

Entrepreneurial Internationalization of Science-based Innovation: A Theory-based Case Study

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Abstract: Scholars have been interested in innovation commercialisation and internationalisation for the last two decades. This study provides an empirical case study based on innovation process theories. The findings indicate that both need-pull and technology-push play an important role in innovation internationalisation, and the interaction between them was critical to achieving success. The innovation needs to be technically and legally ready (technology-push) for diffusion when consumers call for a replacement of the traditional products (need-pull). Case study implies that innovative activities are mainly classified as incremental product innovation from a technological innovation perspective even though it might be radical product innovation from a consumer perspective. Since a new set of products are available to marketplaces, the innovation can also be classified as a process innovation. Product innovation also has characteristics of platform innovation when considering a series of product being upgraded. The paper argues there are a few important challenges and achievements in the innovation management as well.

Keywords: Entrepreneurship, incremental innovation, radical innovation, commercialisation, internationalisation.

I. INTRODUCTION

Zespri Gold or kiwifruit gold (used interchangeably below) was launched onto the world market in 2000. With its sweet, tropical flavour and smooth, golden flesh, Zespri Gold has set the benchmark for gold kiwifruit globally. It is one of the most successful science and technology-based innovations in New Zealand (NZ) in last twenty years. Tidd and Bessant (2013) defined innovation as “the conversion of knowledge and ideas into new or improved products, processes or services, which may be for commercial use or for the public good.” Based on this definition, Zespri Gold is fulfilling the characteristics of the definition because 1) The company has developed a new cultivar by novelty conversion through scientific research and technology applications; 2) Zespri Gold kiwifruit is a new variety in the kiwifruit family; 3) A new process of growing, post-harvest handling and storage was developed by modifying the process of traditional green kiwifruit treatment and management; and 4) Zespri Gold kiwifruit have had tremendous commercialisation success. Zespri Gold kiwifruit was worth over \$525 million in global revenue in 2010, making it the most successful new variety release by any horticulture company between 2000 and 2010 (Zespri, 2016).

This study will examine the characteristics of Zespri Gold innovation using relevant organisation background and innovation typologies. The study also outlines the most significant managerial challenges/successes associated with the Zespri Gold innovation process. Kiwifruit gold was selected for this case study because 1) it is an example of successful innovation and commercialisation; 2) almost its entire innovation life cycle can be analysed; 3) it is a comprehensive innovation related political, technological, economic, environmental, social and legal (PESTEL) areas; and 4) the innovation synthesised technological, organisational and commercial aspects of the innovation process.

II. ORGANISATIONAL INNOVATIVE BACKGROUND AND INNOVATION ROADMAP

Zespri International Limited is the world’s largest marketer of kiwifruit, selling kiwifruit into more than 53 countries and managing 30 percent of the global volume. Based on Zespri’s 2016 Annual Report (Zespri, 2016), in the 2009/2010 season, Zespri sold 22 million trays of premium-quality Zespri Gold. Zespri sets the global benchmark for guaranteed excellence and tasty, nutritious kiwifruit with the Zespri brand. Zespri works with growers and post-harvest operators to source top-quality Zespri Kiwifruit and supply this kiwifruit through its distribution partners to wholesale markets and retail customers.

From an organisational innovation perspective, innovation is a mechanism applied by organisations to adapt to changing conditions of competition, technological advancements and market expansion by producing newer products, techniques and systems (Razavi & Attarnezhad, 2013). To treat the Zespri Gold innovation as a process, seeing the innovation as a linear sequence of functional activities, need-pull and technology-push both played important roles in its success. More importantly, the interaction between market change in the early 1990s and years of continuous organisational scientific research dominated achievements. Tidd (2013) described that innovation is a coupling and matching (need-pull and technology-push) process, where interaction is the critical element.

Firstly, from need-pull perspective, the NZ kiwifruit export dropped dramatically in price and volume between 1990 and 1993 (Figure 1) after an anti-dumping order in the USA (Aitken, 2004) which cause NZ kiwifruit industry in difficulties. The industry urgently needed to have a major breakthrough to recover kiwifruit exports, and growers were keen to try a new variety to compensate the price drop of traditional green kiwifruit (growers called it “Hayward”). When David Jenks and Mike Muller from Zespri went on a road show to growers throughout NZ kiwifruit growing areas to introduce the commercial option of diversifying their orchard with the Zespri Gold variety, growers realised that with total reliance on one cultivar, “Hayward”, they had little flexibility and huge risk. The growers also expected a 20-30% premium price for Zespri Gold due to its potential market appeal (Aitken, 2004). To put it simple, the time was right for introducing kiwifruit gold to growers and there was a market need.

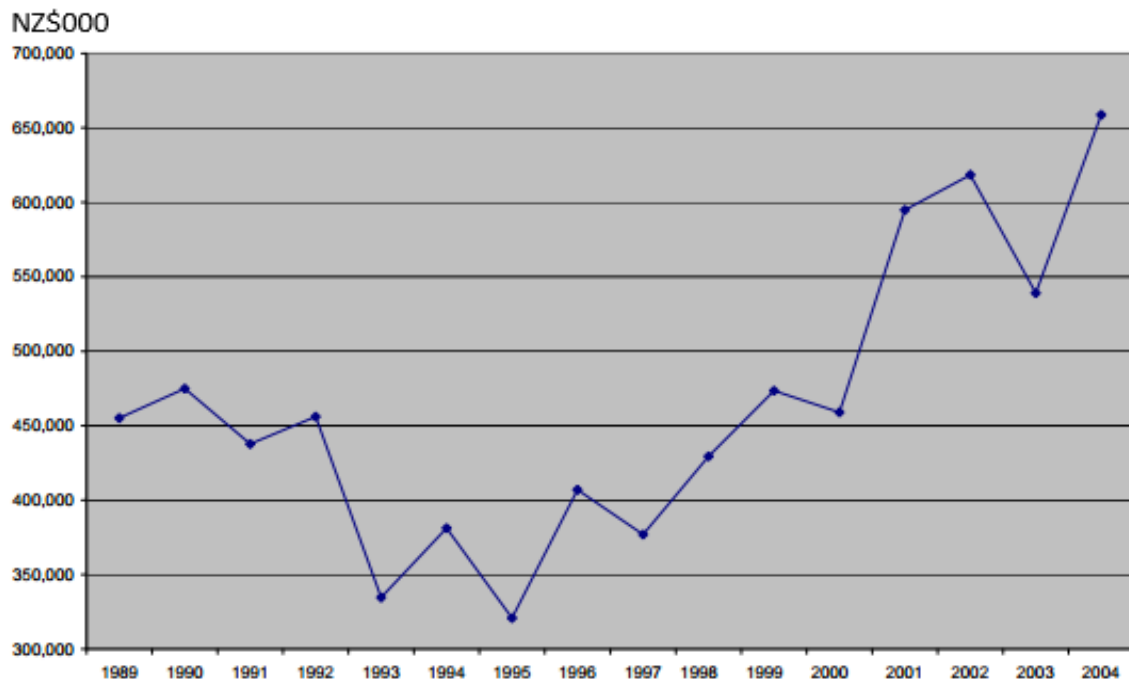


Figure 1. Total Kiwifruit export 1989-2004 (Kilgour, 2008. NZ\$000).

Secondly, from a technology-push perspective, kiwifruit gold has had a long continuous innovation history as shown in Figure 2. It took Dr Alan Seal and his colleagues from HortResearch, a Crown Research Institute, later it was superseded by Plant and Food Research, more than 20 years to breed the gold-fleshed kiwifruit (Smith, 2003). Aitken’s report shows that the development of the new yellow-fleshed kiwifruit cultivar “Hort16A” began in the early 1980s using seed brought from China in 1977 and 1981. Scientists from HortResearch had 600 seedling crosses in development in 1987. After selecting for required quality attributes and then undergoing sensory evaluation by panelists from potential markets in Asia

and Europe, a new yellow-fleshed cultivar with fewer hairs and a sweeter more tropical taste, called “Hort16A”, was chosen. “Hort16A” grafting material was made available to selected growers in 1992, HortResearch applied plant variety rights (PVR) in 1993 and the first export of Zespri Gold to Asia was in 1996.

Finally, the interaction between technology-push and need-pull was critical to kiwifruit gold innovation commercialisation success. As discussed above, the kiwifruit gold innovation was just ready for diffusion when kiwifruit industry required a turn-around for export volume and price in early 1990s. The combination of readiness of technology, market, production, investors, stakeholders and consumers assured the highest achievement of kiwifruit gold commercialisation. This study will focus on innovation and commercialisation process analysis, political and government activities are beyond the scope of this paper.

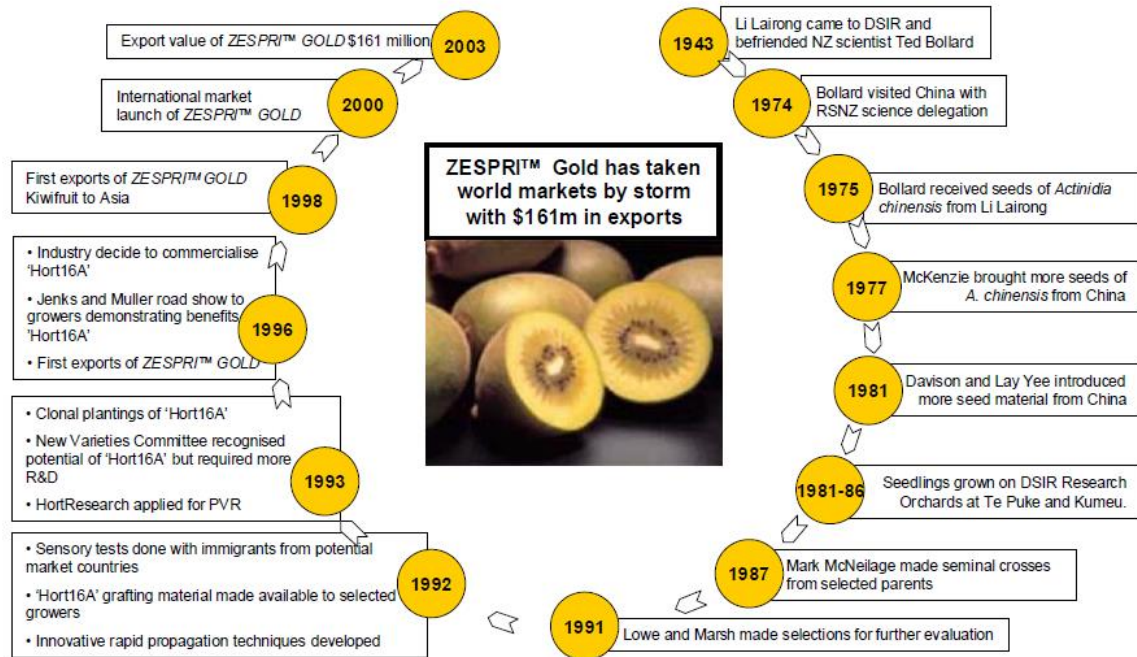


Figure 2. Zespri Gold development and commercialisation roadmap (Aitken, 2004).

III. ANALYSIS OF ZESPRI GOLD INNOVATION TYPE, MODEL AND LIFE CYCLE

Tidd (2013) explained four dimension of the innovation space – product, process, position and paradigm. Each dimension can be an incremental or a radical innovation. An incremental innovation from one perspective (i.e. technical) can be a radical innovation from another perspective (i.e. consumer). In the case of Zespri Gold, firstly, from technological perspective, it is mainly an incremental product innovation. The innovation can also be classified as process or platform innovation, as Tidd (2013) indicated that sometimes the dividing line is somewhat blurred. Secondly, from the consumer perspective, the innovation can be radical because the consumer is introduced to a product with a very different taste. The innovation types will be discussed below.

A simple reason to classify kiwifruit gold as a product innovation is because Zespri Gold is a different product from what Zespri previously offered to the world market, as Tidd (2013) defined product innovation as changes in the products or services that an organisation offers. The main output of the innovation was a product that is different in colour, taste and sugar content from the original offering.

A new crop guide and post-harvest and storage processing procedure provided by Zespri to growers indicates that the innovation of kiwifruit gold is not only about the final product, but also includes the process innovation characteristics. Ten years after PVR was granted to Zespri, the organisation had licensed growers in Italy, France and California to produce Zespri Gold for it to sell in New Zealand’s off-season (Smith, 2003). These exports included the knowledge of Hort16A planting, harvesting, storage and quality control.

The overarching Zespri Gold innovation was a systemic innovation. The output was a new generation of the product with more attractive features for customers. Of course, this system innovation was built up by numerous components and sub-system innovations. The system also includes breeding, plant management, harvesting and storage technologies and procedures.

When exploring different aspects of innovation, the kiwifruit gold innovation can mainly be classified as an incremental innovation from a technological perspective. The characteristics of this incremental innovation are apparent for several reasons: 1) It is a crossed variety from selected original varieties; 2) It is an improved product (variety) with more attractive features for customers; 3) The traditional offering, kiwifruit green, is still available and popular; and 4) As Figure 2 shows, HortResearch scientists spent 20 years to continuously breed this new variety. These characteristics meet Tidd's (2013) definition for incremental innovation as "doing what we do but better".

As far as managing the innovation process is concerned, the platform innovation characteristic exists with Zespri Gold as well. Products such as Kiwifruit Gold juice, jam and ice pops have been developed based on the established Zespri Gold platform. Many new variants and improvements of food products have been invented based on the kiwifruit gold platform over the years by various people and organisations.

Tidd (2013) divided innovation into three stages – fluid, transition and specific, as shown in Figure 3. From the Zespri Gold innovation roadmap (Figure 2), the fluid period could be considered to be between 1980 and 1992. During this time the research team was exploring possibilities with uncertain results and flexibilities. The transitional period could be considered to be between 1992 and 1997. During this period, "Hort16A" gradually became the dominant design after years of experiments. The specific stage began in 1997 and continues today. Zespri has most recently been focusing on improving the product quality, increasing productivity, building up disease resistance and add-on product development.

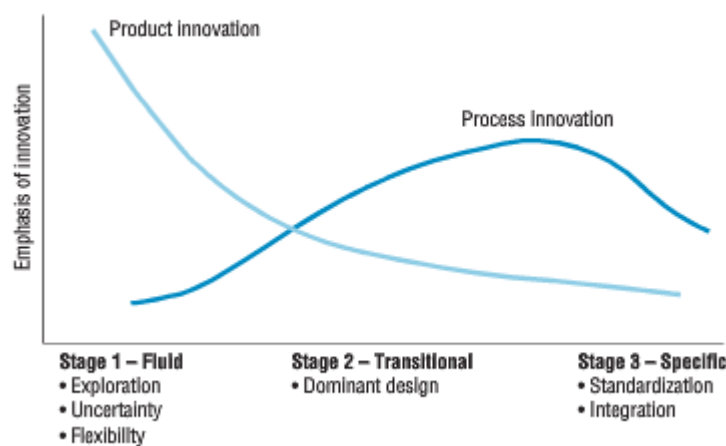


Figure 3. The innovation life cycle (Tidd, 2013).

IV. ANALYSIS OF THE MANAGEMENT PROCESS OF INNOVATION

Innovation (defined in section 2) can also be defined as the organisational capability to renovate ideas and knowledge into new products, services or processes continuously for the benefit of its stakeholders (Razavi & Attarnezhad, 2013). Kiwifruit Gold enabled the NZ kiwifruit industry to have a very successful and complementary new cultivar that created a broader market base. Its export value exceeded NZ\$160 million within five years of its official launch on the international market (Aitken, 2004). Craig Greenlees, Former Chairman of Zespri Group Ltd., said in 2003 company annual report:

The extraordinary success of ZESPRI™ GOLD Kiwifruit must be acknowledged. In just five years this exclusive, new, sweet-tasting kiwifruit has become one of the top three New Zealand horticultural export earners, after ZESPRI™ GREEN Kiwifruit and apples. Its commercialisation is not only testimony to the entrepreneurial spirit of growers – and scientists – but also a unique example of how to take a promising cultivar, commercialise it through promotion and partnerships, and importantly protect the intellectual property (IP) for the benefit of the pioneer investors and producers, New Zealand growers, and for the nation.

Mr Greenlees summarised that the success of Zespri Gold innovation and commercialisation is not only because of technology-push, market-pull or interactions between them, but also market promotion, entrepreneurial spirit, IP protection and partnerships. His conclusion covers Tidd's (2013) description of the four steps of the innovation management process:

searching, selecting, implementing and capturing. Tidd also highlighted the idea of innovation as a core process that needs to be organised and managed in order to enable the renewal of any organisation. The remainder of this section outlines the Zespri Gold innovation managerial challenges, outstanding performances and activities associated with each of Tidd's four steps of managing the innovation process.

Firstly, searching involves scanning the internal and external environment for, and processing relevant signals about, threats and opportunities for change. The NZ kiwifruit industry realised that production based on only one cultivar (green kiwifruit) was very risky from both a production and marketing perspective. Scientists were aware of the potential opportunities for creating new cultivars based on the fact that there are more than 70 individual species of the Actinidia (small Asiatic woody vine bearing many-seeded fruit) genus growing in Asian countries.

Second, selecting involves deciding which threats or opportunities found in the previous step to respond to. HortResearch decided to develop of a new kiwifruit after considering possibilities and opportunities to respond to the risk of single cultivar production. A formal kiwifruit breeding programme was initiated in the 1980s among scientists from China and NZ based on a wide diversity of seed accessions from China (Aitken, 2004). The dramatic drop of kiwifruit exports triggered the recognition of the potential of kiwifruit gold by industry and a possible emergence of a market champion.

Third, implementing involves translating the responding idea from step two into something new (product, process, paradigm or position) and launching it in a market. After scientists selected Hort16A, a major R&D effort was undertaken by Zespri and HortResearch scientists who with industry specialists assisted growers to develop and modify growing, post-harvest handling and storage systems. In 1997, test marketing in several countries was carried out with positive feedback from the UK, Japan and Taiwan. In the same year, Hort16A was chosen for further development for its superior, sweet and unique taste, and growers accepted the selection of Hort16A because of its expected premium price.

Finally, capturing involves seizing value from the innovation. With the willingness of growers to risk planting the new cultivar and utilise technical information provided by scientists, Zespri committed to creating awareness of this new variety in the international market. In 1998 kiwifruit gold were exported to Asia. A few countries were licensed to plant this new kiwifruit variety after Hort16A was officially launched into international market in 2000. The export value of Zespri Gold reached NZ\$161 million in 2003.

V. CONCLUSION

Zespri Gold's innovation generated much excitement both in New Zealand and the international market and with consumers around the world with its yellow flesh and unique flavour. The estimated export value was NZ\$176 million in the 2010 season (Zespri 2015/2016 Annual Report). Based on the analysis in this study, the innovation and commercialisation process had the following characteristics being reinstated in the remainder of the section from a managing innovation perspective.

Firstly, need-pull and technology-push both played an important role in kiwifruit gold innovation, and the interaction between them was critical to the achievement. The new Hort16A cultivar was technically and legally ready (technology-push) for diffusion when the traditional green flesh kiwifruit export dropped dramatically (need-pull).

Secondly, Zespri Gold's innovative activities are mainly classified as incremental product innovation from a technological innovation perspective even though it might be a radical product innovation from a consumer perspective. Since a new set of planting, management and storage procedures were provided to growers, the innovation can also be classified as a process innovation. Furthermore, as many food products were developed based on kiwifruit gold, the innovation had characteristics of platform innovation.

Finally, there were a few important challenges and achievements in kiwifruit gold innovation management. To begin with, the kiwifruit industry realised the risk of relying on only one cultivar production in the country and the potential to create new cultivars. Next, through collaboration among NZ and Chinese scientists, a formal breeding programme was initiated in 1980. Third, Hort16A was selected as new cultivar and granted PVR, and following that the growers accepted the new cultivar with a premium price expectation. Subsequently, Zespri as an organisation realised huge economic and social value.

Although this research was done seven years ago, it still holds value in today's innovation and entrepreneurship environment, particularly for the process of new product internationalisation. It can also to be a great example for higher degree research master's students and PhDs, and for education providers a like.

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