INNOVATIVE SUSTAINABLE PRACTICES: ARE THEY COMMERCIALLY VIABLE?

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Abstract: It is argued that as the planets conventional natural resources are consumed, it has a profound effect on society and the environment. In order to maintain current levels of lifestyle, help solve some of the developing nation's problems and ultimately survive, the world will look more to technology and science for the answers and this will call for partnerships that deliver new approaches and science-based innovations (Teresko, 2006). This research is a part of a bigger study investigating the determinants of innovation in the New Zealand biotechnology sector. This paper discusses business innovation in general and how it could contribute to sustainable development across several key areas like agriculture, biotechnology, consumer products, energy and life sciences. To provide a link between business innovation and sustainability, the research paper explores trends across the following concepts: social expectations of innovation in the biotechnology field, innovations versus sustainability, sustainable agricultural biotechnology, and sustainable industry practices in the biotechnology field. Finally the paper provides some tentative ideas of the conditions required for business innovation to make a constructive contribution to sustainability.

Keywords: business innovation, agricultural biotechnology, and sustainable development.

INTRODUCTION

We are living in an era of rapid technological changes where innovation has increased exponentially. Accordingly companies with cutting edge research are facing lots of challenges in creating new and creative products to enable a sustainable human existence and to ensure their acceptance by the society especially when we hear of reports like Tomorrow's Market signalling that the current trends are leading to an unsustainable human society.

Sustainability has been in the for-front of businesses' consideration for the past 15 years. Research indicates that most eco-efficient companies are also the most successful using such measures as the Dow Jones Sustainable index. A guiding principle for world economic development is "Sustainability defines how countries can

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meet the needs of their people today without compromising those of future generations" (Grayson, Jin, Lemon, Slaughter and Tay, 2008, p.1).

This paper attempts to answer the following question:"How can businesses solve the dilemma of spurring development while promoting sustainability?" To answer this question, the research paper attempts to capture the essence of how biotechnology and innovation might help in the quest for sustainability across a number of sectors including agriculture or green biotechnology, consumer products or white biotechnology, energy and life sciences.

SUSTAINABILITY AND BUSINESS INNOVATION

Overview

The World Business Council for Sustainable Development believes that the "integration of sustainability thinking into a business's innovation process - not as a negative or limiting factor in the creative process, but as an opportunity- is in its best business interests" (Dormann & Holliday, 2002. p. 7). The underlying reason for this is that companies who do tend to gain acceptance of new innovations quicker and are therefore, more successful.

As innovation has the potential to cut across all aspects of human endeavour, it is vital to understand what drives this phenomena and how it can be best managed to gain maximum benefit. Dormann & Holliday (2002, p. 7) has stated that "Innovation is at the core of creating a sustainable human society and as a society, we will not succeed in creating a sustainable world if we focus merely on doing efficiently, what we already do."

Levels of hardship around the world tend to be disproportionately centred on developing countries and their people. As populations enlarge along with the need to consume more and more natural resources, this situation is set to worsen. According to Ozor & Igbokwe (2007), stresses on these valuable recourses is resulting in unprecedented effects on ecosystems, such as pollution, loss of genetic diversity, soil fertility decline, climatic changes, decline in yields, deforestation and desertification. Pinstrup & Pandya-Lorch (1994) noted that over 700 million people did not have sufficient food for a healthy and productive life. Brown, Kane & Roodman (1994) at the same time states that up to a billion people are surviving on less than a dollar a day and Chassy (2003) claims that up to 850 million people are malnourished going on to state that more than 200 million of these are children, the majority of which live in developing countries. Ozor & Igbokwe (2007, p. 1598) quotes, "The United Nations Food and Agriculture Organization (FAO) estimate that two out of five children in the developing societies are stunted, one in three is underweight, and one in ten is 'wasted' due to under-nourishment".

As the planets conventional natural resources are consumed, it is argued that this will have a profound effect on society and the environment. Unpredictable costs associated with oil supply, climate change issues, geopolitical uncertainty and the inevitable end to the fossil based fuel era has finally igniting interest in alternative energy and consumer goods supply (Nelson, 2008). In order to maintain current levels of lifestyle, help solve some of the developing nation's problems and ultimately survive, the world will look more to technology and science for the answers and this will call for partnerships that deliver new approaches and science-based innovations (Teresko, 2006).

So much of modern infrastructure and consumer goods supply relies heavily on the petrochemical industry for raw materials. Nelson (2008) posits that Biotechnology has a major part to play in this area as virtually anything which is petrochemically derived can be produced using biotechnology derived substitutes. In addition, Nelson (2008) claims that "biobased" products offer advantages over the equivalent petrochemically derived product due to renewable, environmentally friendly and often enhanced design characteristics which requires less energy to produce.

What does it mean for Business?

There are some who would walk away from biotechnology and sustainability issues based on lack of knowledge and an unjustified view that there is a price to pay for being involved with an alternative approach.

In a recent interview, the Chairman and CEO of du Pont, Charles Holliday, he was quoted as saying, "Putting the environment first doesn't thwart business opportunities, it creates them" (Teresko, 2006, p. 23). Defining the du Pont mission Holliday explains, "Increasing shareholder and societal value while decreasing our environmental footprint along the value chain is key. While chemistry remains vital to our businesses, the addition of biology has opened tremendous new opportunities. We have turned our world-leading research capability to inventing what our customers tell us they need to grow their businesses" (Teresko, 2006, p. 23).

According to Nelson (2008), the biotechnology industry can be a major driver of any economy and has the potential to enhance environmental sustainability whilst maintaining profitability for companies and their stakeholders. In order to help solve some of the sustainability issues surrounding energy, climate, water and safety, the actions of business must be both market-driven and consistent with societal values and expectations (Teresko, 2006). This coupled with the potential to create "Green Jobs" suggests a win – win between the need to be profitable and doing the socially right thing. Nelson (2008) predicts, for example, there might be 230,000 additional jobs in the biofuels sector by 2012.

Little, 2006 has shown that sustainability-driven innovation is still at an embryonic stage of development. Claiming that there has been a shift in emphasis away from just conducting risk management, however, most companies still focus mainly on compliance. Findings also suggest "a small, but growing apex of leading companies have sought to move above this, breaking through to the ''innovation high ground'' where sustainability-driven innovation really starts to make sense – creating new products and services, processes and markets which will respond to the needs of future as well as current customers" (Little, 2006 p. 37) .

A White Paper entitled "New Mindset for Corporate Sustainability" by Grayson, Jin, Lemon, Rodriguez, Slaughter and Tay (2008, p. 19-20) concluded that "the steps to achieving sustainability do not rely on extensive re-engineering of the corporate structure, but require conviction and vision. These steps can be initiated immediately and indeed, given the speed with which the markets are changing, must be addressed by companies with some urgency". The ten points highlighted are:

1. Make innovating for sustainability a part of your company's vision
2. Formulate a strategy with sustainability at its heart

3. Embed sustainability in every part of your business
4. Walk the talk: emphasise actions, not words
5. Set up a body at board level with the power to make sustainability matter
6. Set firm rules
7. Bring your stakeholders on board
8. Use people power
9. Join the networks
10. Think beyond reporting: align all business systems with the company's vision of sustainability

Innovation and Sustainability Dichotomy

According to Morioka, Saito & Yabar (2006), it is widely known that sustainable development is the only sound and viable pathway for humankind's future. Furthermore, they insist that the current approach based on product and process innovation is not providing the expected results in addressing this important issue. Instead they put forward an integral and dynamic innovation system where technology plays a key role in fulfilling societal functions. They adopt what they term as a highly solution-driven approach which claims technology management is the key to propelling effective innovation towards sustainability. However, Morioka et al (2006) do recognise product and process innovation as important in addressing the problems associated with production and consumption patterns. It should be recognised, however, sustainability is not simply confined to the notion of the environment. Morioka et al (2006) reminds us that social and economic sustainability are also at stake and believe that the path to achieving long-term progress towards sustainable development is through the understanding of these relationships.

Social Expectations of Innovation in the Biotechnology Field

This section discusses the public's perceptions of innovation in the biotechnology field and its trade off and how this impacts on their attitude towards genetic modification and their social expectations.

According to Geibler, Liedtke, Wallbaum & Schaller (2006, p. 335), "emerging technologies such as biotechnology face particularly high accountability and reporting demands" and this can be attributed to the high societal exposure of these emerging sectors, which have not gained broad public acceptance yet.

Biotechnology has been the subject of much public debate, particularly surrounding genetically modified organisms, food and agriculture. Whilst there is a general acceptance that biotechnology has enabled a range of promising innovations in the area of medical science and industrial process sustainability, there remains an underlying scepticism in the public's mind (Geibler et al, 2006). While there is little doubt about consumer's growing interest in sustainability, and about the opportunities for biorenewable energy, for example, the issue of genetic modification is less straightforward and yet to achieve acceptance in many countries (Verbeke, 2007). As a result, biotechnology has not yet attained the standing and significance scientists and analysts had predicted years ago.

Equally, it seems that the general public has not at this time embraced fully the concept of sustainability in their private lives. In the Lifestyles of Health and Sustainability

(LOHS) Study conducted by the Natural Marketing Institute in 2008 suggests that only 5% to 10% of people would accept trade-offs in cost or lesser performance in order to purchase a product which claims environmental benefits. The majority, 70 to 75% understand that environmental and sustainability issues are important, but would not be prepared to make sacrifices in the areas of performance, value and cost, the remaining 15% were indifferent to sustainability (Sauers and Mitra, 2009).

According to Verbeke (2007), a range of complex dynamics and interactions are relevant to how consumers make decisions and this is true in the biotechnology sector. Cultural factors, contextual and personal differences along with general attitudes are important variables. Moreover, the perceived risk from technological innovation may be driven by socio-political factors as in the case of GM food. This case, as explained by Verbeke (2007) demonstrated the difficulties associated with convincing consumers to change their initial attitudes of genetic modification as tampering with nature, and therefore is ethically wrong.

SUSTAINABLE AGRICULTURAL BIOTECHNOLOGY

Agricultural or "green" biotechnology is being adopted at record speed around the world and ninety percent of farmers who benefited from biotech crops in 2006 were resource poor farmers from developing countries. Industrial or White Biotechnology is also growing exponentially. White biotechnology is the application of biotechnology for the processing and production of chemicals, materials and energy and uses enzymes and micro-organisms to make biodegradable products in sectors such as chemistry, food, paper and pulp, textiles and energy (Europabio, 2007).

Ozor & Igbokwe (2007) posit that agriculture is asked to satisfy two apparently contradictory needs, that is, to become more productive and at the same time more sustainable. In the case of agriculture, the human race is almost totally dependent on this sector, however, the same might be said of other primary sectors. It is clear, however, that as world populations continue to expand, there must be continuous reassessment of agricultural practices to optimize their efficiency.

On the other hand it is argued that biotechnology, centred on the agricultural sector, has the potential to significantly increase food supply and at the same time de-stress the natural resources applied to this endeavour. Unfortunately, biotechnology in the agricultural world has become an emotional issue creating a sense of unease and resistance among some consumers, developing countries farmers, environmental groups and some societies. Moreover, in order to maximise the benefit of innovation and sustainability, individual countries need to identify their specific national priorities and preferences in food production, and harness the growing body of science and innovations in genetic engineering to address specific issues (Ozor & Igbokwe, 2007).

In the EuropaBio Annual Report, 2007, Dr. Bernward Garthoff, Bayer CropScience, Chairman of the German Biotechnology Industry Association (DIB) and Chair of EuropaBio's Agri-food Council said: "The application of biotechnology to plant breeding has yielded benefits to farmers, the economy and the environment which are simply not possible with the more traditional approaches. These new possibilities are making an essential contribution not only

to the food and animal feed security of a growing and increasingly prosperous global population, but also to the sustainable supply of renewable raw materials for industry and energy such as transport fuels. We need harmonised policies that are coherent and consistently implemented so that benefits get through to society" (Europabio, 2007, p. 7).

SUSTAINABLE INDUSTRY PRACTICES AND BIOTECHNOLOGY

Issues surrounding energy are at the heart of sustainability. No other sector does so much good yet with such a devastating impact on the planet. Therefore, governments, industry, and academia are inputting much effort towards finding a sustainable solution for the increasing energy crisis (Sudesh and Iwata 2008). According to Ozor & Igbokwe (2007) energy usage on biotechnology crops is lower than conventional methods due to a reduced requirement for chemical application. Consequently, less fuel is used resulting in less carbon entering the atmosphere as carbon dioxide (Co2). They go on to say that herbicide-resistant crops encourage the adoption of conservation tillage, especially no-till, which reduce erosion of topsoil, promoting agricultural productivity and reducing the environmental impact, leading to agricultural sustainability and food security in developing societies.

When considering the manufacture of antibiotics, EuropaBio, (2007) have reported a reduction in the use of electricity by 37%, solvents by almost 100% and a reduction in wastewater by 90% and suggest other industrial applications, such as biodegradable plastics and packaging, could bring similar benefits.

Plastics are an essential part of modern life and are found across all industry sectors. Derived from fossil resources, plastics are undoubtedly superior materials in terms of their costs, processability and functional properties, however, they are not readily assimilated by the various ecosystems upon disposal (Sudesh and Iwata 2008). Significant progress is currently being made in the search for a biotechnological solution to the associated issues of conventional plastic production and disposal. Two of the most promising biobased plastics, (i.e. polylactic acid and polyhydroxyalkanoates) have received much attention as potential alternatives to existing processes (Sudesh and Iwata 2008). "Industrial biotechnology" is helping to answer the current debate on fuel verses food by using organic materials to produce plastics, composites, chemicals and fuels which are then used in biobased products (Nelson, 2008).

INNOVATION BUSINESS MODEL

The researchers believe that businesses are capable of solving the dilemma of spurring development by promoting sustainability in various fields e.g. green biotechnology and reduction in fuel consumption. The following Figure 1 is presented as a business model which is a modified version of the "Contribution of Business Model" developed by World Business Council for Sustainable Development and published in Dormann & Holliday (2002). It attempts to show the relationships between the following determinants of innovation and its impact on sustainability within the role of business. The following determinants are the basis for a bigger research study being developed by the researchers investigating the determinants of innovation in the New Zealand biotechnology sector.

- Biotechnology companies who employ experienced biotechnology mangers with commercial and modern Human Recourses Management experience are more innovative through a specified range of determinants than those companies who do not.

- Private biotechnology companies located in New Zealand who fosters relationships with public organisations such as research institutes and universities have a higher innovation rate and are more competitively positioned than those who do not.

- The New Zealand National System of Innovation is having a positive impact on the innovations of private companies and public organisations.

- Complementary biotechnology companies in New Zealand who locate in a cluster format enjoy enhanced innovation levels.

- Small biotechnology companies are more innovative than large companies in New Zealand.

- Companies who secure off shore investment have higher levels of innovation than those companies who are financed locally.

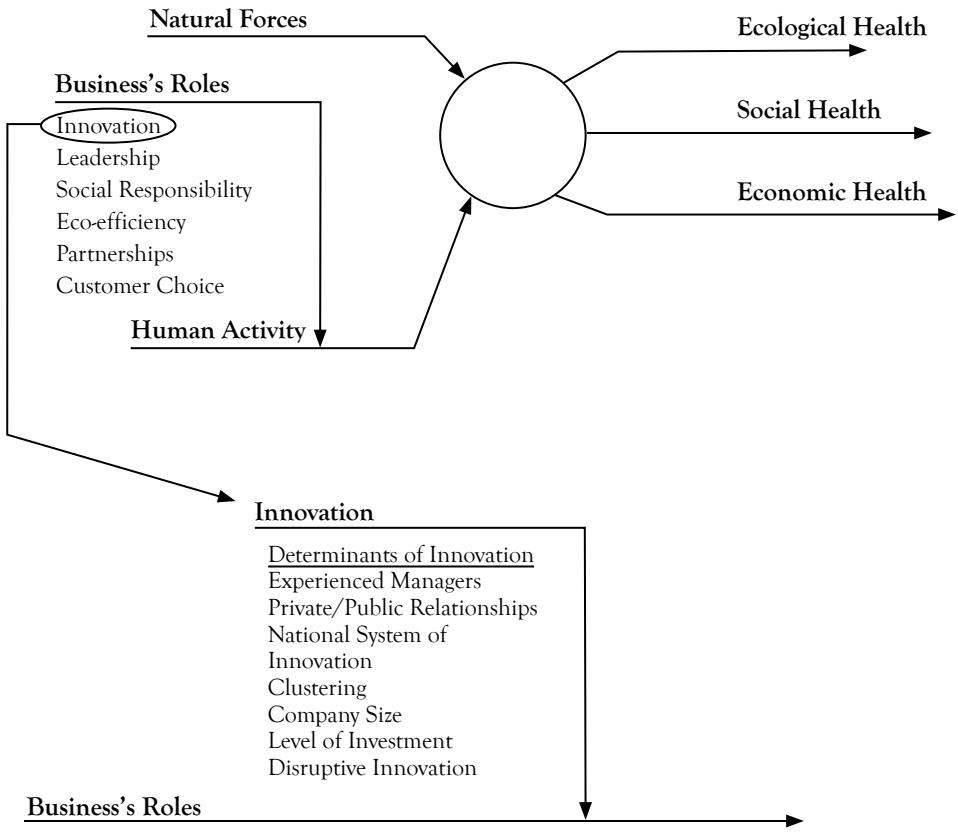
- Biotechnology companies who introduce novel products through disruptive innovation are competitively advantaged when compared to those who do not.

CONCLUSION AND RECOMMENDATIONS

This paper attempted to answer the question: "How can businesses solve the dilemma of spurring development while promoting sustainability?" It is argued that technological development plays an important but not the only role in the transformation of the economic system towards a more sustainable institution. Consequently, other areas of society need to also play their full part. For example, changes are also required in the areas of institutional configurations, social norm adjustment, compliance issues to name but a few. Outhwaite & Bettridge (2008) posit that real innovation and transformation, and the biggest leverage points for integrating sustainability, occur in the 'interior' of individuals mindsets and values, and organisation's cultures.

Innovation is defined in many ways but generally share a similar concept of idea generation, development and introduction. The issue of radical verses incremental innovation is becoming more of an issue as time is becoming critical if long lasting or permanent negative impacts on the planet are to be averted. If we are to maintain economic activity as we currently know it, a rapid movement to "eco-innovation" will be required.

"Innovation is the only way to meet the needs of a burgeoning population and a growing economy without causing unacceptable environmental damage. We must produce more energy - but with lower carbon intensity and more food - but not in ways that spread deserts and waste water" also Sustainability requires new thinking across the spectrum of human endeavour, not merely among scientists and technologists. Economic, social, and institutional innovations must keep pace with technological innovations if greener technologies are to come into their own" (World Business Council for Sustainable Development, 2009).



Source: Adapted from Dormann & Holliday (2002, p, 9)

Figure 1 The Business Model

BIOGRAPHY

Dr Siham El-Kafafi is currently a Senior Lecturer in Management at the Faculty of Business, Manukau Institute of Technology, Auckland, New Zealand. She holds a Master in Public Administration from the American University in Cairo (AUC), Egypt and a PhD from the University of Waikato, Hamilton, New Zealand awarded with distinction in 2004. She also teaches on the MBA and DBA Supervisor for the Southern Cross University, Australia. Dr El-Kafafi has previously taught in the American University in Cairo, the Public Administration Department and the Waikato Management School at The University of Waikato. She has published research papers in international conferences, international journals and several research papers for public organisations in the areas of quality management, water management, sustainability, corporate governance and business excellence and tertiary education. Dr El-Kafafi is the regional editor for 6 international journals and she is also on the Board of Examiners for the Asia-Pacific Business Excellence Standard (APBEST) Award.

Stephen Liddle currently manages his own engineering services company supporting research and development companies based in New Zealand. He holds a Masters in Business Administration from Durham University (DUBS) in the United Kingdom and a Bachelors Degree in Engineering from Sunderland University (UK). He is currently progressing with his Doctorate in Business Administration with the Southern Cross University (Australia) and in association with the Manukau Institute of Technology (MIT) in New Zealand. Stephen Liddle has worked in senior technical and operational roles for some of the largest "blue chip" pharmaceutical companies over a 25 year period and has been active in many industry forums including Validation Policy and Good Automated Manufacturing Practices GAMP). His current interests surround innovation in the biotechnology sector, specifically in small, remote and open economies such as New Zealand.

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