth in higher quality more personalised tourism facilities both regionally and globally which are opening up opportunities for the supply of unique 'décor' and ambience enhancing products such as plants, flowers, and their derivatives.

Target Markets

- High-end niche markets in North America (East Coast), Europe and the Caribbean – possibly also in India, Singapore, China and other wealthy parts of Asia.
- The tourism sector in the Caribbean, especially spas and resorts.
- The seeds and plant material wholesale and retail markets in specific niche areas – could be anywhere in the world.
- The international nursery industry through alliances in key markets and exclusive plant variety rights use agreements.
- Plant producers for the cut flower growing sector in key production areas – e.g. Columbia, Ecuador, Kenya, Sri Lanka, Caribbean countries.
- Public and private sector specialist breeders – for patented screening processes.

What We Have

- A considerable pool of experience in the field in both the research and private sectors.
- An existing excellent example of the results that can be achieved by public – private sector cooperation (Dr Pat Umaharan from UWI and Chris Avey of Kairi Blooms).
- A pool of indigenous plant material that provides a unique and valuable source of genetic material and diversity as well as considerable local knowledge, in particular in areas such as herbal remedies and the cultivation of indigenous species.
- Existing development programmes for flowers, plants, and seeds – including many years of work with Anthurium.
- Good micro-propagation and seed production facilities.
- Well-developed research resources and capabilities along with highly experienced R&D personnel who are experts in their fields.
- A regional trade framework and ready access to markets and markets that are prepared to pay a premium for unique products – locally and globally.
- A global flower and plant based fashion sector that is always searching for new products.
- An ideal relatively low-cost growing environment.
- An opportunity to become a 'centre of excellence' in the global cut flower, plants and derivatives sector built around existing and future IP such as patented processes and PVRs.

What We Need

To take this 'Best Bet' from where it is today – an early emergence from world-class research programmes – to a point where it makes a significant and valuable economic and social contribution to T&T, a number of areas need to be addressed.

From the Private Sector

- Increased private sector involvement including commercialising R&D findings.
- There is a shortage of skilled labour – which means the sector needs to become smarter and more rewarding financially if it is to attract and retain key people. This means going more 'high-tech'.
- A more global perspective to realise the full potential of the opportunity that already exists in T&T – for example producing tissue culture high health planting material in T&T and in key offshore centres under license or licensing production of T&T developed cultivars for production in more competitive production countries.
- Public – private sector consortiums to speed up the transfer of research developments into the commercial sphere, drive commercial development of the sector, and prioritise ongoing R&D initiatives.
- Handling facilities that can ensure products meet importing country standards
- Highly developed branding and marketing strategies including a stronger marketing connection / presence in key mature and developing markets.
- Re-defining of value-chains and their redevelopment.
- IP protection and plant variety rights licensing and management capabilities.
- Improved freight connections to key markets – in particular airfreight space.

From the Public Sector

- Recognition that there is a considerable pool of unique genetic material, accumulated knowledge, and expertise that is a valuable asset and that can contribute significantly to T&T's future economically and socially.
- A new strategic focus in the way the T&T biotechnology offer is presented to the world through government agencies built around foresight-based growth opportunities.
- An integrated approach within a national growth and innovation framework that provides a long-term direction for the biotechnology sector and which has a clear, harmonised strategy of development with the dedicated resources of manpower, finance, institutional supports, private sector involvement, and community involvement.
- Identifying opportunities for IP protection in areas related to T&T derived and developed genetic material – in particular plant variety rights – and securing the rights as an intellectual capital asset for the country.
- Funding new areas of research that have a strong foresight focus and break away from the traditional 'academic' focus.
- Accelerating the commercialisation of IP that currently exists in many state and regional research institutions as well as the commercialisation of research project outcomes with potential through public/private partnerships.
- Improved infrastructure such as roads and the quality and cost of telecommunications – in particular Internet access and speeds.
- Speeding up and improving the effectiveness of the cross-border authorities.
- Better collection and more speedy processing of statistical data.

- Increased capacity (human and infrastructure) in R&D focussed on this sector as well as increased investment in training skilled people.
- Changes in the R&D policy and funding initiatives.
- Efficient quarantine and quality control systems.
- Improved freight connections to key markets – in particular airfreight space.
- Public – private sector consortiums to speed up the transfer of research developments into the commercial sphere, drive commercial development of the sector, and prioritise ongoing R&D initiatives.

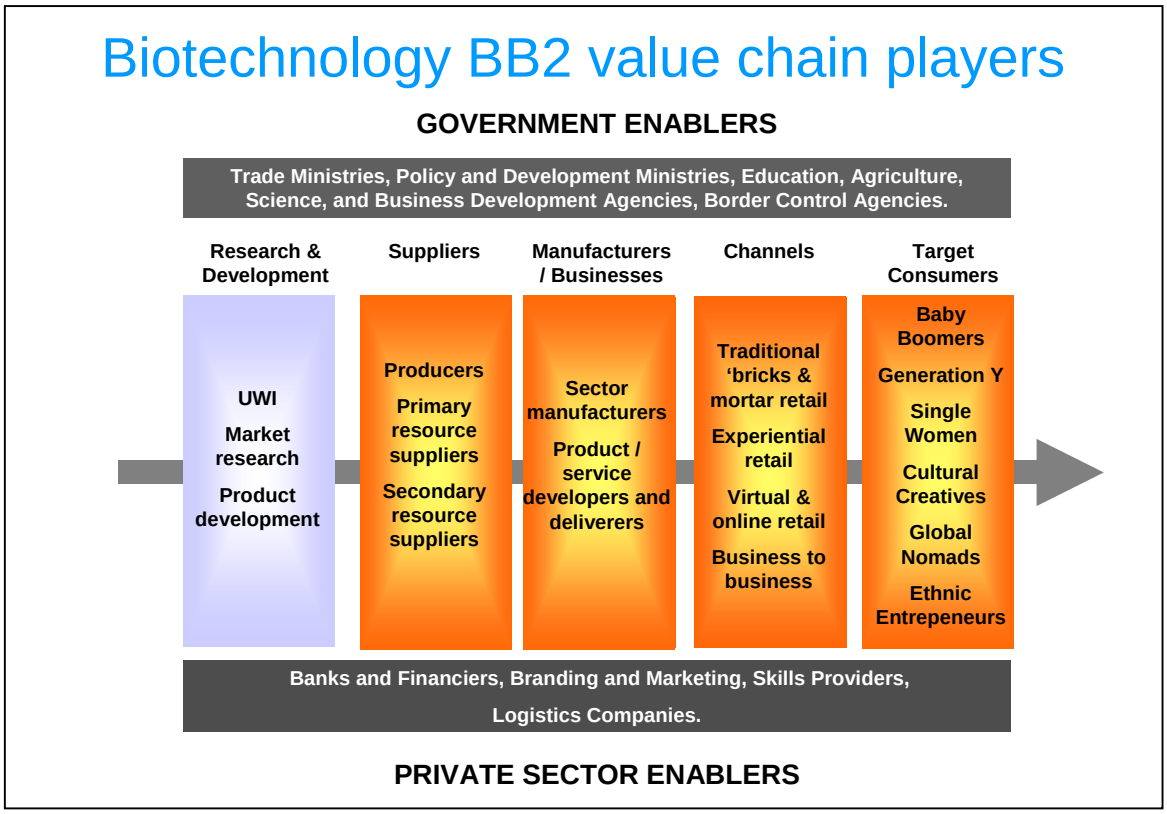
From R&D

- An expansion of the skills base and knowledge associated with the existing Anthurium project into other unique opportunity areas for which there are strong growing global niches.
- A more innovative approach to developing new and unique plant, seed, and floral products.
- A priority focus on securing IP in the way of patents and PVRs to maximise the benefits to T&T.
- More involvement in consortia and public-private partnerships/alliances to hasten the commercialisation of research.
- Market research to establish connections in key target markets.
- Improved linkages between research and technology institutions, and the commercial sector.

Best Bet Value Chain

This Best Bet centres on the 'Research & Development' component of the value chain with the prime focus being on leveraging the outcomes of many years of research work, and future foresight based research work, to gain commercial benefits for T&T. However, this component is of little value unless all the other value chain components are aligned in the same direction towards a common medium to long-term goal.

Figure 8: The 'Novel Tropical Flowers and Seeds' Value Chain

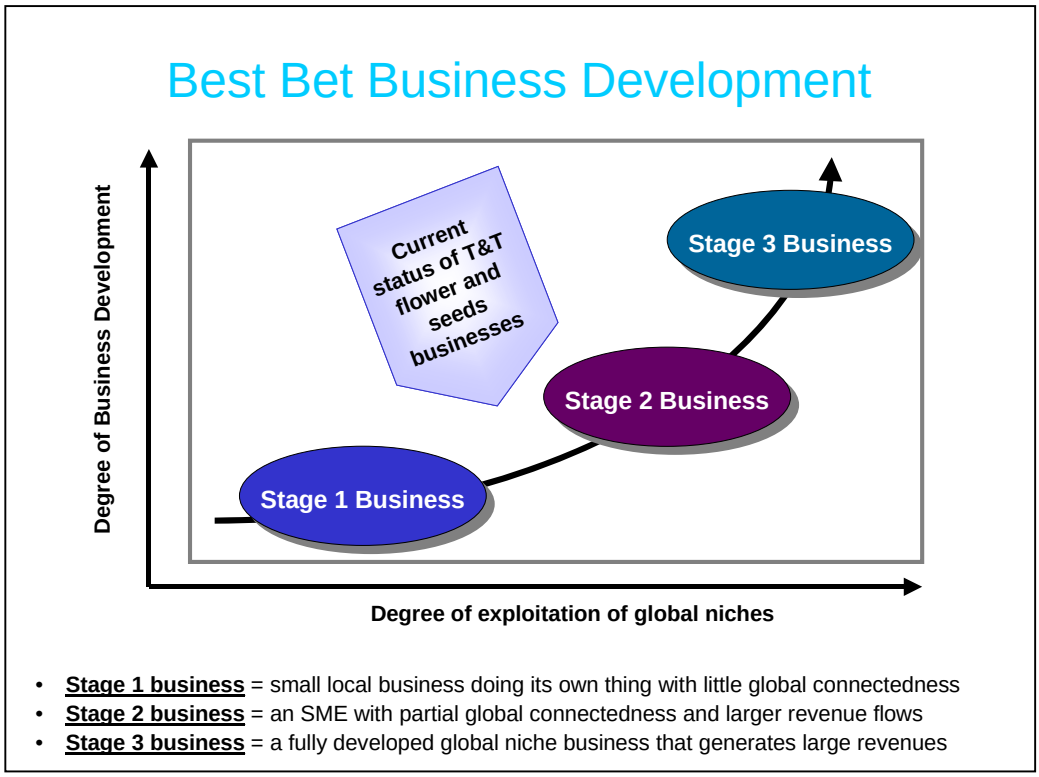


Key Local Players, Entrepreneurs, and Offshore Examples

There are a number of key researchers who have high levels of expertise relevant to this Best Bet. In addition, there are businesses already set up and being operated by local entrepreneurs, several on a relatively large scale, that could contribute to leveraging the potential value of a T&T 'Best Bet' investment built around this opportunity.

At present, after a considerable amount of research and investment and a very long lead time, the level of commercial development of high-value opportunities associated with this Best Bet is still at a relatively low level as shown in Figure 9, but there is potential for relatively fast business growth if existing and new public – private sector initiatives can be fully exploited.

Figure 9: The stage of development of businesses in T&T associated with the 'Novel Tropical Flowers and Seeds' Investment Opportunity



Local key biotechnology players and entrepreneurs

To develop a view of the potential of this sector, the following stakeholders from the sector were interviewed:

- Dr Laura Roberts-Nkurmah.
- Professor Richard Braithwaite.
- Dr Pat Umaharan (who has led the UWI Anthurium improvement programme in recent years).
- Mr Chris Avey – owner of Kairi Blooms and a leading entrepreneurial producer.
- Mr Burt Manning, a former exporter of cut flowers.
- Mr Chancey Moll – President of the Garden Club.
- Mr Alexander Gibson – T&T Orchid Society.
- Mr Anthony Tang Kai – T&T Orchid Society.
- Ms Paula Pantin – President of the T&T Orchid Society.
- Ms Wendy Lee Yuen – President of the T&T Agricultural Society.

Kairi Blooms (http://www.tradetnt.com/details.php?719)

Chris Avey is the owner and operator of Kairi Blooms which specialises in Anthurium Bloom production. His business was almost ruined by bacterial diseases that seriously debilitated the mainly Dutch bred cultivars the industry was based on.

Dr Pat Umaharan, from UWI, St Augustine, has worked closely with Chris Avey to test progeny from his Anthurium breeding work under commercial conditions. The result is that a number of promising lines have been multiplied up and tested on a

more extensive commercial scale. The results have been extremely positive and are set to change the face of in industry in the tropical regions.

Dr Pat Umaharan (L) and Mr Chris Avey (R)

The innovation and entrepreneurship shown by these two individuals provides an excellent example of the solid base this 'Best Bet' opportunity has to build on.

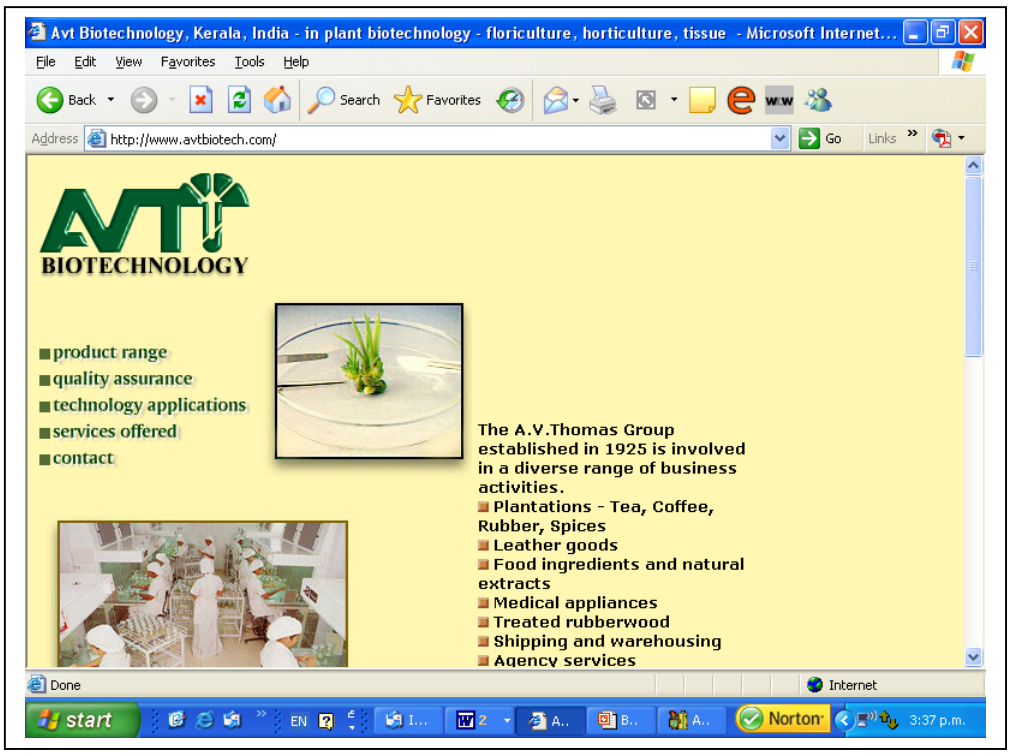
Offshore examples

Royal Van Zanten, Holland ***http://www.royalvanzanten.com/***

This is one of the world's largest plant and flower development and trading groups and illustrates the scale of operations that can be achieved with the right investment. Dutch groups such as this dominate the flower and pot plant industry globally in a wide range of areas.

AVT India ***http://www.avtbiotech.com/html/a0100prd.htm***

We have included this example because it is a high technology tissue culture operation located in a rapid growth part of the world - India. They currently produce millions of tissue culture plantlets for over forty different species – including 250,000 Anthuriums.



The 'Best Bet' Roadmap

An indicative roadmap of targets set, how they will be reached, and who is involved, in order to achieve the desired outcomes of this investment opportunity is shown in Table 3.

Table 3: Indicative road map for implementing the 'Novel Tropical Flowers and Seeds' Investment Opportunity

Timing	What?	How?	Who?
Initial	• Identify three most significant business opportunities • Value basis – production or licensing • Short list potential target markets • Quarantine requirements in import	• Assess market prices and demand and ease of producing • Economic studies • ID possible target markets • Find out standards that need to be	• Market research,S&T players • S&T, commercial • Market research, commercial? • Govt. agencies

	countries • Funding needs and sources	met • Consensus	• Commercial / govt.
1st 6 months	• Do an in depth assessment for 6 key niche markets – ID any import barriers • Have QA/QC in place for exports • Develop a brand and marketing strategy • Develop and plan improvement and PVR strategy	• Market research and networking • By matching import countries needs • Scope out what is needed • Strategy session	• Market research, commercial, government • Government / sector • Marketer / sector • S & T / sector
2nd 6 months	• Set up the first specialist production units • Send first sample product to selected key markets • Assess improvements needed • Strategy for volume production and logistics • Licensing strategy – on and offshore • Best fit for purpose value chain development	• Through a JV? • Assess feedback and reactions • Market development strategy building • IP strategy building • Market/sector research • Marketing and networks	• Marketer / commercial • S&T community / commercial • Market researcher / commercial • S&T community / IP expert • Market / sector researcher • Commercial / marketers
Year 2	• Branding /marketing strategy launched • First sales of high value product • First PVR license agreement signed • First IP use licence signed off • Build 'best value' value chains'	• Smart networks and clever alliances • Through exclusive arrangements • Contract negotiation • Contract negotiation • ID best channels – real and virtual	• Networker / marketer • Premium buyers • S&T community / sector / legal • S&T / commercial • Commercial / govt
Year 3	• 8 PVR licenses signed • 3 more IP use licences signed off • A doubling of revenues from all activities	• Contract negotiation • Contract negotiation • Expand the opportunities in niche markets	• S&T / sector • S&T / commercial • S&T / commercial / govt
Year 4	• 4 more PVR licenses signed • 3 more IP use	• Contract negotiation • Contract	• S&T / sector • S&T /

	licences signed off • A doubling of revenues from all activities	negotiation • Expand the opportunities in niche markets	commercial • S&T / commercial / govt
Year 5	• 6 more PVR licenses signed • 3 more IP use licences signed off • A doubling of revenues from all activities	• Contract negotiation • Contract negotiation • Expand the opportunities in niche markets	• S&T / sector • S&T / commercial • S&T / commercial / govt

Financial Summary

The summary in Table 4 provides a 'best-guess' estimate of the potential revenues, expenses, and EBIT figures that could be achieved over a ten-year period based upon a business that focuses on selling high health plantlets to end-producers, owns and collects royalties for PVR protected material, and sells specialist seeds and plants.

Table 4: Indicative financial projections for the 'Novel Tropical Flowers and Seeds' Investment Opportunity

	By year 3	By year 6	By year 10
Revenue from sales and PVR royalties	US $ 3,000,000	US$ 10,200,000	US$ 62,600,000
Basis of revenue figure	100,000 plantlets @ US1.50 each 500,000 PVR royalties @ US$1.00 each 4,000 kg of seeds @ US$ 70 /kg 0 novel plants @ US$ 10.00 each	800,000 plantlets @ US1.50 each 5,000,000 PVR royalties @ US$1.00 each 30,000 kg of seeds @ US$ 70 /kg 100,000 novel plants @ US$ 10.00 each	100,000 plantlets @ US1.50 each 30,000,000 PVR royalties @ US$1.00 each 30,000 kg of seeds @ US$ 70 /kg 2,000,000 novel plants @ US$ 10.00 each
Capital expenditure	US$ 1,300,000	US$700,000	US$ 1,200,000
Operating expenditure	US$ 1,030,700	US$ 7,298,000	US$ 44,824,000
Earnings before interest and tax (EBIT)	US$ -100,700	US$ 2,902,000	US$ 17,776,000

Note: This financial overview has not been subjected to detailed scrutiny. It is intended to be an example of what could be achieved in an optimistic scenario. Before making an investment commitment, it would need further development and to be subjected to due diligence.

The NEXT Star Rating for This ‘Best Bet’ Investment Opportunity

- This has to be a truly excellent investment opportunity for T&T as it is built around something that is already well-known in the country.
- There is a pool of internationally unique T&T bred Anthurium genetic material that is highly suitable for tropical production of this in demand product.
- There is IP protected by a patent and the opportunity of securing PVR protection for a range of special cultivars with international potential.
- There is a strong demand for products associated with this best bet opportunity.
- There is a real opportunity to develop a large international business similar to the Dutch model but specialising in products that are suitable for growing in the tropical regions as increasing amounts of production are likely to move to those areas in the world because of:
    - Proximity to rapidly growing markets.
    - Low energy costs.
    - Competitive labour costs.
    - Growing expertise.
- The final key factor warrants awarding this investment opportunity with five stars is the strong pool of expertise in both the public and private sectors needed to underpin the growth envisaged.

5.3 ***Best bet 3: 'Bio-Solutions – Promoting Environmental Wellness'***

The Investment Opportunity

- The primary investment opportunity is in **the commercialisation and marketing of unique biopesticides, biological control agents and bioremediation agents** for the agricultural and industrial sectors that have been derived from the natural resources available in T&T or discovered by leading edge researchers in the country. This includes securing IP protection and managing licensing in every case where it is possible.
- A secondary investment opportunity is in **a global contract remediation business** for major industrial pollution problems, such as those associated with the energy sector, built around a combination of T&T derived products and expertise.

The Customer Offer

- The provision of highly effective naturally derived bio-remediation products to remediate complex inherited pollution problems on old 'blackfield' and 'brownfield' sites and collateral damage occurring in sectors such as oil and gas and rapid industrialisation in fast growth economies by using natural agents that have a high degree of efficacy.

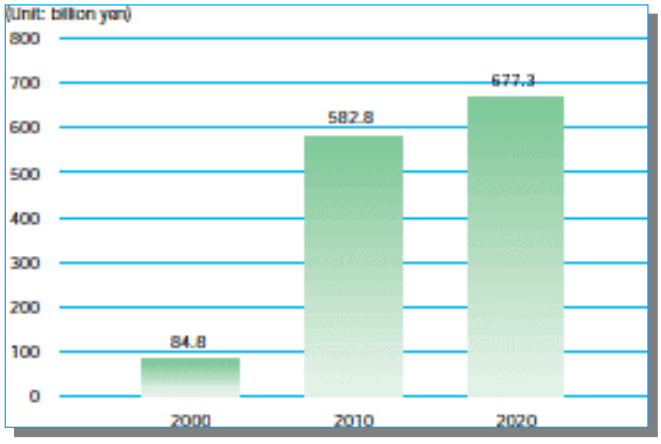
Figure 10: The 'Bio-Solutions – Promoting Environmental Wellness' Offer

8 extracts from plant species used in traditional medicine in T&T showed significant activity against one or more micro-organisms.

Plant extracts from Justicia pectoralis, Manihot utilissima and Stachytarpheta jamaicensis were the most effective against the Aedes aegypti mosquite.

Charlandy et al, 1999

Solutions for the Growing Soil and Water Remediation Sector e.g. Japan



Trichoderma ovalisporum
Fighting Cocoa Frosty Pod Rot

- An offer for growers in the rapidly expanding organic products sector that provides new naturally derived biological pest and disease control agents that are stable and provide a high degree of efficacy and are also accepted by bio-registration systems such as 'Biogro' and 'Demeter'.
- Providing internationally significant exporters with Euregap and SPS (Sanitary and Phytosanitary) compliant technologies and products.

The Foresight Context For This Best Bet

- There is growing concern about mankind's impact upon the environment and the long-term sustainability of many of the traditional agricultural and industrial systems.
- The rapid rise of climate change on political and business agendas is a strong driver.
- There is strong growth at consumer level in organic and natural products.
- There is an increasing demand by societies for governments and businesses to reduce the impacts of farming and industry upon the environments within which people live – including in rapid growth developing economies such as India and China.
- There is a trend for major chemical and pharmaceutical companies to move away from developing 'chemical solutions' towards' naturally derived' solutions.
- Government policy shifts towards more sustainable solutions.
- Increasingly more stringent environmental standards around the world and the correspondingly greater liabilities faced by polluters in the event environmental damage occurs.
- Advances in genetic engineering.

Target Markets

- For the bio-remediation area – pollution clean up opportunities in both developed and developing countries through companies and agencies that have a specialist role / focus in dealing with such problems with a particular focus on the 'green', responsible corporation.
- The local T&T energy and heavy industrial sectors - proposed growth of heavy industries and smelting will provide a cache of potential clients.
- For the biological control agent/protocol – producers and producer groups with a strong focus on biological and integrated pest and disease management strategies worldwide.

What We Have

- A large energy and energy products related sector that is the main driver of the economy which is unlikely to be insignificant in the medium term and has traditionally been a significant cause of environmental degradation.
- Centres of excellence at UWI and CARIRI with trained scientists and research infrastructure that can develop the product concepts.
- Sources of pollution to test naturally derived bioremediation solutions.
- Indigenous microbes that have the potential to provide bioremediation-based pollution solutions. There is a significant amount of research that has already been done in this area.

- The T&T Green Fund which, by 2005, had risen to TT$ 465 million and is intended to be used for environmental improvement projects.
- Local natural biodiversity which provides a source of bioremediation and biological control agents.
- A reputation as being a country with expertise in biological control.
- An active and recognised CABI Office - who are internationally respected for work on biological control.
- New facilities and infrastructure being developed ain association with UTT at the Wallerfield Technopolis.
- Tertiary courses at university level in bioremediation and biological pest management.
- Well-developed IP protection legislation that is aligned with international requirements.

What We Need

To take this 'Best Bet' from where it is today – a relatively undeveloped offer that is still largely 'locked up' in the research area – to a point where it makes a significant and valuable economic and social contribution to T&T, a number of areas need to be addressed.

From the Private Sector

- A leading entrepreneur to pursue the large growth opportunity associated with this 'Best Bet' investment opportunity
- Alliances with key global players in the bioremediation and biological control agent areas. These include groups with expertise in approval processes, marketing channels, and large potential customer bases in offshore markets.
- An ability to deliver 'package solutions' in the bioremediation area.
- More investment in the biotechnology area.
- Greater interaction with the R&D community and the formation of public – private sector partnerships to hasten the commercialisation process.
- An integrated industry structure that can guarantee to meet the requirements of international certification and approval schemes.
- IP protection and license management skills.
- A greater desire to 'go global'.

From the Public Sector

- Recognition that there is already a considerable pool of unique genetic material, accumulated knowledge, and expertise that is a valuable asset and that can contribute significantly to T&T's future economically and socially.
- An integrated approach within a national growth and innovation framework that provides a long-term direction for the biotechnology sector and which has a clear, harmonised strategy of development with the dedicated resources of manpower, finance, institutional supports, private sector involvement, and community involvement.
- A new strategic focus in the way the T&T offer in the biotechnology field is presented to the world through government agencies built around foresight-based growth opportunities.
- Identifying opportunities for IP protection in areas related to T&T derived and developed genetic material and securing the rights as an intellectual capital asset for the country.

- Accelerating the commercialisation of IP that currently exists in many state and regional research institutions as well as the commercialisation of research project outcomes with potential through public/private partnerships.
- Funding new areas of research that have a strong foresight focus and break away from the traditional 'academic' focus.
- Improved infrastructure such as roads and the quality and cost of telecommunications – in particular Internet access and speeds.
- Better collection and more speedy processing of statistical data.
- Increased capacity (human and infrastructure) in R&D focussed on this sector as well as increased investment in training skilled people.
- Changes in the R&D policy and funding initiatives.
- Efficient quarantine and quality control systems.
- Public – private sector consortiums to speed up the transfer of research developments into the commercial sphere, drive commercial development of the sector, and prioritise ongoing R&D initiatives.

From R&D

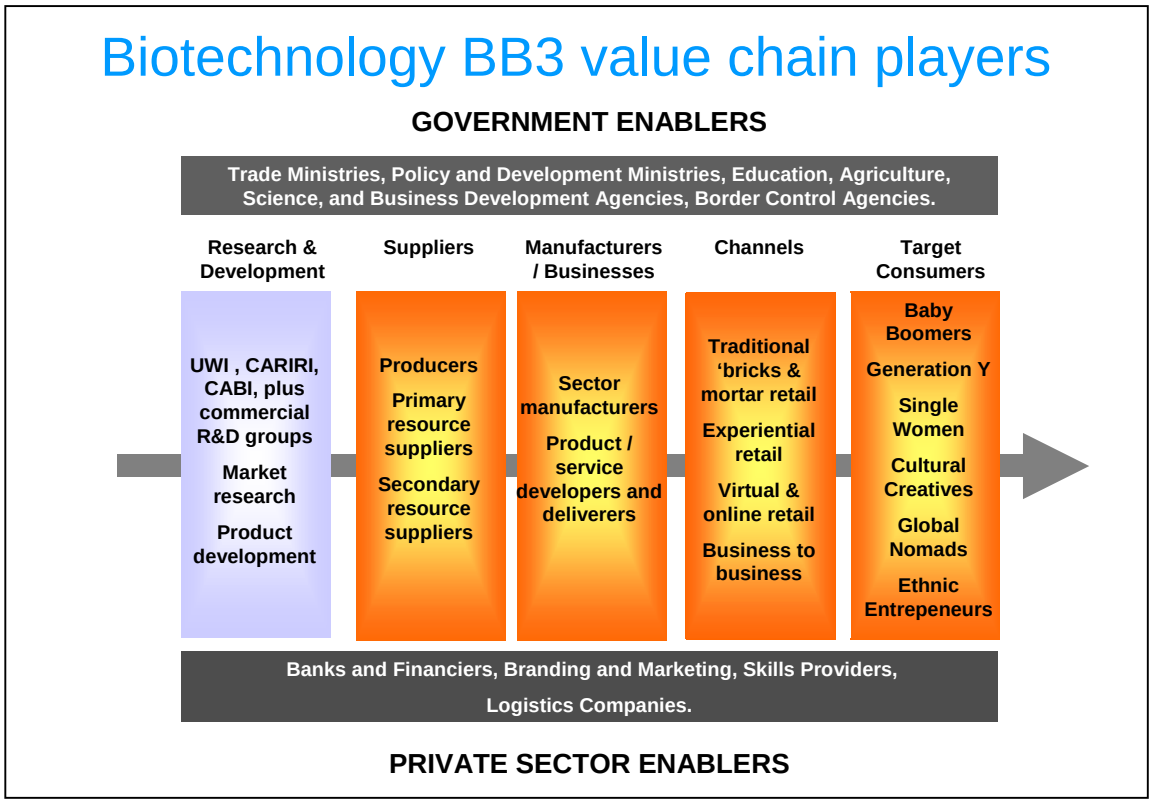
- An appraisal of the work the research sector has already done in terms of potentially valuable biological agents and ranking them in order for possible commercialisation.
- Further scoping of T&T's indigenous biodiversity to identify potential products and active ingredients.
- Using foresight research to identify strong growth potential commercial opportunities and then research the solutions.
- A priority focus towards securing IP protection on biological agents, or associated processes based around them, of potential value wherever this is possible.
- More involvement in consortia and public-private partnerships/alliances to hasten the commercialisation of research.
- Market research to define opportunities and establish connections in key target markets.
- Improved linkages between research and technology institutions, and the commercial sector.

Best Bet Value Chain

This Best Bet centres largely on the 'Research & Development' component of the value chain with the prime focus being on leveraging the outcomes of many years of research work, and future foresight based research work, to gain commercial benefits for T&T. The R&D component, in this case, is also quite significant in the private sector.

However, this component is of little value unless all the other value chain components are aligned in the same direction towards a common medium to long-term goal.

Figure 11: The 'Bio-Solutions – Promoting Environmental Wellness' Value Chain

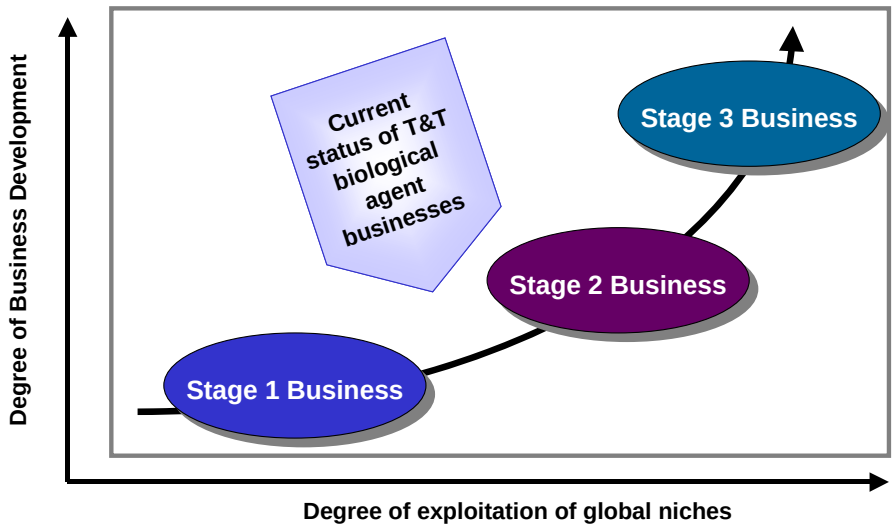


Key Local Stakeholders, Entrepreneurs, and Offshore Examples

There are a number of key researchers who have high levels of expertise relevant to this Best Bet. In addition, there are existing businesses already set up and being operated by international groups and local entrepreneurs, several on a relatively large scale, that could contribute to leveraging the potential value of a T&T Best Bet investment built around this opportunity.

At present, after a considerable amount of research and investment, the level of commercial development of high-value opportunities associated with this Best Bet is still at a relatively low level, shown in Figure 12, but there is potential for relatively fast business growth if existing and new public – private sector initiatives can be fully exploited.

Figure 12: The stage of development of businesses in T&T associated with the 'Bio-solutions – Promoting Environmental Wellness' Investment Opportunity



- **Stage 1 business** = small local business doing its own thing with little global connectedness
- **Stage 2 business** = an SME with partial global connectedness and larger revenue flows
- **Stage 3 business** = a fully developed global niche business that generates large revenues

Local biotechnology stakeholders and entrepreneurs

The following commercial sector executives were interviewed with regard to this 'Best Bet' Investment opportunity:

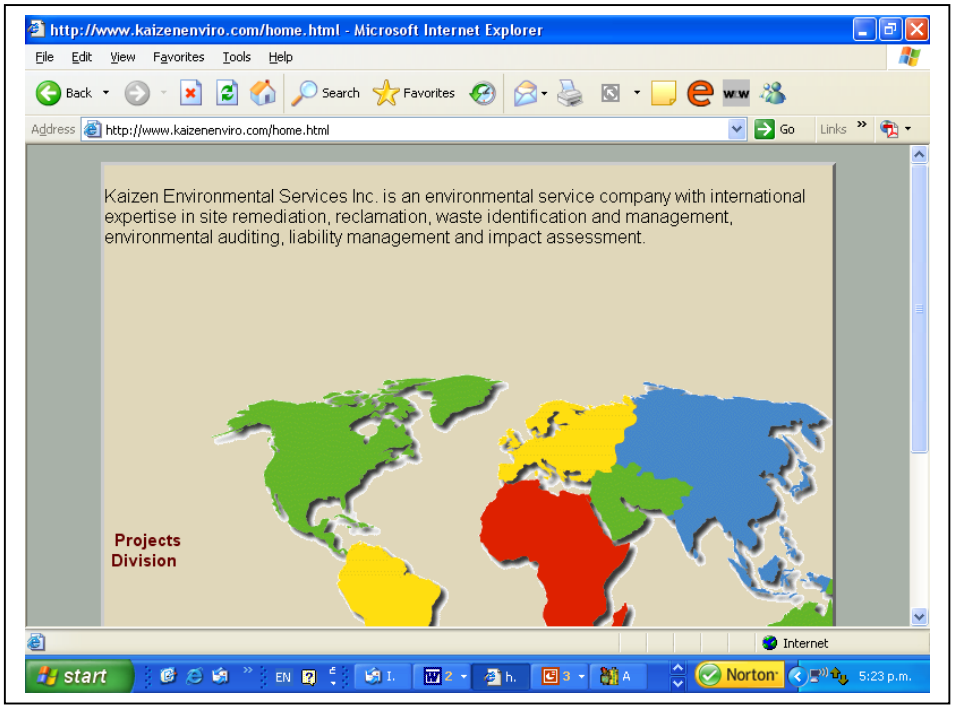
- Mr Finbar McEachnie, HSE Team Leader, BHP Billiton.
- Mr Avril Mohammed, Environmental Specialist (Bioremediation), Petrotrin.
- Mr Anthony Superville, Business Development Manager, Kaizan.

The following specialists were also interviewed:

- Dr Ulrike Krauss, Co Director and Regional Representative, CABI.
- Mr Andre George, Trinidad's only qualified organic production unit certifier.

Kaizen Environmental Services Inc ***http://www.kaizenenviro.com/home.html***

This group is Canadian based but also has a strong presence in T&T. It is focussed on the environmental services and bioremediation areas and has a high degree of commercial expertise that is highly relevant to this 'Best Bet'.



Dr Ulrike Krauss, CABI

Frosty pod disease in cacao plants, particularly when in combination with 'witches broom', can cause up to 100% loss of cocoa crops and is becoming a serious problem in Latin America where crops are being devastated.

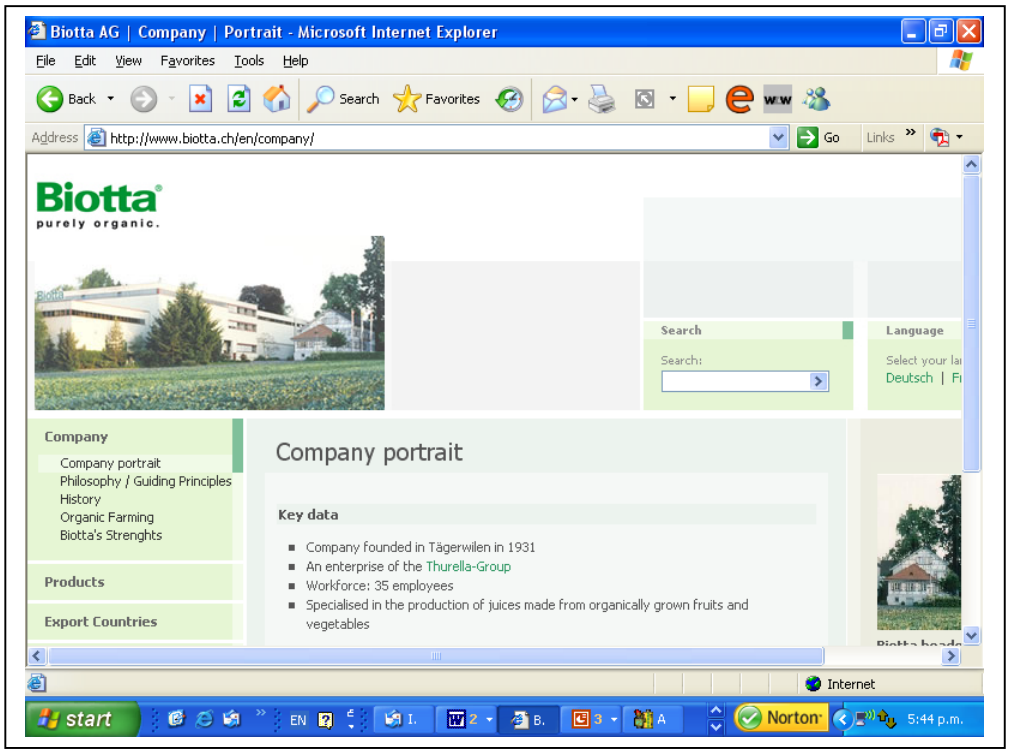
Dr Krauss has been involved with a team of researchers who have discovered an endophytic fungus (a fungus which lives within a plant) from the genus Trichoderma which, once inoculated into cocoa plants, reduces the crop loss caused by this disease by 60 – 80% in a 100% natural way. This biological control agent has exciting prospects for the international cacao industry.

Figure 7: Dr Ulrike Krauss (centre) searching for new biological control agents in centres of origin

Offshore examples

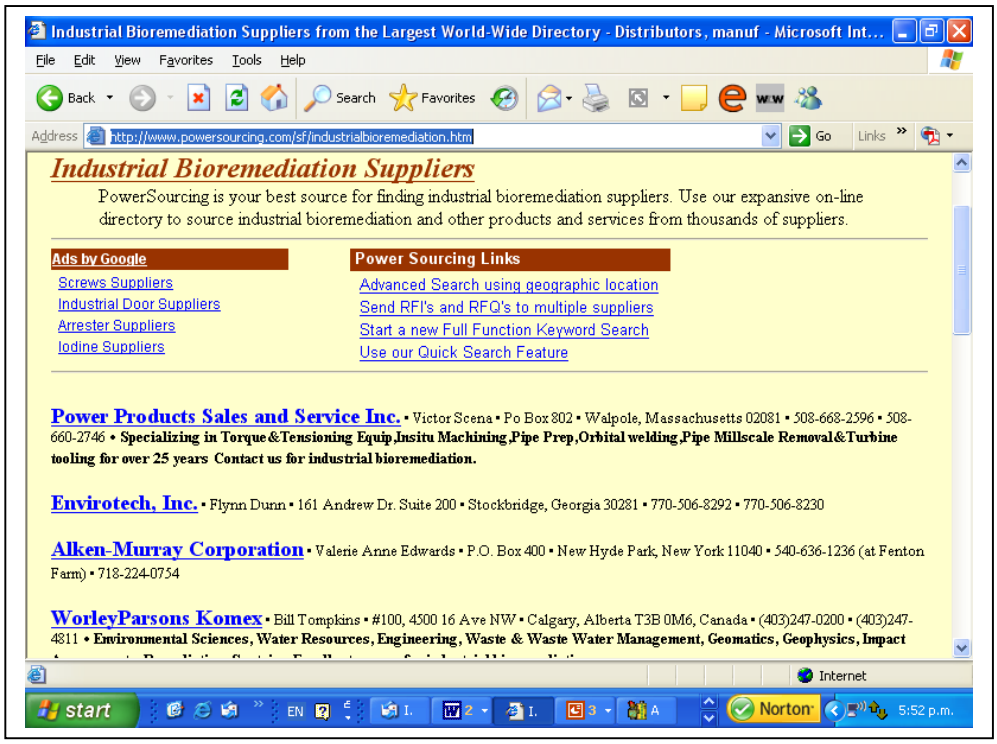
Biotta Ag, Switzerland ***http://www.biotta.ch/en/***

This is one of the world's longest established producers of organic fresh and processed products and was established in 1931 in Tägerwilen, Switzerland. The company exports to around 40 countries and has alliances with key biological control agent producers and suppliers.



Industrial bioremediation suppliers
http://www.powersourcing.com/sf/industrialbioremediation.htm

This site lists a large number of companies in many countries that specialise in supplying bioremediation solutions and could act as channels for solutions developed in T&T.



The 'Best Bet' Roadmap

An indicative roadmap of targets set, how they will be reached, and who is involved, in order to achieve the desired outcomes of this investment opportunity is shown in Table 5.

Table 5: Indicative road map for implementing the 'Bio-Solutions – Promoting Environmental Wellness' Investment Opportunity

Timing	What?	How?	Who?
Initial	• Identify the top 3 prospect areas for each focus	• Collaborative effort	• S&T/ commercial
	• Agree funding needs	• Consensus	• S&T / govt
	• Agree who will do what	• Consensus	• S&T / govt
	• Funding needs and sourcing	• Consensus	• S&T / govt
1st 6 months	• Initiate research projects with at least 2 in each focus area	• Consensus	• S&T/ commercial
	• Investigate IP needs	• Review	• Govt / S&T
	• Initiate legislation review to meet international needs	• Review	• Govt and S&T
	• Initiate market development initiative	• Market research	• Market researcher / sector specialists

2nd 6 months	• First bio-remediation agent through to pre-trial stage • First BCA screening lab-tests • IP review completed and action plan developed • Legislative review completed and action plan developed • Initial market development plan completed • Search for potential alliance partners and value chain components initiated and completed	• R & D • R & D • Review • Review • Market research • Market research	• S & T • S & T • Govt and S&T • Govt and S&T • Market researcher / sector specialists • Market researcher / sector specialists
Year 2	• Sales of first BCA product initiated • First bioremediation product in commercial trials • Second bioremediation product through initial trial stage • First BCA in certification programme • Second BCA undergoing lab-tests	• Commercialisation • R&D • R&D • R&D • R&D	• Commercial • S & T / commercial • S & T / commercial • S & T • S & T
Year 3	• Two new products progressing through the commercialisation process • Commercial revenues of US$1.390,000	• R & D and commercialisation	• S & T / commercial
Year 4	• Two new products progressing through the commercialisation process • Commercial revenues of US$ 4.42 million	• R & D and commercialisation	• S & T / commercial
Year 5	• Two new products progressing through the commercialisation process • Commercial revenue of US$10.28 million	• R & D and commercialisation	• S & T / commercial

Financial Summary

The summary in Table 6 provides a 'best-guess' estimate of the potential revenues, expenses, and EBIT figures that could be achieved over a ten-year period based upon a business that focuses on selling high health plantlets to end-producers, owns and collects royalties for PVR protected material, and sells specialist seeds and plants.

Table 6: Indicative financial projections for the 'Bio-Solutions – Promoting Environmental Wellness' Investment Opportunity

	By year 3	By year 6	By year 10
Revenue from sales and license fees	US $ 1,390,000	US$ 15,370,000	US$ 118,240,000
Basis of revenue figure	10,000 kg biopesticides @ US 60 / kg 1,000 kg of bioremediation product @ US$ 250 / kg 9 biofacility licenses @ US$ 60,000 each	80,000 kg biopesticides @ US 80 / kg 25,000 kg of bioremediation product @ US$300 / kg 21 biofacility licenses @ US$ 70,000 each	640,000 kg biopesticides @ US 150 / kg 40,000 kg of bioremediation product @ US$ 500 / kg 28 biofacility licenses @ US$ 80,000 each
Capital expenditure	US$ 1,120,000	US$700,000	US$ 1,200,000
Operating expenditure	US$ 1,030,700	US$12,346,400	US$ 104,332,800
Earnings before interest and tax (EBIT)	US$ 269,200	US$ 3,023,600	US$ 13,907,200

Note: This financial overview has not been subjected to detailed scrutiny. It is intended to be an example of what could be achieved in an optimistic scenario. Before making an investment commitment, it would need further development and to be subjected to due diligence.

The NEXT Star Rating for This 'Best Bet' Investment Opportunity

- Researchers have already discovered a number of extracts and biological agents that have commercial potential.
- Several of these have potential application in areas where substantial benefits can be reaper e.g. with frosty pod disease in the cocoa sector.
- The potential markets for highly effective bio-remediation products are forecast to be huge.
- T&T has significant expertise that is valuable for realising this Best Bet
- It also has the presence of several large global players, such as Kaizen, that have global reach.
- The challenge is to move research findings into the commercial sector and secure any IP in advance to extract the maximum value out of any commercialisation process.

6 What Comes Next?

There have been many people involved in these Sector Foresight Best Bet Projects since they commenced in early 2006. They came from a wide range of public, private, and institutional organisations. The level of enthusiasm and the quality of input from participants has been outstanding.

There are a number of highly positive outcomes that have already been achieved as a result of these projects including:

- Building a network of people who have a passion for foresight and innovation in both the public and private sectors that, we hope, will continue to grow and help T&T attain its Vision 2020 economic and social objectives.
- At least four of the sixteen 'Best Bet' Investment Cases are now in the process of being developed into commercial businesses. There is strong commercial interest in at least several of the others.
- A number of participants in various project workshops and processes have indicated that they are looking to move into new business ventures that they have been thinking about for some time. Involvement with the sector foresight process has given them the impetus to make bold go-forward decisions
- Discovering that T&T has a lot more entrepreneurial business people than most who live and work in the country recognised. The lesson here is that entrepreneurs tend to be low-profile and just get on and do things. They are not publicity seekers.
- Realising that T&T has a large pool of relatively unexploited talent and resources that has a great deal of potential in tomorrow's evolving consumer markets.
- Awaking interest from at least one T&T based financial institution with regard to the potential benefits their business and shareholders would gain if they began to take a small but highly focussed interest in investing in particular 'Best Bet' projects which have high growth and earnings potential.

The challenge now is not only to see how many of these Sector 'Best Bet' Investment Cases become a commercial reality but also for Trinidad and Tobago to develop a National Growth and Innovation Framework and Strategy. This will be essential if the foresighting approach is to take a hold and stimulate the development of new entrepreneurial businesses that have medium to long-term high growth prospects and can deliver the outcomes the country desires.

Such a framework and strategy would align all the country's key agencies, stakeholders, and resources in one go-forward direction. Once this is achieved, then the country will make real progress towards achieving its goal of becoming a fully developed nation by the year 2020.

Initial indications are that such an approach is likely to happen and the Sector Foresight 'Best Bet' Projects will have played a significant part in moves towards establishing a National Growth and Innovation Framework and Strategy.

7 Acknowledgements

Many people have invested a great deal of time and effort to ensure that the Sector Foresight Project makes a meaningful contribution to the future economic and social success of Trinidad and Tobago. We would like to acknowledge some particular contributions:

- NIHERST, in particular Ms Maureen Manchouck, President of NIHERST; Ms Joycelyn Lee Young, Registrar of NIHERST – for funding and leading these projects . They have been staunch supporters of the whole foresighting process.
- The NIHERST staff for the first class support they have provided us at all times.
- Larry Placide, Andre Vincent Henry, Keith Nurse, ColinDale Marcelle, Steve Maximay, Jacqueline Morris, Michele Reis, Chanzo Greenidge, Maurice Moniquette and Laura Superville – the T&T based researchers who contributed greatly to the 'Best Bet' project work.
- All the private sector, public sector, and institutional sector people who contributed their valuable time and expertise to help build the final sixteen 'Best Bet' Investment Cases – and who have done so with such great enthusiasm!

8 Appendix 1: Detailed Best Bets Research Feedback

This Appendix includes more detailed research input undertaken by the T&T researchers to further develop and test the Chapter 3 'Best Bet' overviews as well as financial models.

8.3 Best Bet 1: Cacao – 'Brown Gold'

Description

Trinitario cacao is known for its special qualities. Demand currently exceeds supply. This 'Best Bet' opportunity focuses on improving and labelling the genetic material whilst addressing the estate management shortcomings. This proposed programme will extract added value in several ways:

- By improving the basic genetic plant material and protecting those improvements through international plant variety rights.
- By developing a system for measuring the PEA (phenylethylamine content), or other key 'bioactive' compounds (up to 5 are known) as a basis for extracting additional value from the 'feel good factor' of different lines of cocoa – the higher the content the higher the value.
- Developing an 'appellation system' in conjunction with the PEA /other bioactive compounds measurement system.
- Including cacao growing in the 'Feel the Passion" Trinidad immersion tourism experience.

Rationale

- Trinitario cacao has an inherent quality that differentiates it from other cacao types.
- Chocolate is known for its feel good factor and high anti-oxidant content – which provides not only a pleasure connection but also a health and wellness (and performance) connection in people's minds.
- The use of herbal stimulants is increasing around the world as a form of legal recreational mind altering substances.
- The New Zealand honey sector, in conjunction with researchers at Waikato University, developed a scientifically based system for measuring the level of an anti-bacterial factor called UMF (unidentified manuka factor). The outcome was a rating scale that provides buyers with an indication of the UMF level contained in each batch of honey from different sources.
- This has leveraged the value of a kilogram of high active manuka honey (15+) to over ten times that received for standard commodity honey.
- Its prime selling point is in the health and wellness area and it is now being used in hospitals to help cure wounds that won't heal using normal antibiotics.
- In Nigeria, the Director of the Federal Agency for Food & Medicine is promoting cocoa not only for it's health benefits but also as a replacement for Viagra because recent research found cocoa boosted libido.
- More tourists are searching for unique immersion type experiences. The concept of being able to visit a cacao growing enterprise and to be able to

enjoy the end products in a convivial on site atmosphere is likely to be a strong tourist attraction – just in the way vineyards and themed parks such as "The Big Pineapple" in Australia and 'Kiwifruit Country' in New Zealand have become
- Trinidad and Tobago can easily triple its' current production without affecting the price. A new premium product would also cement its place as a market leader in quality cocoa

Target Markets

- High-end consumers in wealthy market niches in both traditional and growth economies.
- Both the personal pleasure (in all its senses) and the health and wellness consumer focuses would be strongly targeted.
- The high end developing markets in China and India.
- Women - who are particularly fond of chocolate.
- Men who suffer from erectile disfunction – there are several studies which indicate various compounds in cocoa appear to have a similar stimulatory effect as Viagra
- Indonesia, Europe, Japan, the former Soviet Union (particularly Lithuania)
- Consumers who can appreciate fine flavours as Trinidad cocoa is renowned for its fruity and raisins notes.
- Weight watchers

The Market Offer

- Satisfying the need for fascination and more intense pleasure experiences.
- Improving personal health and wellness whilst indulging in pleasure.
- Cocoa/chocolate with a defined PEA/other bioactive compounds measure that has an associated premium. Currently chocolate is marketed like champagne in vintage years or by origin as in Grande Couva chocolate. The greater percentage of Trinidad cocoa in a chocolate bar the greater the price.
- Extended use into non-food areas such as cosmetics and 'feel good' products.
- An associated 'appellation system' – to address growing consumer interest in where products come from and the conditions under which they are grown
- The total cacao immersion experience. Trinidad cocoa has a distinct flavour and tradition. The offer would be persuading the consumer that they are 'eating an experience' real or perceived. For instance one can be eating the chocolate and visualise the process that produces it.
- Access to high value genetic material under an international plant variety right protected basis.

What We Have

- A demand that far exceeds the current supply of high quality Trinitario cacao.
- Plant material, including the Trinitario strain.
- Some expertise in growing and cacao holdings and estates.
- R&D skills.
- Land and a unique environment for growing cacao.
- An existing marketing plan and branding.

- Some experience with estate related marketing.
- Knowledge of at least some of the components that make cacao/chocolate an 'essential' for many consumers.
- Some innovative product developments based around cacao in the non-food sector.
- The Cocoa Research Unit.
- A germplasm bank plus a breeding programme to boost mother stock quality and disease resistance.
- A historical association with cacao growing and processing.
- A capability to produce our own T&T based cacao-derived products.

Regulatory issues

- The regulatory status is based on bean size and fermentation, which affects the price. The broken beans are discarded although they can be used for production. Chocolate manufacturing companies prefer uniformity and do not necessarily require large beans.

IP protection

- IP is currently protected in the following ways:
  1. Trademark legislation for producers and manufacturers.
  2. Geographical Indication Act.
  3. Protection of new plant varieties.
  4. Process patents.

Infrastructure

- Cocoa production requires the farmer to be both the planter and processor. So there need to be an avenue for sale of wet cocoa and a central processing unit. This would ensure standardized handling of all cocoa to be sold securing the taste.

Research and development

- Research activities include germplasm conservation, morphological and molecular characterisation of cacao accessions, screening of germplasm, resistance to diseases, germplasm enhancement for commercial varies (pre-breeding for desirable traits), and quality and flavour assessment.
- On-going research activities of characterisation, evaluation and utilization are centred at:
  - Cocoa Research Unit (CRU).
  - Ministry Of Agriculture.
  - CARIRI.
  - The University of the West Indies, St Augustine, Faculties of Science and Agriculture (research), Engineering (processing machinery), Food Science and Technology (microbiology and research).
- Key T&T-based researchers in the cocoa field include the following
  - Dyer Narinesingh -The Dean of the Faculty of Science and Agriculture.
  - Margaret Tailor – CARIRI.
  - Haroon Mohammed – CARIRI.
  - Sadiah Mohammed – CARIRI.

- Clement Sankat – Faculty of Engineering.
- Patricia Maharaj – Centeno.
- Camaldeo Maharaj – Centeno.
- Daveonat Ramnat – Centeno.
- Lauren Walldropt - CL Financial.

Education and training

- There is a pool of skilled people in the cocoa development area currently available that is under-utilised. The Faculty of Science and Agriculture has the capability to train the graduates needed for the execution of the planned initiatives.

Incentives and assistance

The Agricultural Development Bank offers a sector focussed 'cocoa revitaliser loan'. Other sources of grants, technical assistance, joint ventures include:

- World cocoa foundation, USA
- Lindt & Sprungli International AG Switzerland.
- Masterfoods, UK.
- United Nations Common Funds for Commodities.
- The Biscuit Cake, Chocolate & Confectionary Association UK.
- Cadbury Ltd, UK.
- United States Department of Agriculture.
- The University of Reading.
- The University of Hamburg, Germany.
- Guittard Chocolate Company Burlingame, USA.
- Centre de cooperation internationale en recherche agronomique pour le developpement (CIRAD), France.
- The Cocoa and Coffee Industry Board.

Resources and Materials

- T&T has all the human resources required to develop this best bet. The area where resources are likely to be an issue is in the agricultural production area.
- Cocoa estates are becoming more and more fragmented and are converted into residential lots. Creation of a productive estate is a long-term investment. But C. L. Financial is attempting to restore the plantation system by purchasing these lots.
- T&T has all the material resources required to develop this best bet. T&T has the genetic material, the environment to produce unique flavour, the heritage, the 'know how' and research facilities.
- Resources are available locally there is no need to import. Consultants are also available locally with long-term experience in the field.

Investment and Entrepreneurship

- The following groups and individuals are sources of investment and entrepreneurship:
  - CL Financial.
  - Mr. Varmer – the owner of an estate.
  - Mr Manichan- a producer.

- Mr Paul Marry - Manager of Stollmeyer Estate Santa Cruz.

Employment

- The traditional production approach is very labour intensive. Local people generally have a negative view of agriculture as it is associated with poor wages, hard work, and being a 'dirty' occupation. People tend to favour working in government employment programmes such as URP and CEPEP where they can receive the same level of income for half the normal number of working hours.

Business capabilities and alliances

- Charles Candy – They purchased a factory in France and also have the machinery to utilise cocoa.
- Caribbean Chocolate - produce cocoa products. Rosemary Stone has contacts with an English chocolate manufacturing company.
- Scharfenberger - embraces the younger market that prefers a less bitter chocolate 60% cocoa.
- Côte d'Or in Belgium and Philip Morris with his individual recipes.
- Cadbury is no longer interested in purchasing Trinidad's cocoa due to previous history with the Cocoa and Coffee Industry Board.

Value chain development and management

The Cocoa and Coffee Industry Board is very important as it finds buyers for the cocoa beans. The beans are then sold to a broker. This regulates the selling of cocoa thereby reducing the possibility of any one manufacturer purchasing all the product.

Branding and marketing

The current areas where T&T has skills and expertise include:

- Technical and trade requirements.
- Geographical location.
- Routine percentage of cocoa butter fat.
- Percentage of fermentation.
- Percentage of (passi amount) purity.
- Freedom from genetically modified sources compared to conventionally bred.
- Packaging requirements.
- Laboratory reports on samples.
- Language barriers.
- Branding by distributors or manufacturers e.g. Angostura.

The agencies currently involved include:

- Ministry of Legal Affairs.
- Bureau of Standards.
- The Cocoa and Coffee Industry Board.
- Cocoa Research Unit.
- Ministry of Agriculture.
- CARDI.

What We Need

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- Cocoa has a great economic advantage the market price is on average $4,000 US per metric ton however there is a paradoxical decline in production.
- Trinidad and Tobago can easily triple its' current production without affecting the price. However if cocoa is to value added the value needs to far exceed the price of the raw material. A new premium product needs to be generated.
- Improved genetic plant material.
- Development of a PEA/other bioactive compound measurement scale that can be used in practice.
- Identification of ways that Trinitario derived plant material could become protected through international plant variety rights.
- Top notch market research – especially with potential end users (traditional and non-traditional) – to identify mutually beneficial ways of leveraging extra value.
- Branding.
- Broadcasting the unique characteristics of Trinitario cacao more widely.
- Value chain analysis and optimisation.
- Identifying key alliances and relationships needed to make the whole thing work.
- Turning at least one cacao estate into a 'living experience' for tourists.
- Investors into land, plants, and machinery.
- A value upgrade from production through to consumption to extract greater value from the market.
- A move to fixed price contracts.
- Better dispersal of research knowledge.
- TQM at all levels including maturity and harvesting.
- A supply buffer in order to provide consistent supplies to premium end users.
- Developing higher value non-food uses for cocoa butter.
- Top notch R&D and support of the research arm at UWI.
- Increase the T&T production base.
- Preserve good agricultural land in T&T.
- Quality based incentive payments to producers.
- An industry marketing plan.
- Agro-tourism including cacao and link with TT experiential tours.
- Own storage in major markets such as Europe.
- Regional cooperation with producers e.g. in Jamaica.
- Labour saving devices and coverage of lack of skills.
- A new industry structure to handle production, processing and marketing to global buyers.

IP Protection

- In order to achieve IP protection a detailed description of the product needs to be developed.
- Cocoa has at least 200 morphological characters and is responsive to the environment. Hence DNA profiling needs to be performed.
- The breeders of new types of coca plants are the ones who need to file for IP protection. In the case of the Ministry of Agriculture, where they possess their own hybrids and cultivars, the head of the unit is responsible for filing for IP protection.

- Often, filing for IP protection is neglected as people in research units are unclear as to who has the responsibility to do so.
- Education is required to improve understanding of the purpose and benefits of IP protection.

Best Bet Roadmap

See main text.

Financial Model & Assumptions

BEST BET SECTOR: Biotechnology				BEST BET 1: Cacao - 'Brown Gold'							
			File date:	20/09/06							
			Last review:	15/01/07							
10 Year Financial Projection Model (US$)											
NOTE - This model is for value adding on top of existing businesses so the figures refer only to the value added component											
		YEAR									
		1	2	3	4	5	6	7	8	9	10
GOVT INVESTMENT	Description										
S&T research	X factor and breeding	500000	500000	500000	500000	500000	500000	500000	500000	500000	500000
Education	Training	200000	200000	200000	200000	200000	200000	200000	200000	200000	200000
Trade development	Trade promotion	100000	100000	100000	200000	200000	200000	300000	300000	300000	300000
Total Govt investment		**800000**	**800000**	**800000**	**900000**	**900000**	**900000**	**1000000**	**1000000**	**1000000**	**1000000**
COMMERCIAL INVESTMENT											
		YEAR									
		1	2	3	4	5	6	7	8	9	10
REVENUE	Description										
Product/Service Line 1	X-factor' cocoa (1)										
Volume	Kg	10000	25000	50000	100000	150000	400000	500000	600000	700000	800000
Value/unit	Value add per kg	1	1.5	2	2.5	3	3.5	4	4	4	4
Gross line revenue		**10000**	**37500**	**100000**	**250000**	**450000**	**1400000**	**2000000**	**2400000**	**2800000**	**3200000**
Product/Service Line 2	Plant material sales (2)										
Volume	No of plants	0	0		10000	50000	100000	250000	500000	1000000	2000000
Value/unit	Royalty per plant $	1	1	1	1	1	1	1	1	1	1
Gross line revenue		**0**	**0**	**0**	**10000**	**50000**	**100000**	**250000**	**500000**	**1000000**	**2000000**
Total Revenue		**10000**	**37500**	**100000**	**260000**	**500000**	**1500000**	**2250000**	**2900000**	**3800000**	**5200000**
EXPENSES											
Capex	Description										
Item 1	X-factor rating set up	30000									
Item 2	PVR set up	10000		10000		10000		10000		10000	
Total Capex		**40000**	**0**	**10000**	**0**	**10000**	**0**	**10000**	**0**	**10000**	**0**
Opex	Description										
Salary and wages	30% gross rev (3)	50000	50000	50000	78000	150000	450000	675000	870000	1140000	1560000
Marketing	10% of gross rev. (4)	1000	3750	10000	26000	50000	150000	225000	290000	380000	520000
Travel	10% of gross rev.	1000	3750	10000	26000	50000	150000	225000	290000	380000	520000
Communications	2% of gross rev	200	750	2000	5200	10000	30000	45000	58000	76000	104000
Rental	5% of gross revenue	500	1875	5000	13000	25000	75000	112500	145000	190000	260000
Consumables	2% of gross rev	200	750	2000	5200	10000	30000	45000	58000	76000	104000
Administration	5% of gross rev	500	1875	5000	13000	25000	75000	112500	145000	190000	260000
Total Opex		**53400**	**62750**	**84000**	**166400**	**320000**	**960000**	**1440000**	**1856000**	**2432000**	**3328000**
Total Expenses		**93400**	**62750**	**94000**	**166400**	**330000**	**960000**	**1450000**	**1856000**	**2442000**	**3328000**
EBIT		**-43400**	**-25250**	**16000**	**93600**	**180000**	**540000**	**810000**	**1044000**	**1368000**	**1872000**
EBIT - Capital		**-83400**	**-25250**	**6000**	**93600**	**170000**	**540000**	**800000**	**1044000**	**1358000**	**1872000**
EBIT - (Capex + Govt)		**-883400**	**-825250**	**-794000**	**-806400**	**-730000**	**-360000**	**-200000**	**44000**	**358000**	**872000**
NOTES:											
	1	X-factor rated cacao - assumes this can be set up quite quickly and, with smart marketing, can leverage a premium of up to $4 a kg by year 10 if marketed correctly									
	2	Royalties only on licensed production of PVR plants									
	3	First three years one full time manager at US$ 50,000									
	4	Supplementary to standard channel marketing costs									

8.4 Best bet 2: Novel Tropical Flowers and Seeds

Description

- This 'Best Bet' offers a unique range of services and products to offshore buyers with a full range of novel aesthetically and aromatically appealing flora. The licensed seed and tissue cultured plantlets yield plants with therapeutic and aesthetic appeal from aromatherapy to aromachology (psychology of aroma and its effect on the mind).
- There are a number of tropical flowers and seeds in T&T that are seen in local Spa resorts, houses, and supermarkets.
- Some of these have been well researched, production systems developed and tested, and some degree of market testing done.
- Initial market research has found there is good potential for new therapeutic fashion flower and plant products that command a premium.

Rationale

- The ancient art of using aromatic plant essences to enhance well-being has been edging its way into the mainstream for the last twenty or thirty years. Some of modern uses of aromatherapy potpourris: lavender and rosemary odours are used in patient waiting rooms to keep their occupants calm, while lemon and eucalyptus oils are used in banks to keep the staff alert.
- Aromatherapy is part of a growing movement towards alternative medicine and natural treatments, on which some 65% to 80% of the world's population—that is, 3 billion people—rely on as their primary form of health care. Americans spent almost $1.5 billion on herbal remedies in 1993, and that dollar amount has only grown since then, approximately $3 billion today.
- In Europe, alternative medicine and aromatherapy are receiving more mainstream support, such that the British National Service runs five homeopathic hospitals in Great Britain and one out of three prescriptions in Germany is an herbal remedy rather than a synthetic drug.
- In the United States, a September 2004 market report shows a distinct preference for aromatherapy and anti-stress products in soap, bath, and shower product purchases. It's a $1.6 billion market industry, which is not going to slow down any time soon. It's clear there is a market in today's world for scents that calm the mind, relax the body, and improve our quality of life.[1]
- There is also the expanding world flower trade, which, in 2000, was worth an estimated US$7 billion. Over 65 countries are involved in the international trade in cut flowers and foliages[2]. Combinations of aesthetically appealing and fragrant flora are at the core of this 'Best Bet'.
- Consumers are increasingly searching for new and different floral and garden products.
- Both are in a growth sector driven by two main things – more people living in apartments and ageing populations (who tend to favour gardening more as a therapeutic pastime).
- There are niches in global markets for quality new and novel products that provide a unique difference.

[1] http://www.stylecareer.com/potpourri_maker.shtml

[2] http://www.ricecrc.org/reader/ornamentals/export-flowers.htm

- Growers in T&T could increase their incomes by twenty times if a business could be developed in this area linking production with key markets.
- There are also opportunities for exploiting plant variety rights (PVRs) internationally for unique cultivars.

Target Markets

- High-end niche markets in North America (East Coast), Europe and the Caribbean – possibly also in India, Singapore, China and other wealthy parts of Asia.
- The tourism sector in the Caribbean especially spas and resorts.
- The seeds and plant material wholesale and retail markets in specific niche areas – could be anywhere in the world.
- The international nursery industry through alliances in key markets and exclusive plant variety rights use agreements.
- Plant producers for the cut flower growing sector in key production areas – e.g. Columbia, Ecuador.

The Market Offer

- Propagation services for genetically modified flowering plants under exclusive licensing arrangements.
- Specialised aromatherapeutic seed and plant lines for the international nursery sector.
- Specialised cut and dried “potpourri” flower production and delivery to the spa/resort accommodation, restaurant and venue sectors worldwide.

What We Have

- Human, biological and financial resources.
- Indigenous knowledge.
- Existing development programmes for flowers, plants and seeds – including many years of work with Anthurium.
- Good micro-propagation and seed production facilities.
- Well-developed research resources and capabilities.
- Highly experienced R&D personnel who are experts in the field.
- A regional trade framework and ready access to markets.
- Markets that are prepared to pay a premium for unique products – locally and globally.
- A global flower and plant based fashion sector that is always searching for new products.
- An ideal low-cost growing environment.

Regulatory issues

- The technology will be compliant with most of the important regulations governing the trans-national movement of biological material. Current Sanitary and Phytosanitary (SPS) issues will be avoided by selling plantlets in sterile media, thereby avoiding soil-borne concerns about pathogens or infestations.

IP protection

- Trinidad and Tobago is a regional leader in UPOV-updated legislation and can afford its producers protection for new plant varieties.

Infrastructure

- The range of laboratory space required will fit into the Governments commitment to the construction of a modern Technopolis at Wallerfield in Trinidad.

Research and Development, Education and Training

- UWI is a key institution in T&T that is relevant to areas that make up the best bet, additionally the facilities and staff earmarked for the University of Trinidad and Tobago.

Incentives and assistance

- Very little incentive and assistance is currently available from the government and off shore but a joint venture partner will be sought to address the global promotion and distribution of the range of specialized propagation services.

Resources and Materials

- The National Biodiversity project currently being undertaken by the UWI St Augustine and the University of London will further document the rich biodiversity with regard to tropical flowering plants that have their centre of diversity in the Americas.

Investment and Entrepreneurship

- The initial venture capital will be through an amalgam of public and private sector interests through a commercialisation start-up housed in the Science incubator facility to be constructed in Wallerfield.

Employment

- There is generally a shortage of labour and wages are high but this best bet requires a range of top-end skills that will be independent of the Level 1,2 and 3 fluctuations in the labour market. The local source of graduates will be the UWI campuses primarily and graduates of North American Universities wooed by the prospects of commercialisation of specialist skills in propagation and genetic engineering using locally modified markers.

Business capabilities and alliances

- The country has had the experience of mega-bucks joint ventures and the legal, regulatory and administrative capability is already tried and tested.

Value chain development and management

- The services provided by this best bet are already far along the value chain, removed from the bulk produced product and involving intellectual property.

What We Need

- Increased capacity (human and infrastructure) for R&D.
- Linkages between research and technology institutions, and the commercial sector.
- Consortiums to drive development of the sector and prioritise R&D initiatives.
- R&D policy and funding initiatives.
- Increased private sector involvement.
- Efficient quarantine and quality control systems.
- A marketing presence in Europe and North America.
- Handling facilities that can ensure products meet importing country standards.
- Highly developed branding and marketing strategies.
- Market research to establish connections in key target markets.
- Value chain definition and development.
- IP protection and plant variety rights licensing capabilities.
- Commercialisation – both investment and business entity components.
- Improved freight connections to key markets – in particular airfreight space.

Best Bet Roadmap

See main text.

Financial Model & Assumptions

BEST BET SECTOR: Biotechnology				BEST BET 2: Novel Tropical Flowers and Seeds							
			File date:	22/09/06							
			Last review:	15/01/07							
10 Year Financial Projection Model (US$)											
		YEAR									
		1	2	3	4	5	6	7	8	9	10
GOVT INVESTMENT	**Description**										
S&T research	Development research	500000	500000	500000	500000	500000	500000	500000	500000	500000	500000
Education	Specialist Training	400000	400000	400000	400000	400000	400000	400000	400000	400000	400000
Trade development	Offshore markets	250000	250000	250000	250000	250000	250000	250000	250000	250000	250000
Incentives											
Other	PVRs	100000	50000	50000	50000						
Total Govt investment		**1250000**	**1200000**	**1200000**	**1200000**	**1150000**	**1150000**	**1150000**	**1150000**	**1150000**	**1150000**
COMMERCIAL INVESTMENT											
		YEAR									
		1	2	3	4	5	6	7	8	9	10
REVENUE	**Description**										
Product/Service Line 1	Plantlets										
Volume	No of plantlets	0	50000	100000	200000	400000	800000	1600000	3200000	6400000	6400000
Value/unit	Value per plantlet	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5
Gross line revenue		**0**	**75000**	**150000**	**300000**	**600000**	**1200000**	**2400000**	**4800000**	**9600000**	**9600000**
Product/Service Line 2	Plant PVRs (1)										
Volume	Licence volume (units)	10000	100000	500000	1000000	2000000	5000000	10000000	20000000	25000000	30000000
Value/unit	Royalty fee	1	1	1	1	1	1	1	1	1	1
Gross line revenue		**10000**	**100000**	**500000**	**1000000**	**2000000**	**5000000**	**10000000**	**20000000**	**25000000**	**30000000**
Product/Service Line 3	Seeds										
Volume	Kgs	0	1000	4000	20000	20000	30000	30000	30000	30000	30000
Value/unit	US$/kg	50	60	70	80	90	100	100	100	100	100
Gross line revenue		**0**	**60000**	**280000**	**1600000**	**1800000**	**3000000**	**3000000**	**3000000**	**3000000**	**3000000**
Product/Service Line 4	Novel plants										
Volume	No of plants	0	0	0	10000	50000	100000	250000	500000	1000000	2000000
Value/unit	US$/plant				10	10	10	10	10	10	10
Gross line revenue		**0**	**0**	**0**	**100000**	**500000**	**1000000**	**2500000**	**5000000**	**10000000**	**20000000**
Total Revenue		**10000**	**235000**	**930000**	**3000000**	**4900000**	**10200000**	**17900000**	**32800000**	**47600000**	**62600000**
EXPENSES											
Capex	**Description**										
Item 1	Production units	500000	100000	100000	500000	100000	100000	500000	100000	100000	500000
Item 2	PVR set up	500000									
Item 3	Online portal	100,000									
Total Capex		**1100000**	**100000**	**100000**	**500000**	**100000**	**100000**	**500000**	**100000**	**100000**	**500000**
Opex	**Description**										
Production inputs (non staff)	15% of rev (2)	0	20250	64500	300000	435000	780000	1185000	1920000	3390000	4890000
Packaging	5% of rev (3)	0	5000	25000	50000	100000	250000	500000	1000000	1250000	1500000
Salary and wages	25% gross rev (4)	300000	450000	600000	750000	1225000	2550000	4475000	8200000	11900000	15650000
Freight	All ex farm gate	0	0	0	0	0	0	0	0	0	0
Marketing	10% of gross rev.	20000	50000	93000	300000	490000	1020000	1790000	3280000	4760000	6260000
Distribution	All ex factory	0	0	0	0	0	0	0	0	0	0
Travel	10% of gross rev.	1000	23500	93000	300000	490000	1020000	1790000	3280000	4760000	6260000
Communications	2% of gross rev	200	4700	18600	60000	98000	204000	358000	656000	952000	1252000
E-commerce	5% of gross rev	500	5000	25000	50000	100000	250000	500000	1000000	1250000	1500000
Rental	5% of gross revenue	500	11750	46500	150000	245000	510000	895000	1640000	2380000	3130000
Consumables	2% of gross rev	200	4700	18600	60000	98000	204000	358000	656000	952000	1252000
Administration	5% of gross rev	500	11750	46500	150000	245000	510000	895000	1640000	2380000	3130000
Other											
Total Opex		**322900**	**586650**	**1030700**	**2170000**	**3526000**	**7298000**	**12746000**	**23272000**	**33974000**	**44824000**
Total Expenses		**1422900**	**686650**	**1130700**	**2670000**	**3626000**	**7398000**	**13246000**	**23372000**	**34074000**	**45324000**
EBIT		**-312900**	**-351650**	**-100700**	**830000**	**1374000**	**2902000**	**5154000**	**9528000**	**13626000**	**17776000**
EBIT - Capital		**-1412900**	**-451650**	**-200700**	**330000**	**1274000**	**2802000**	**4654000**	**9428000**	**13526000**	**17276000**
EBIT - (Capex + Govt)		**-2662900**	**-1651650**	**-1400700**	**-870000**	**124000**	**1652000**	**3504000**	**8278000**	**12376000**	**16126000**
NOTES:											
1	Assumes these PVR fees are generated through offshore licensing arrangment with major nurseries										
2	Things like fertilisers, pesticides, groiwng media, irrigation, etc - for all except PVRs										
3	For all except PVRs										
4	Relates mainly to plantlets, seeds and novel plants only as PVRs are a license fee and need monitoring and collection only										

Interviewees

- Dr. Laura Roberts-Nkurmah.
- Professor Richard Brathwaite.
- Dr. P Umaharan.
- Chris Avey (Kairi Blooms).
- Burt Manning a former exporter of cut flowers.
- Chancey Moll is the President of the Garden Club.
- Alexander Gibson.
- Anthony Tang Kai.
- Paula Pantin is currently the president of the Trinidad & Tobago Orchid Society.
- Wendy Lee Yuen.

8.5 Best Bet 3: Bio-Solutions – 'Promoting Environmental Wellness'

Description

- Bioremediation: Nature's Way to a Cleaner Environment.
- Biopesticides: Nature's Way to a Pest-Free Environment.
- Trinidad and Tobago has a number of plant and microbial species that offer unique products and solutions for environmental problems due to pollutants and pests. The key is going to be in highlighting the unique selling points, including associated licensing opportunities that will provide a price leveraging advantage in those niches in areas such as:
  - Bio-remediation – through identifying and commercialising microbial solutions for pollution, remediation projects which can also be protected through the use of IP.
  - The use of indigenous marine and aquatic fish species to counteract the impacts of various pollutants.
  - Biological control agents – including natural pesticides which can be identified, protected through IP and commercialised.

Rationale

- Environmental considerations are major determinants of international trade and marketing. Amidst concerns of environmental degradation Climate Change and global warming there is ongoing and increasing interest in natural processes to remedy those ills.
- **Biopesticides** are certain types of pesticides derived from such natural materials as animals, plant and bacteria. At the end of 2001, there were approximately 195 registered biopesticide active ingredients and 780 products. Biopesticides fall into three major classes:
  1. Microbial pesticides consist of a microorganism (e.g., a bacterium, fungus, virus or protozoan) as the active ingredient. Microbial pesticides can control many different kinds of pests, although each separate active ingredient is relatively specific for its target pest[s]. For example, there are fungi that control certain weeds, and other fungi that kill specific insects.The most widely used microbial pesticides are subspecies and strains of Bacillus thuringiensis, or Bt. Each strain of this bacterium produces a different mix of proteins, and specifically kills one or a few related species of insect larvae.
  2. Plant-Incorporated-Protectants (PIPs) are pesticidal substances that plants produce from genetic material that has been added to the plant. For example, scientists can take the gene for the Bt pesticidal protein, and introduce the gene into the plant's own genetic material. Then the plant, instead of the Bt bacterium, manufactures the substance that destroys the pest.
  3. Biochemical pesticides are naturally occurring substances that control pests by non-toxic mechanisms. Conventional pesticides, by contrast, are generally synthetic materials that directly kill or inactivate the pest. Biochemical pesticides include substances, such as insect sex

pheromones, that interfere with mating, as well as various scented plant extracts that attract insect pests to traps.

Advantages of using Biopesticides

- Biopesticides are usually inherently less toxic than conventional pesticides.
- Biopesticides generally affect only the target pest and closely related organisms, in contrast to broad spectrum, conventional pesticides that may affect organisms as different as birds, insects, and mammals.
- Biopesticides often are effective in very small quantities and often decompose quickly, thereby resulting in lower exposures and largely avoiding the pollution problems caused by conventional pesticides.
- When used as a component of Integrated Pest Management (IPM) programs, biopesticides can greatly decrease the use of conventional pesticides, while crop yields remain high.
- **Bioremediation** technologies can be generally classified as *in situ* or *ex situ*. *In situ* bioremediation involves treating the contaminated material at the site while *ex situ* involves the removal of the contaminated material to be treated elsewhere. Some examples of bioremediation technologies are bioventing, landfarming, bioreactor, composting, bioaugmentation, rhizofiltration, and biostimulation.
- Not all contaminants, however, are easily treated by bioremediation using microorganisms. For example, heavy metals such as cadmium and lead are not readily absorbed or captured by organisms. The assimilation of metals such as mercury into the food chain may worsen matters. Phytoremediation is useful in these circumstances, as many plants are able to bioaccumulate these toxins in their above-ground parts, which are then harvested for removal. The heavy metals in the harvested biomass may be further concentrated by incineration.
- Genetic engineering approaches are at the core of this best bet
- The use of genetic engineering to create organisms specifically designed for bioremediation has great potential.

Advantages

- There are a number of cost/efficiency advantages to bioremediation, which can be employed in areas that are inaccessible without excavation. For example, hydrocarbon spills (specifically, petrol spills) or certain chlorinated solvents may contaminate groundwater, and introducing the appropriate electron acceptor or electron donor amendment, as appropriate, may significantly reduce contaminant concentrations after a lag time allowing for acclimation.
- This is typically much less expensive than excavation followed by disposal elsewhere, incineration or other *ex situ* treatment strategies, and reduces or eliminates the need for "pump and treat", a common practice at sites where hydrocarbons have contaminated groundwater.
- As an example the cleaning up of existing environmental contamination in the United States could cost as much as $1 *trillion* dollars. Bioremediation can help contain costs as follows:
    - ***Treating contamination in place -*** Most of the cost associated with traditional cleanup technologies is associated with physically removing and disposing of contaminated soils. Because engineered bioremediation can be carried out in place by delivering nutrients to contaminated soils, it does not incur removal-disposal costs.

    - ***Harnessing natural processes -*** At some sites, natural microbial processes can remove or contain contaminants without human intervention. In these cases where intrinsic bioremediation (natural attenuation) is appropriate, substantial cost savings can be realised.
    - ***Reducing environmental stress -*** Because bioremediation methods minimize site disturbance compared with conventional cleanup technologies, post-cleanup costs can be substantially reduced.
- The global focus on redressing pollution problems is strengthening – cleaning up old industrial sites in developed economies and dealing with growing pollution problems in rapid growth economies such as India and China.
- There are indigenous microbes that have been identified which could help provide an effective natural solution to pollution problems caused by heavy industry and the oil and gas sector.
- Sales of organic products are increasing rapidly in wealthy markets e.g. Sainsbury's in the UK had 18% growth in the past year and so there is an increasing need for bio-control agents for pests and diseases that are compatible with bio-certification systems.
- On the local scene Petrotrin and BHP have indicated an interest in funding bioremediation technology provided efficacies at least match the imported bacteria.. Petrotrin is budgeted to spend $14m on bioremediation works this financial year although that figure may rise to $20m.
- Petrotrin is doing the lion's share of the bioremediation in T and T as they are cleaning up field and dump pits onshore that were used since the 1920's. They have also made some observations concerning what areas in Trinidad may already be inoculated with some local species.

Target Markets

- For the bio-remediation area – pollution clean up opportunities in both developed and developing countries through companies and agencies that have a specialist role / focus in dealing with such problems with a particular focus on the green, responsible corporation.
- The local energy and heavy industrial sectors. The growth of heavy industries and smelting will provide a cache of potential clients.
- For the biological control agent/protocol – producers and producer groups with a strong focus on biological and integrated pest management strategies worldwide. The service and product dimensions of the best bet will be promoted together.

The Market Offer

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- Satisfying a growing need to remediate complex inherited pollution problems on old 'blackfield' and 'brownfield' sites and collateral damage occurring in sectors such as oil and gas and rapid industrialisation in fast growth economies by using natural agents that have a high degree of efficacy.
- Satisfying the growing need for organic products by providing new naturally derived biological pest and disease control agents that are stable and provide a high degree of efficacy and are also accepted by bio-registration systems such as 'Biogro' and 'Demeter'.
- Providing internationally significant exporters with Euregap and SPS (Sanitary and Phytosanitary) compliant technologies and products.

What We Have

- An impressive energy and energy products related sector that is the main driver of the economy. Unlikely to be insignificant in the medium term and traditionally a potential environmental degrader.
- Centres of excellence at UWI and CARIRI that can develop the product concepts.
- Sources of pollution to test naturally derived bioremediation solutions.
- Indigenous microbes that have the potential to provide bioremediation-based pollution solutions.
- The T&T Green Fund which, by 2005, had risen to TT$ 465 million and is intended to be used for environmental improvement projects.
- Trained bio-scientists and research infrastructure at UWI and UTT.
- Acknowledged Biodiversity, as evidenced by recently funded joint university programmes, which provides a source of bioremediation and biological control agents.
- A reputation as a leader in the field of biological control.
- An active and recognized CABI Office, internationally respected for work on biological control.

Regulatory issues

- Local and international target markets all have legislative and regulatory systems and obligations that require the range of services and products on offer. Environmental legislation provides crosscutting obligations on Public and Private sector interests worldwide.
- Provision of this Best Bet will require registration and regulatory mechanisms that are already in place given the countries adherence to international treaties and conventions from RAMSAR to UNCLOS.

IP protection

- Trinidad and Tobago has the most comprehensive and wide-ranging Intellectual Property legislation and the administrative/legal wherewithal to enact it in the Anglophone Caribbean.

Infrastructure

- The underlying capacity for this best bet has been quietly developing in pockets of activity at the UWI and CABI in particular. The University has already provided a business incubator facility for a successful start-up that went on to provide bio-remedial services and products to the energy sector in Trinidad.
- The laboratory and educational infrastructure at CABI and UWI will be augmented by that to be constructed at the Wallerfield Technopolis, as part of the UTT.

Research and development

- The current research and development is concentrated at the UWI, CABI, Petrotrin, CARDI , Environmental Solutions and Kaizen. However, there exists a cadre of trained scientists that can be the core of a well-funded focused initiative as espoused in this 'Best Bet'.

Education and training

- There are training and educational opportunities at the University level in both bioremediation and biological pest control. Several nationals have particular kinds of expertise but are not necessarily placed in positions where concentrated and focused efforts are devoted to this area. The kind of commitment envisaged for this Best Bet will afford larger numbers of Science graduates to specialize in these areas.

Employment

- The initial venture capital will be through an amalgam of public and private sector interests through a commercialisation start-up housed in the Science incubator facility to be constructed in Wallerfield.
- The local source of graduates will be the UWI campuses primarily and graduates of North American Universities wooed by the prospects of commercialisation of specialist skills in genetic engineering for bio-remedial and bio-pesticide capabilities.

Business capabilities and alliances

- The country has had the experience of utilizing bioremedial technologies from world-rated companies like Alabaster Corp. and there are local agents of similar companies already providing ad hoc services. A centralized biotechnological thrust will benefit from the range of experiences available locally. Possible alliances can be forges with Kaizen International and BHP Billiton. The country has the legal, regulatory and administrative capability to manage this 'Best Bet'.

What We Need

- Scoping of the biodiversity to identify areas of potential, protection and development.
- Phytochemical analysis to identify potential products and active ingredients.
- The development of QA/QC systems and market opportunities.
- Value chain and market development.
- A legislative framework that is in tune with global standards and requirements.
- Trained personnel – both from local and foreign sources.
- Industry structure and certification schemes – especially for bioremediation but also applies to the other areas.
- Roll out and commercialisation expertise.
- Sources of investment.
- Regional marketing structure.
- IP protection for sources, processes and products where appropriate.

- International legal archives.

Best Bet Roadmap

See main text.

Financial Model & Assumptions

BEST BET SECTOR: Biotechnology		BEST BET 3: Bio-Solutions – 'Promoting Environmental Wellness'									
		File date:		24/11/06							
		Latest update:		16/01/2007							
10 Year Financial Projection Model (US$)											
		YEAR									
		1	2	3	4	5	6	7	8	9	10
GOVT INVESTMENT	Description										
S&T research	Development researc	500000	500000	500000	500000	500000	500000	500000	500000	500000	500000
Education	Specialist Training	400000	400000	400000	400000	400000	400000	400000	400000	400000	400000
Trade development	Offshore markets	250000	250000	250000	250000	250000	250000	250000	250000	250000	250000
Other	IP protection	100000	50000	50000	50000						
Total Govt investment		**1250000**	**1200000**	**1200000**	**1200000**	**1150000**	**1150000**	**1150000**	**1150000**	**1150000**	**1150000**
COMMERCIAL INVESTMENT											
		YEAR									
		1	2	3	4	5	6	7	8	9	10
REVENUE	Description										
Product/Service Line 1	Bio-pesticide dehydrate										
Volume	Kgs	300	5000	10000	20000	40000	80000	160000	320000	640000	640000
Value/unit	US$ / kg (1)	60	60	60	60	80	80	90	140	150	150
Gross line revenue		**18000**	**300000**	**600000**	**1200000**	**3200000**	**6400000**	**14400000**	**44800000**	**96000000**	**96000000**
Product/Service Line 2	Bioremediation product										
Volume	Units	0	100	1000	10000	20000	25000	25000	30000	30000	40000
Value/unit	US$ / kg (1)	0	250	250	250	300	300	400	400	500	500
Gross line revenue		**0**	**25000**	**250000**	**2500000**	**6000000**	**7500000**	**10000000**	**12000000**	**15000000**	**20000000**
Product/Service Line 3	Bio-solutions facilty license										
Volume	Units	0	3	9	12	18	21	24	24	24	28
Value/unit	Royalty fee (2)	0	30000	60000	60000	60000	70000	70000	70000	70000	80000
Gross line revenue		**0**	**90000**	**540000**	**720000**	**1080000**	**1470000**	**1680000**	**1680000**	**1680000**	**2240000**
Total Revenue		**18000**	**415000**	**1390000**	**4420000**	**10280000**	**15370000**	**26080000**	**58480000**	**112680000**	**118240000**
EXPENSES											
Capex	Description										
Item 1	Production units	500000	100000	100000	500000	100000	100000	500000	100000	100000	500000
Item 2	Licensing set up	500000									
Item 3	Online portal	100,000									
Total Capex		**1100000**	**100000**	**100000**	**500000**	**100000**	**100000**	**500000**	**100000**	**100000**	**500000**
Opex	Description										
Production inputs (non staff)	15% of rev	2700	45000	90000	180000	480000	960000	2160000	6720000	14400000	14400000
Packaging	5% of rev	900	15000	30000	60000	160000	320000	720000	2240000	4800000	4800000
Salary and wages	35% gross rev	200000	400000	486500	1547000	3598000	5379500	9128000	20468000	39438000	41384000
Marketing	10% of gross rev	20000	41500	139000	442000	1028000	1537000	2608000	5848000	11268000	11824000
Travel	10% of gross rev	1800	41500	139000	442000	1028000	1537000	2608000	5848000	11268000	11824000
Communications	5% of gross rev	10000	20750	69500	221000	514000	768500	1304000	2924000	5634000	5912000
Rental	5% of gross rev	10000	20750	69500	221000	514000	768500	1304000	2924000	5634000	5912000
Consumables	2% of gross rev	5000	8300	27800	88400	205600	307400	521600	1169600	2253600	2364800
Administration	5% of gross rev	10000	20750	69500	221000	514000	768500	1304000	2924000	5634000	5912000
Total Opex		**260400**	**613550**	**1120800**	**3422400**	**8041600**	**12346400**	**21657600**	**51065600**	**100329600**	**104332800**
Total Expenses		**1360400**	**713550**	**1220800**	**3922400**	**8141600**	**12446400**	**22157600**	**51165600**	**100429600**	**104832800**
EBIT		**-242400**	**-198550**	**269200**	**997600**	**2238400**	**3023600**	**4422400**	**7414400**	**12350400**	**13907200**
EBIT - Capital		**-1342400**	**-298550**	**169200**	**497600**	**2138400**	**2923600**	**3922400**	**7314400**	**12250400**	**13407200**
EBIT - (Capex + Govt)		**-2592400**	**-1498550**	**-1030800**	**-702400**	**988400**	**1773600**	**2772400**	**6164400**	**11100400**	**12257200**
NOTES:											
1	Biopesticide dehydrate - assumes that a value added activated product is produced as a high value ingredient - ex factory price										
2	Assumes that after testing these products are licensed to a manufacturer, either in T&T or offshore, with royalties due.										

Interviewees

- BHP - Finbar McEachnie HSE Team Leader.
- Petrotrin - Avril Mohammed, Environmental Specialist (bioremediation).
- Kaizen - Anthony Superville Business Development Manager.
- CABI – Dr Ulrike Krauss.
- Andre George.